



VANUATU LOW EMISSIONS DEVELOPMENT STRATEGY



DECEMBER 2022



Vanuatu



Map source: The Pacific Community, 2022

FOREWORD

The Government of Vanuatu takes seriously the call for global action on climate change. We have put forward ambitious targets for emissions reductions in our Nationally Determined Contributions to 2030. To plan, respond and adapt to climate change, we work to bring in the latest climate science and adaptation into our national policies, strategies and plans. We mourn the loss and damage from unavoidable climate change and we advocate for global funding for the injustice on Vanuatu and other development countries.

Why do we do this all? Because our country and our planet is worth protecting. Our homes, livelihoods and cultures depend on limiting climate change and adapting to the change locked in. We have a responsibility to future generations.

Vanuatu delivers this long term Low Emissions Development Strategy (LEDS) to the United Nations Framework Convention on Climate Change (UNFCCC), in line with the Paris Agreement to limit global warming, and as part of Vanuatu realising its responsibilities. This document puts forward Vanuatu's pathway of lower emissions across all sectors and expanded climate adaptation and resilience to 2050.

I commend this document to you.

Sincerely,



Honourable Ralph Regenvanu, MP
Minister for Climate Change
Government of Vanuatu

ACKNOWLEDGEMENTS

The development of the Vanuatu Low Emissions Development Strategy (LEDS) is the product of a team effort led by the Government of Vanuatu with contribution from the Global Green Growth Institute (GGGI), private sector and non-government organisations and community-based organisations in Vanuatu. The Government of Vanuatu would also like to thank all other individuals and groups who contributed throughout the consultations, drafting and validation of the LEDS and especially acknowledge the contribution of the Steering Committee members. Several individuals and organisations are recognised here for their particular contributions to the LEDS development.

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The Government of Vanuatu Ministry of Climate Change Adaptation, Meteorology, Geo-Hazards, Energy, Environment and Disaster Management led development of the LEDS.

GGGI provided technical assistance to develop the LEDS. Vanuatu is a GGGI member country and GGGI is proud to support Vanuatu's green growth and climate resilient future.

The LEDS development was financially supported by Government of New Zealand Ministry of Foreign Affairs and Trade (MFAT) through the Pacific Regional Low Emissions Climate Resilient Development Program. Further financial support was provided by the Government of France Agence Française de Développement (AFD) through the 2050 Facility to support the establishment of low-carbon and resilient development strategies and public policies.

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ACRONYMS AND ABBREVIATIONS

AFD	Agence Francaise de Developpement
AFOLU	Agriculture, Forestry and Other Land Use
AR6	6th Assessment Report of the IPCC
BAU	Business-As-Usual
CCA	Climate Change Adaptation
CCDRR	Climate Change and Disaster Risk Reduction
CH₄	Methane
CO₂-e	Carbon dioxide equivalent
COP	Conference of the Parties
CSA	Climate Smart Agriculture
DFAT	Australia Department of Foreign Affairs and Trade
DoCC	Department of Climate Change
DoE	Department of Energy
DoF	Department of Forests
DEPC	Department of Environmental Protection and Conservation
DoWR	Department of Water Resources
EV	Electric Vehicle
GDP	Gross Domestic Product
GGGI	Global Green Growth Institute
GHG	Greenhouse Gases
GoV	Government of Vanuatu
GVA	Gross Value Added
KG	Kilogram
kWh	Kilowatt Hour
IPCC	United Nations Intergovernmental Panel on Climate Change
LEAP	Low Emissions Analysis Platform
LEDS	Low Emissions Development Strategy
LNG	Liquid Natural Gas
LPG	Liquid Petroleum Gas
LTA	Long-Term Agreement
LTS	Long-Term Strategy
MALFFB	Ministry of Agriculture, Livestock, Forestry, Fisheries, and Biosecurity
MFAT	New Zealand Ministry of Foreign Affairs and Trade
MIPU	Ministry of Infrastructure and Public Utilities
MoLNR	Ministry of Lands and Natural Resources
MoCC	Ministry of Climate Change Adaptation, Meteorology, Geo-Hazards, Environment, Energy and Disaster Management

MoH	Ministry of Health
MRV	Monitoring, Reporting, and Verification
MWh	Megawatt Hour
N₂O	Nitrous Oxide
NAB	National Advisory Board on Climate Change and Disaster Risk Reduction
NAP	National Adaptation Plan
NDC	National Determined Contribution
NDMO	National Disaster Management Office
NERM	National Energy Road Map
NGO	Non-Governmental Organisation
NSDP	National Sustainable Development Plan
NVAF	National Vulnerability Assessment Framework
PA	Paris Agreement
PIC	Pacific Island Country
PSIDS	Pacific Small Island Developing State
PV	Photovoltaic
PWD	Public Works Department
RE	Renewable Energy
REDD+	Reducing Emissions from Deforestation and Forest Degradation
SIDS	Small Island Developing State
TC	Tropical Cyclone
TIP	Millennium Challenge Corporation Transport Infrastructure Project
TNC	Third National Communication to the UNFCCC
TOE	ton of oil equivalent
UN	United Nations
UNDP	United Nations Development Programme
UNELCO	Union Electrique du Vanuatu Limited
UNFCCC	United Nations Framework Convention on Climate Change
URA	Utilities Regulatory Agency
USD	United States Dollar
VBRC	Vanuatu Business Resilience Council
VCCI	Vanuatu Chamber of Commerce and Industry
VMGD	Vanuatu Meteorology and Geo-Hazards Department
VNSO	Vanuatu National Statistics Office
VREP	Vanuatu Rural Electrification Project
VUV	Vanuatu Vatu
W	Watt

EXECUTIVE SUMMARY

Vanuatu is unique among the Paris Agreement parties that have produced Low Emissions Development Strategies (LEDS) and Long-Term Strategies (LTS). Vanuatu is already net negative for greenhouse gas (GHG) emissions. Vanuatu's large forest area removes more than 10 times the GHG emissions generated from human activity.

Yet, Vanuatu's own pathway of reducing emissions demonstrates the commitment it seeks at a global level to address climate change. The guiding vision for the LEDS is the following: Reduce emissions across all sectors in a way that supports resilient, sustainable, and equitable growth for its people.

The Vanuatu LEDS provides sector by sector review of alignment with the vision for reduced emissions mitigation, resilience, and adaptation. It assists mainstreaming of emissions mitigation and adaptation in key sectors: energy, transport, waste management, livestock, forestry and agriculture, and water and health. It brings new insights, attention, and engagement with strategic policy challenges and in doing so, identifies new and complementary actions to those actions described in short- and medium-term strategies.

Vanuatu's energy sector has ambitious mitigation targets to 2030, as described in the National Energy Road Map (NERM) and Nationally Determined Contribution (NDC). For the most part, these strategies and targets align with the vision of the LEDS to reduce emissions through to 2050. Additional actions are needed to meet the LEDS vision, including enhancing existing programmes to meet the electricity demand outside of grid concession areas, promoting a clean cooking transition, scaling up coconut oil production and improving climate resilience and adaptation planning in the energy sector.

Vanuatu has efficiency targets for the transport sector which will reduce emissions. This is a step in the right direction towards the LEDS vision of reduced emissions, but further steps can be taken by developing a national transport policy and accompanying institutional arrangements which consider objectives for long-term emissions reduction and climate resilience. Additional steps include better coordinated Electric Vehicle (EV) pilots, implementing vehicle and fuel standards, and industry skills development for the future of EVs in the country.

The waste sector, including municipal solid waste and wastewater, is a driver of emissions as well as a source of vulnerability in natural disasters. The waste sector is a potential source of energy at household or industry scales. While the waste sector and emissions policy frameworks align with the LEDS vision, additional steps which would support waste sector transition include scaling up biogas production and consumption in urban and rural areas, as well as increasing waste management awareness and support cultural norms of safe waste management.

The livestock sector is the largest single contributor to Vanuatu's GHG emissions. The ambitions to grow this sector must consider other national ambitions to reduce emissions. There is alignment between sector strategy and climate strategy to raise productivity in the livestock sector. Higher productivity systems have lower emissions for the same herd size. Further engagement with the livestock sector is needed to understand and address climate hazards, vulnerability, resilience, and adaptation.

Land uses including forestry and agriculture are the key to Vanuatu's long-term emissions balance and a potential source of carbon credit revenue. But Vanuatu's forests are under pressure from expansion of agriculture, timber and fuel wood gathering, and settlements. Land use policy in both urban and agriculture sector settings offers opportunity to increase resilience and adaptation. Further actions can be taken by implementing a REDD+ forest strategy, submit the Forest Reference Level to UNFCCC, and develop a consolidated programme to access forest carbon markets. For agriculture, Vanuatu can mainstream climate smart agriculture (CSA), increase land use efficiency through integrated practices and develop a framework for land use planning and climate response in the context of Vanuatu custom land practices.

For both water and health sectors, Vanuatu recognises the great vulnerability due to negative impacts on secure access to safe water as well as an increased burden of disease. To meet the LEDS vision, Vanuatu can enhance mitigation efforts in the water sector through inclusion of priorities and frameworks in sector strategies, as well as further develop adaptation plans for the water and health sectors through integration of updated climate change projections into sector plans and strategies.

The long-term actions identified in the LEDS are summarised in Table 1 (below). Their scope and costs, as well as needs for international assistance, will be refined through further policy development. With further refinement and endorsement, the actions identified in this long-term strategy will feature in future iterations of short- and medium-term strategies. Existing institutional structures in the Government of Vanuatu will retain oversight of domestic policy development and implementation.

Table 1: Summary of long-term actions

#	Sector	Action	Action type	Implementation period
1	Electricity and energy use	Enhancing existing programmes to meet the growing electricity demand outside of grid concession areas.	Scaling up programmes	2025–2050
2		Promoting a clean cooking transition to save money, the environment, and lives.	Technology change	2025–2040
3		Scaling up coconut oil production to achieve NERM and NDC targets of renewable energy supply.	Policy and institutional change	2025–2050
4		Bolstering climate resilient and adaptation planning in energy sector.	Study	2025–2030
5	Transport	Develop a national transport policy and accompanying institutional arrangements.	Policy and institutional change	2025–2030
6		Develop national vehicle and fuel standards.	Policy and institutional change	2025–2025
7		Coordinated electric mobility pilots.	Scaling up programmes	2025–2040
8		Green technology skills plan for Vanuatu.	Scaling up programmes	2025–2040
9	Waste	Scaling up biogas production and consumption.	Scaling up programmes	2025–2040
10		Increase waste management awareness and support cultural norms of safe waste management.	Public communication	2025–2040
11	Livestock	Introduce livestock sector emissions target and strategy.	Policy and institutional change	2030–2050
12		Livestock sector analysis of hazards, vulnerability, resilience, and adaptation options.	Study	2025–2050
13	Forestry, agriculture, and land use	Implement the REDD+ forest strategy and submit the Forest Reference Level to UNFCCC.	Policy and institutional change	2025–2050
14		Consolidated programme to access forest carbon markets.	Policy and institutional change	2025–2040
15		Mainstream climate smart agriculture (CSA) strategy to address changing climate and sustainable agriculture.	Scaling up programmes	2025–2040
16		Increasing land use efficiency through integrated practices.	Policy and institutional change	2025–2040
17		Framework for land use planning and climate response in the context of Vanuatu custom land practices.	Policy and institutional change	2025–2030
18	Water and public health	Enhance mitigation efforts in the water sector through inclusion of priorities and frameworks in sector strategies.	Policy and institutional change	2025–2030
19		Further develop adaptation plans in water and health sector plans and strategies.	Policy and institutional change	2025–2030



INTRODUCTION

- 1.1. Purpose of Vanuatu's LEDS
- 1.2 National government context
- 1.3 Definitions

01

1.1 Purpose of Vanuatu's LEDS

1.1.1 International purpose

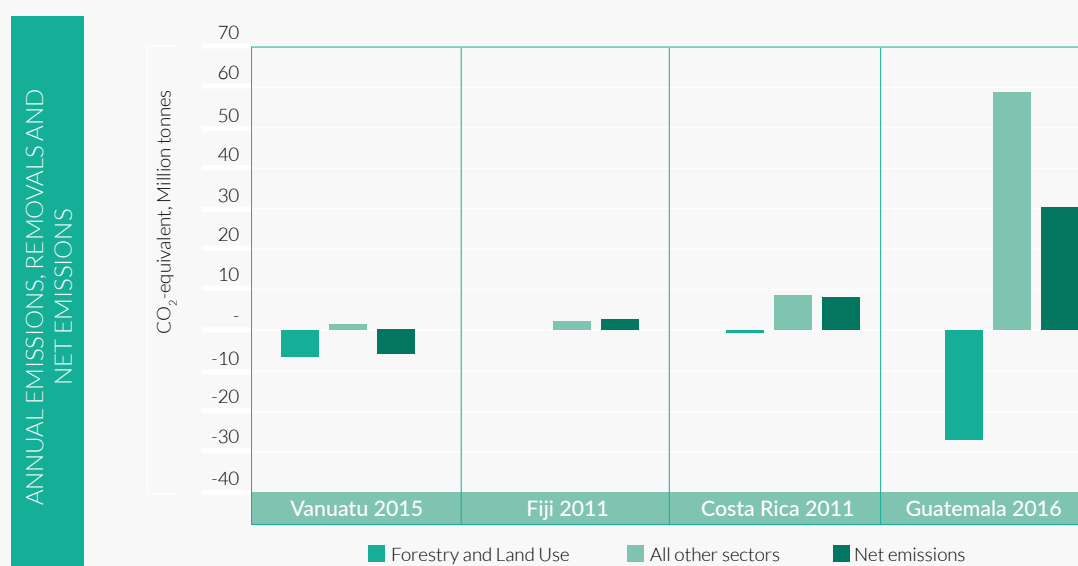
The Paris Agreement sets out a global commitment to limiting warming to well below 2° C while pursuing efforts to limited global temperature rise to 1.5° C. The Republic of Vanuatu signed the Paris Agreement on 22 April 2016 and deposited its instrument of ratification on 21 September 2016. The Government of the Republic of Vanuatu is fully committed to effective and transparent implementation of the Agreement.

Vanuatu submits this LEDS to the UNFCCC and in doing so, fulfils one of the requests of the Paris Agreement. Article 4/para 19¹ invites countries to formulate and communicate long-term low GHG emissions development strategies in line with the global goals to limit the temperature to 1.5° C above pre-industrial levels.

To date, over 50 LEDS and LTS have been produced by a range of developed and developing countries. These strategies reflect a variety of national priorities and circumstances that must be navigated to achieve the global goals, and especially, a credible pathway to net zero by 2050. Other goals include increasing the ability to adapt to a changing climate, increasing finance flows, and pursuing sustainable development objectives.

Vanuatu submits this LEDS to the UNFCCC in the unique position of net negative emissions already. The relative weighting of Vanuatu's large forest sector carbon removals as against smaller human-activity associated emissions means that Vanuatu has net negative emissions. (Figure 1)

Figure 1: Annual emissions, removals, and net emissions, noting the last GHG inventory in 2015 showed Vanuatu had a net negative emissions balance



The existential threat of climate change is taken seriously by Vanuatu. In May 2022 the Parliament of the Republic of Vanuatu declared a climate emergency and responded with domestic and international climate actions. Through international engagement, Vanuatu's seeks increased ambition under the Paris Agreement. Vanuatu is seeking advice in emerging areas of international law on climate change. Furthermore, Vanuatu is currently leading a global movement for an Advisory Opinion from the International Court of Justice on the obligations of States under international law to protect the rights of present and future generations against the adverse effects of climate change.

¹ Article 4, Paragraph 19 of the Paris Agreement states, 'All Parties should strive to formulate and communicate long-term low greenhouse gas emission development strategies, mindful of Article 2 taking into account their common but differentiated responsibilities and respective capabilities, in the light of different national circumstances'.

Through publication of the LEDS, Vanuatu is advocating for greater climate ambition from other global parties and more credible pathways to net zero emissions. Vanuatu's own pathway of sustained net negative emissions in this LEDS demonstrates the commitment needed at a global level.

Vanuatu's most recently updated NDC, published in August 2022, reflects a broadening scope of ambition and commitment to assistance with adaptation and loss and damage. Through publication of the LEDS, Vanuatu is affirming its priorities, capabilities and needs most recently set out in its NDC.

1.1.2 Domestic purpose

As a whole of economy strategy, the Vanuatu LEDS supports and complements strategic policy such as the National Sustainable Development Plan (NSDP) 2016 to 2030. Vanuatu's NSDP serves as the country's highest-level policy framework, comprised of 'three pillars' of sustainable development, encompassing society, environment, and the economy. In line with the three pillars, the plan outlines 15 sustainable development goals. The third target of the environment pillar (ENV 3) addresses the climate links stating that they seek to build, 'A strong and resilient nation in the face of climate change and disaster risks posed by natural and man-made hazards.' The NSDP's accompanying monitoring and evaluation framework outlines how government measures progress towards reaching sustainable development goals, including goals such as mainstreaming climate change and disaster risk in public policies, budget, and legislation by 2030. Though focused on emissions and adaptation, there is an intention to support NSDP goals and implementation where applicable.

The Vanuatu LEDS complements domestic sector strategies. Many domestic sector strategies have five- or ten-year implementation periods. Through synthesis of strategies, identification of gaps, and long-term challenges, the LEDS provides an opportunity to add a low emissions and climate resilient direction to sector development. The refined scope and costs of implementation of the long-term actions, and the needs for international assistance, will be developed through further domestic policy development. With further refinement and endorsement of the LEDS, the actions identified in the long-term strategy will feature in future iterations of both short- and medium-term strategies.

The LEDS communication to the international climate finance institutions and networks offers an opportunity to direct climate funds towards sectors with higher emissions and adaptation impact. As a whole of economy strategy, the Vanuatu LEDS provides insight into transformative changes in energy use, emissions and adaptive capacity.

1.2 National government context

1.2.1 Form of government

Vanuatu is a constitutional democracy. The Prime Minister is the head of government and is elected by the Parliament, comprised of 52 members. At time of publication, the most recent election was held on 13 October 2022.

The Prime Minister appoints a Council of Ministers, which functions as the head of the executive branch of government. The President is the ceremonial Head of State and is elected by Parliament and the Presidents of the six local government councils (provinces). The Malvatumauri (National Council of Chiefs) is elected by District Councils of Chiefs and advises the government in a range of matters.

1.2.2 National development priorities

There are several strategic policies which inform, support, and are supported by a LEDS. The strategic policies include the following:

- Vanuatu National Sustainable Development Plan 2016–2030 The People's Plan: adopted the vision of a stable, sustainable and prosperous Vanuatu, which is to be implemented through

15 goals and measured by targets and indicators. The Plan is supported by a National Planning Framework and Monitoring and Evaluation Framework, which mandates the central role of the Department of Strategic Policy, Planning, and Aid Coordination.

- Updated the National Energy Road Map (NERM) 2016–2030 and the Implementation Road Map: adopted the vision to energise Vanuatu's growth and development through the provision of secure, affordable, widely accessible, high quality, clean energy services for an educated, healthy, and wealthy nation. The five energy sector priorities were access, petroleum supply, affordability, energy security, and climate change. There were 12 indicators included in the NERM and NERM-IP.
- Vanuatu's Climate Change and Disaster Risk Reduction Policy (CCDRR) 2016–2030: this Policy enunciated the vision Vanuatu is a resilient community, environment, and economy. The Policy developed six principles of accountability, sustainability, equity, community focus, collaboration, and innovation. The Policy's objective is to provide the framework for mainstreaming climate change and disaster risk reduction into sustainable development processes.

Relevant sector policies are described in the subsequent sections.

1.2.3 Climate action is a priority

Climate change action is a priority for the Government of Vanuatu. In May 2022, the National Parliament unanimously declared a climate emergency. Vanuatu is a leading global voice for an advisory opinion on climate change responsibilities from the International Court of Justice.

Though methodologies vary, Vanuatu is usually rated in the highest quartile for a country's exposure to climate risk. The Germanwatch 2021 paper using MunichRe data ranked Vanuatu 37 out of 180 countries for combined loss of life and economic damage (GDP) for the period 2000 to 2019. Several Category 5 cyclones have struck Vanuatu in recent years, including Cyclone Pam (2015) and Cyclone Harold (2020).

1.3 Definitions

This document focuses on climate change mitigation and adaptation. The definitions contained within Vanuatu's *Meteorology, Geological Hazards, and Climate Change Act 2016*² are the following:

'Climate change adaptation' is defined as a response to the impacts of climate change, including:
(a) addressing adverse effects arising from climate change; or (b) the possibility of change on any part of the environment (such as the water resources and rainfall, coastal and foreshore areas, reefs and marine habitats); or (c) from harmful weather events and any other event or impact on the environment or human health.

'Climate change mitigation' means activities relating to the reduction of GHG emissions.

The definitions contained within Vanuatu's National Sustainable Development Plan³ are the following:

'Sustainable' is defined as being able to be maintained at a certain rate or level, and not adversely impacting future generations or our environment. Refers principally to ensuring resilience and the effective long-term management of our natural, financial, and human resources.

The definitions contained within Vanuatu's Climate Change and Disaster Risk Reduction Policy⁴ are the following:

'Resilient development' is defined to include activities that enable and strengthen capacities to absorb and quickly bounce back from climate and/or disaster shocks and stresses.

2 Republic of Vanuatu, *Meteorology, Geological Hazards, and Climate Change Act No. 25 of 2016*: <https://www.ilo.org/dyn/natlex/docs/ELECTRONIC/105148/128518/F-500801273/VUT105148.pdf>

3 Government of Vanuatu, *Vanuatu 2030: People's Plan, National Sustainable Development Plan 2016–2030 (NSDP) (2016)*: <https://www.govvu/images/publications/Vanuatu2030-EN-FINAL-sf.pdf>

4 Government of Vanuatu, *National Climate Change and Disaster Risk Reduction (CCDRR) Policy 2022–2030, Second Edition*: <https://www.nab.vu/sites/default/files/documents/National%20CCDRR%20Policy%202022-2030.pdf>

VANUATU'S BAU PATHWAY TO 2050

- 2.1. Long-term emissions drivers
- 2.2. Energy demand in the BAU pathway
- 2.3. Energy supply in the BAU pathway
- 2.4. Agriculture, forestry and land use in the BAU pathway
- 2.5. Emissions in the BAU pathway
- 2.6. Climate change impacts
- 2.7. Vulnerability



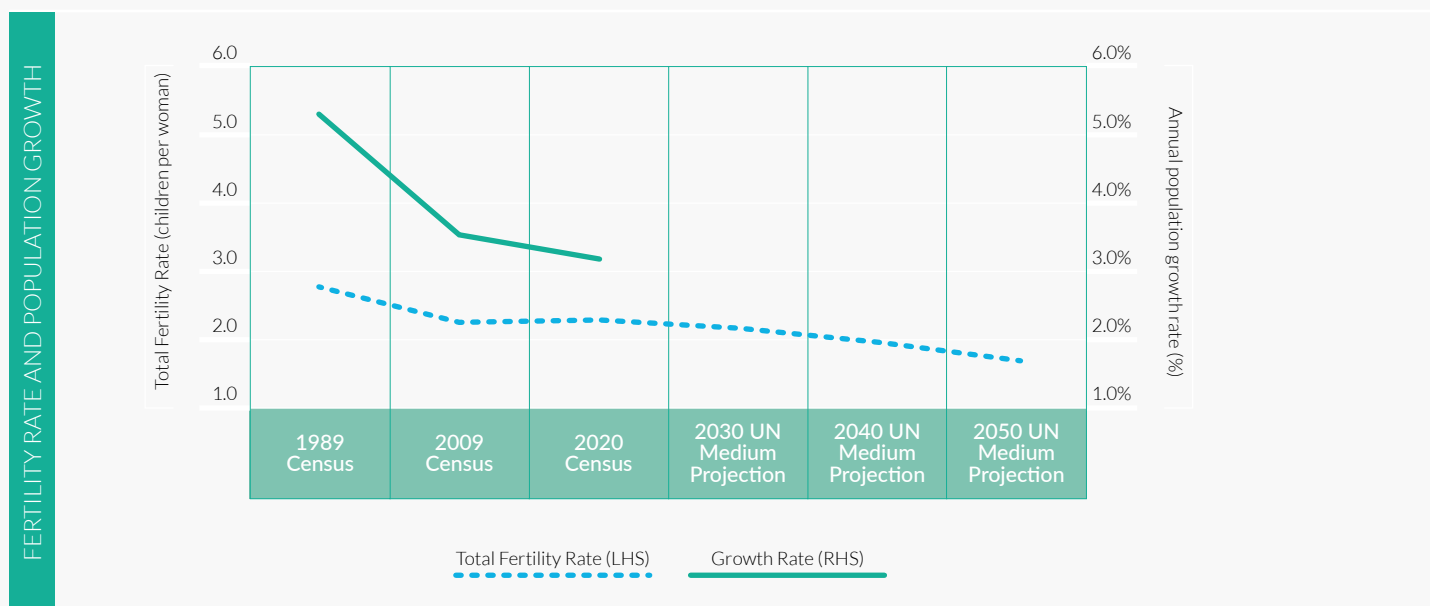
2.1 Long-term emissions drivers

2.1.1 Population

The population of Vanuatu drives energy and emissions through demand for residential services (heating, cooking, appliance use) and transport services (land, sea, and air travel), as well as production of municipal solid waste and wastewater.

To prepare the Vanuatu LEDS, the population forecasts are sourced from the United Nations Population Division's World Population Prospects⁵. The medium variant population growth forecast was used. Over the past three decades, Vanuatu's population has grown approximately 2.3% per year (Figure 2 below). This population growth rate is relatively high within the Pacific region and is surpassed only by the Solomon Islands (2.5% in 2020). The projected rate of population growth declines over time in the UN Population Division medium variant scenario. The decline in the Total Fertility Rate to 3.2 children per woman in the Vanuatu 2020 National Population and Housing Census⁶ indicates that future forecasts and actual population growth rates may be lower than current UN Population Division projections.

Figure 2: Vanuatu's total fertility rate and population growth rates from 2020 VNSO Census and UN Population Division's World Population Projections

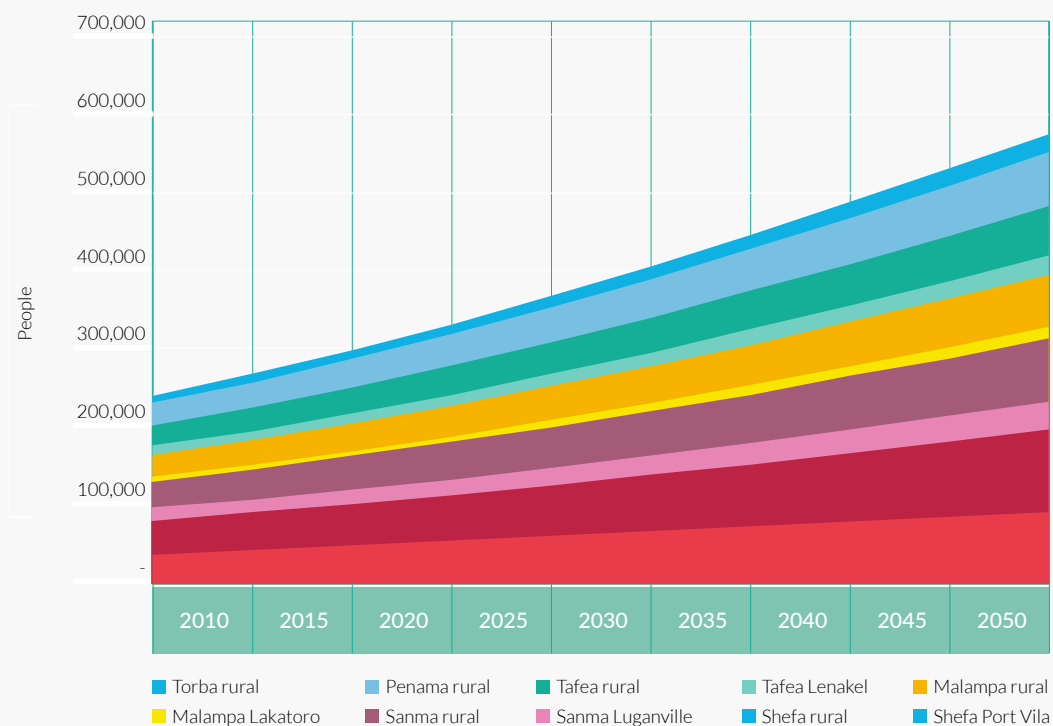


To determine regional distribution of service demand, the 2020 census distributions of provincial and urban populations were applied to national population projection. This implied no change to urbanisation over time, and which has been evident between 2009, 2016, and 2020 Census results. The population projections over time are shown in Figure 3 and Table 2 below.

⁵ United Nations, Population Division, 2022 Revision of World Population Prospects: <https://population.un.org/wpp/>

⁶ Government of Vanuatu, Vanuatu National Statistics Office (VNSO), National Population and Housing Census 2020: <https://vnso.gov.vu/index.php/en/statistics-report/census-report/national-population-and-housing-census/province>

Figure 3: Population projection by province



POPULATION PROJECTION BY PROVINCE

Table 2: Population projection at decade intervals

	National	Port Vila	Luganville	Lenakel	Lakatoro	Rural (outside of current concession areas)
2010	245,453	40,377	14,236	10,309	5,498	175,033
2020	311,685	51,272	18,078	13,091	6,982	222,263
2030	391,135	64,342	22,686	16,428	8,761	278,918
2040	481,641	79,230	27,935	20,229	10,789	343,458
2050	578,568	95,174	33,557	24,300	12,960	412,576

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

There is variation between the estimated national population in the current period, to 2020. The Census 2020 (301,695 people) was approximately 3% or 10,000 persons less than the United Nations Population Division estimate (311,685). The United Nations Population Division estimate was selected for the purpose of the LEDS because of the consistency of projection between current and future period. The Government of Vanuatu does not provide its own population projections.



2.1.2 Economy and industry growth

The size of the economy, represented by the goods and services produced and consumed, is a driver of energy demand and emissions for industry and services sectors. Economic production from agriculture, forestry, and fisheries sectors were not modelled as drivers of emissions.

To prepare the Vanuatu LEDES, industry and services sector value added was projected forwards to 2050 based on real Gross Domestic Product (GDP) growth rate of 3% from 2028 onwards. This assumes no change in economy structure and relative sector contributions to the economy. The industry sector includes manufacturing, construction, mining, electricity, water, and gas; the composition corresponds to International Standard Industrial Classification (ISIC) divisions 10–33. The services sector includes wholesale and retail trade (including hotels and restaurants), transport, and government, financial, professional, and personal services such as education, health care, and real estate services, corresponding to ISIC divisions 45–99.

The projected real GDP growth rates for the period 2021 to 2028 were produced by Vanuatu's Department of Finance and Treasury within their Half Year Update 2022 (Table 3 and Figure 4 below)⁷. For the purposes of LEDES modelling, a 3% real growth rate was selected for the period 2028–2050. The selection of 3% growth rate is conservative compared to recent real GDP and Gross Value Added (GVA) growth for the period 2007–2020 of 3.95 and 3.14% respectively.

Table 3: GDP and sector real growth rates used for the LEDES emissions modelling

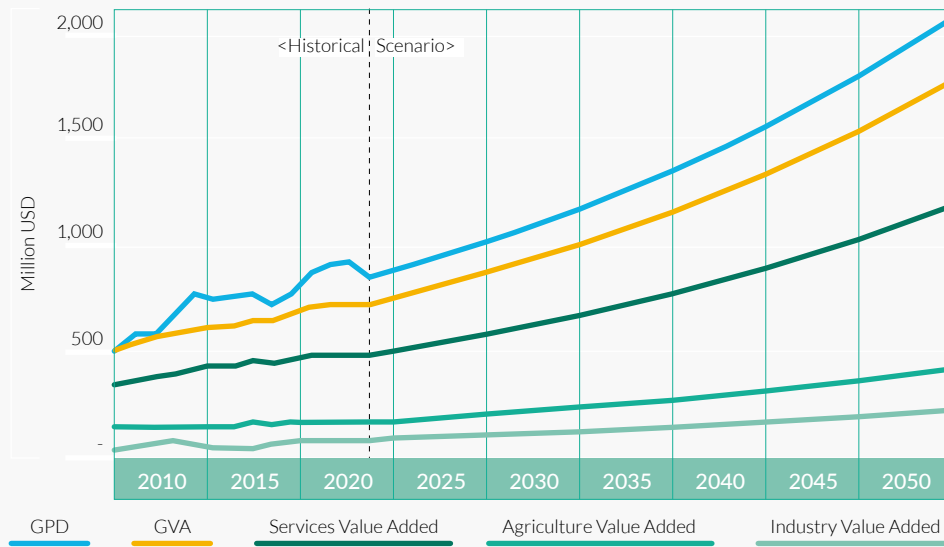
% change, 2006 prices	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028 to 2050
Real GDP Growth	2.9	3.90	-5	2.8	3.6	5.0	4.7	3.2	3.0	2.6	3%
Agriculture Forestry and Fisheries	0.9	4.00	-2.7	2.3	3.0	4.7	3.7	3.3	3.1	2.3	3%
Industry	4.9	9.80	4	10.3	14.6	13.6	10.7	4.0	3.4	3.4	3%
Services	0.8	3.30	-6.7	2.1	2.3	3.5	3.6	2.8	2.6	2.1	3%

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

⁷ Government of Vanuatu, Ministry of Finance and Economic Management (MFEM), Half-Year Economic and Fiscal Update of 2022 (July 2022): https://dof.gov.vu/images/2022/Economics/HYEFU_2022_English.pdf



Figure 4: Projected GDP and industry value added over the LEDS period

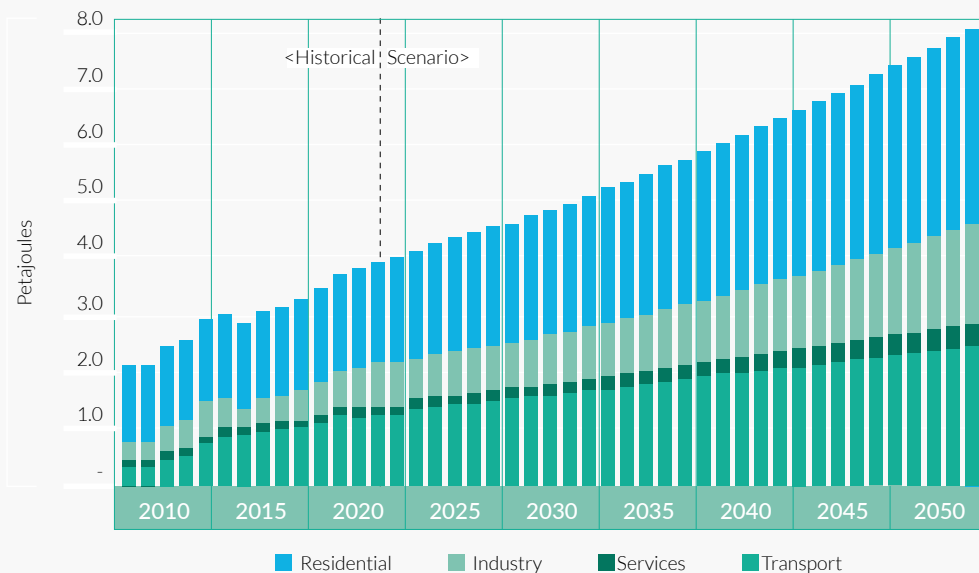


2.2 Energy demand in the BAU pathway

The key energy end uses modelled in the Vanuatu LEDS are the residential sector, industry sector, services sector, and transport sector. The agriculture sector and tourism sector energy demand were not modelled due to an absence of data on energy use in these two sectors.

The business as usual (BAU) pathway holds constant the efficiencies and elasticities of energy use with respect to residential, industry, services, and transport end use. Energy demand is projected to increase from 3.4 Petajoules (PJ) in 2020 to 6.8 PJ in 2050 (Figure 5).

Figure 5: Energy demand projection and composition under the BAU pathway



2.2.1 Residential sector energy demand

Residential sector energy demand is estimated using data gathered from household energy and appliance surveys: Urban Household Appliance & Energy Use Survey of Port Vila & Luganville 2013⁸ and the Vanuatu Household Income & Expenditure Survey 2010⁹.

The primary driver of energy demand in the residential sector in the current accounts and base case pathway is cooking. The vast majority of rural population use wood fuel on an inefficient open stove, also known as a three stone fire. This energy end use is predominately met by fuel wood (Figure 6 and Figure 7). Residential sector energy use per capita is constant over the period to 2050. This comes about from constant patterns of energy use, efficiencies, and sources.

Figure 6: Composition of the residential sector energy demand under the BAU pathway

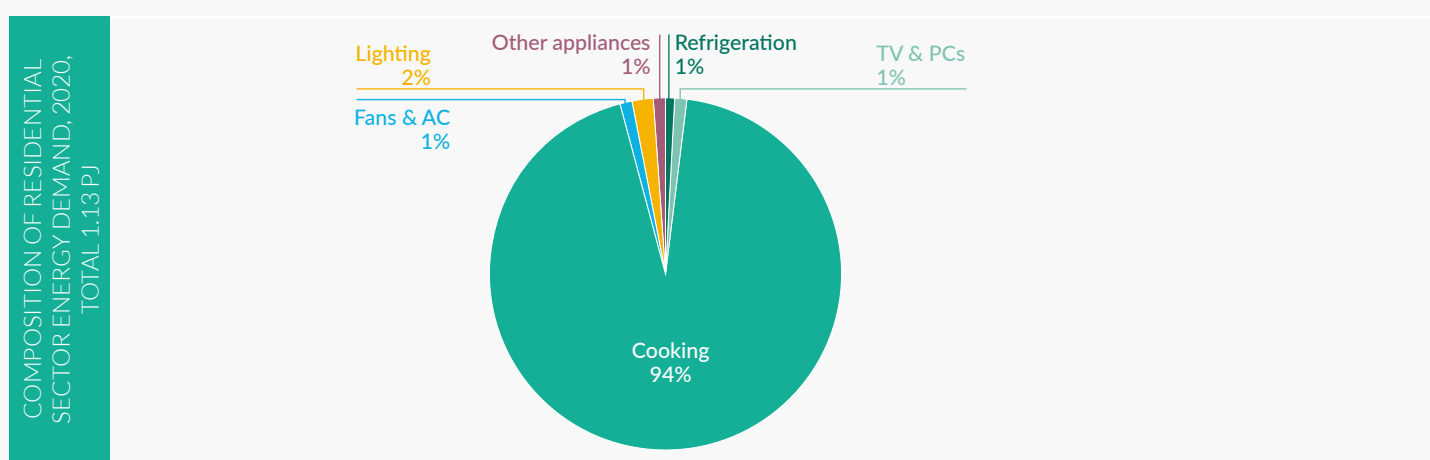
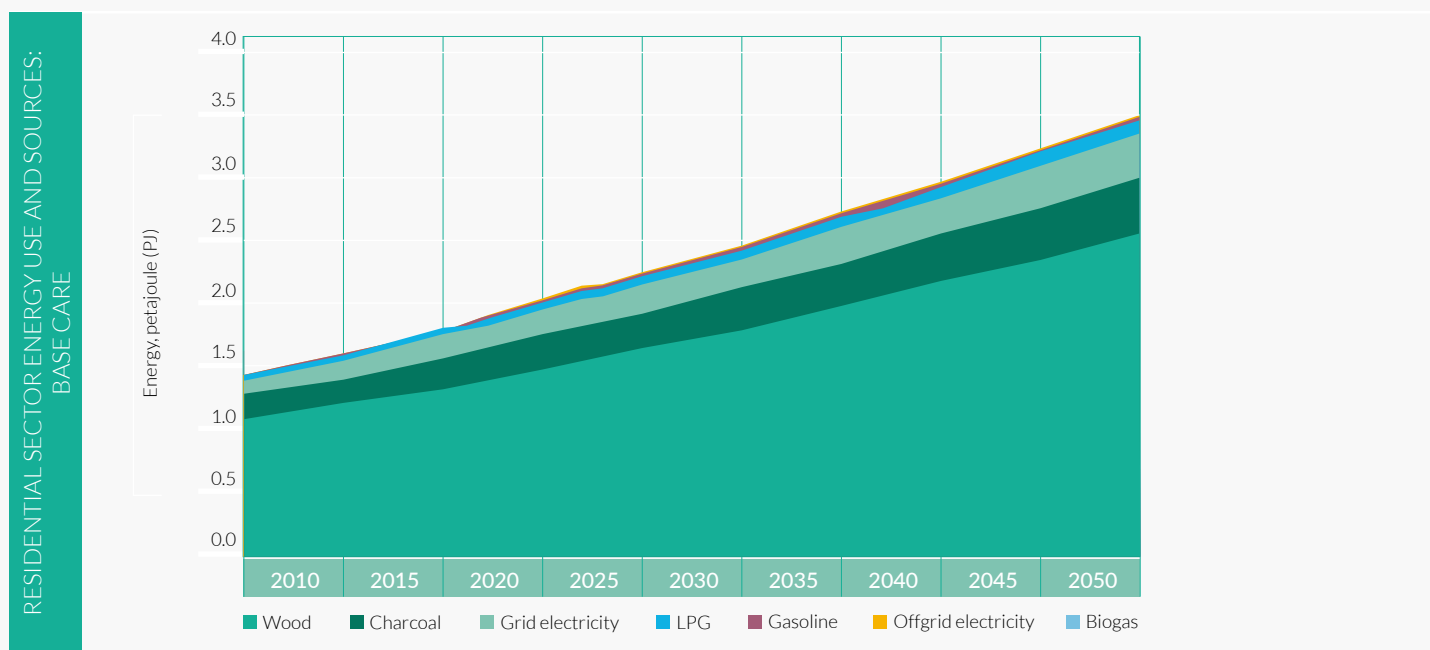


Figure 7: Residential sector energy sources 2010–2050 under the BAU pathway



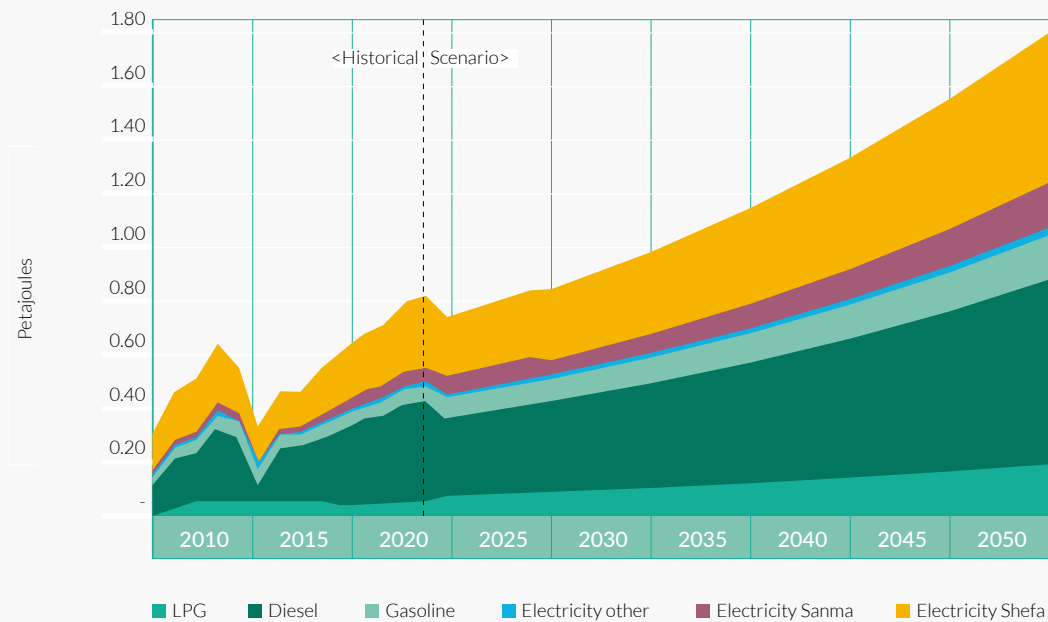
8 International Institute for Energy Conservation (IIEC), 2013

9 Vanuatu National Statistical Office, VNSO, 2010, accessible here: <https://vnso.gov.vu/index.php/en/statistics-report/survey-reports/household-income-expenditure-survey/2010-hies-report>

2.2.2 Industry sector energy demand

In the BAU pathway, industry energy demand grows at the same rate as industry growth. Industry sector energy demand drives consumption of electricity, gasoline, diesel, and liquid petroleum gas (LPG, commonly butane). The BAU energy intensity and projected demand growth are shown in Table 4 and Figure 8.

Figure 8: Energy demand for industry, allocated to fuel source, under the BAU pathway



INDUSTRY ENERGY DEMAND IN BAU PATHWAY

Table 4: Energy intensity of Vanuatu's industry

Energy intensity measure	Value	Units
Average industry electricity intensity 2014–2018, electricity kWh / Industry GVA \$ 2015 constant	0.354	kWh per USD
Average diesel use intensity 2007–2015, Diesel L/ Industry GVA \$ 2015 constant	0.076	Litres per USD
Average petrol use intensity 2007–2015, Petrol L/ Industry GVA \$ 2015 constant	0.021	Litres per USD
Average LPG use intensity, 2007–2017, Tonnes LPG/Industry GVA \$2015 constant	0.0000178	Tonnes per USD

2.2.3 Services sector energy demand

In the BAU pathway, electricity demand for the services sector is projected to grow at the same rate as services sector GVA. The projected demand for electricity is shown in Figure 9 below and electricity intensity is shown in Table 5. Note that only electricity use from the service sector was modelled as data on other energy types was insufficient.

Figure 9: Services sector electricity demand under the BAU pathway

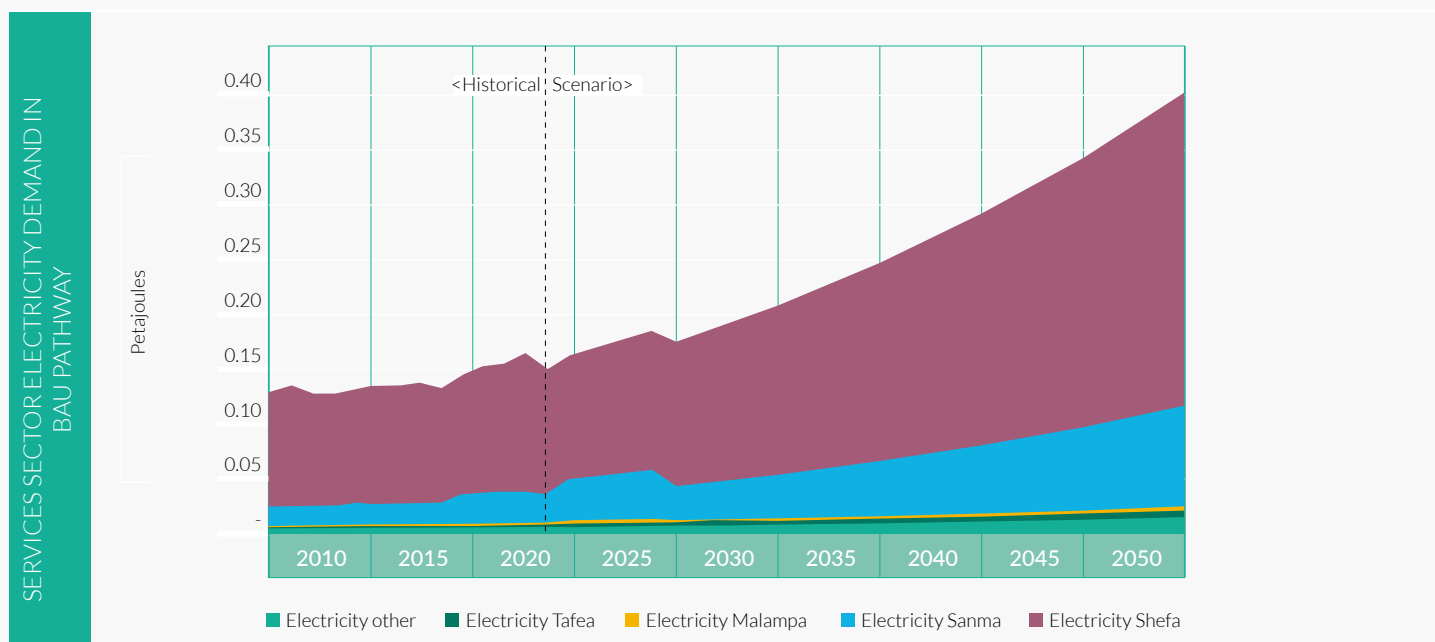


Table 5: Energy intensity of the services sector

Energy intensity measure	Value	Units
Average services electricity intensity 2014–2018 electricity kWh / Services GVA \$ 2015 constant	0.038	kWh per USD

2.2.4 Transport energy demand

In the BAU pathway, transport sector energy demand is projected to grow commensurate with population (Figure 10). The efficiencies and demand parameters are shown in Tables 6 and 7 below.

Figure 10: The transport sector energy demand under the BAU pathway

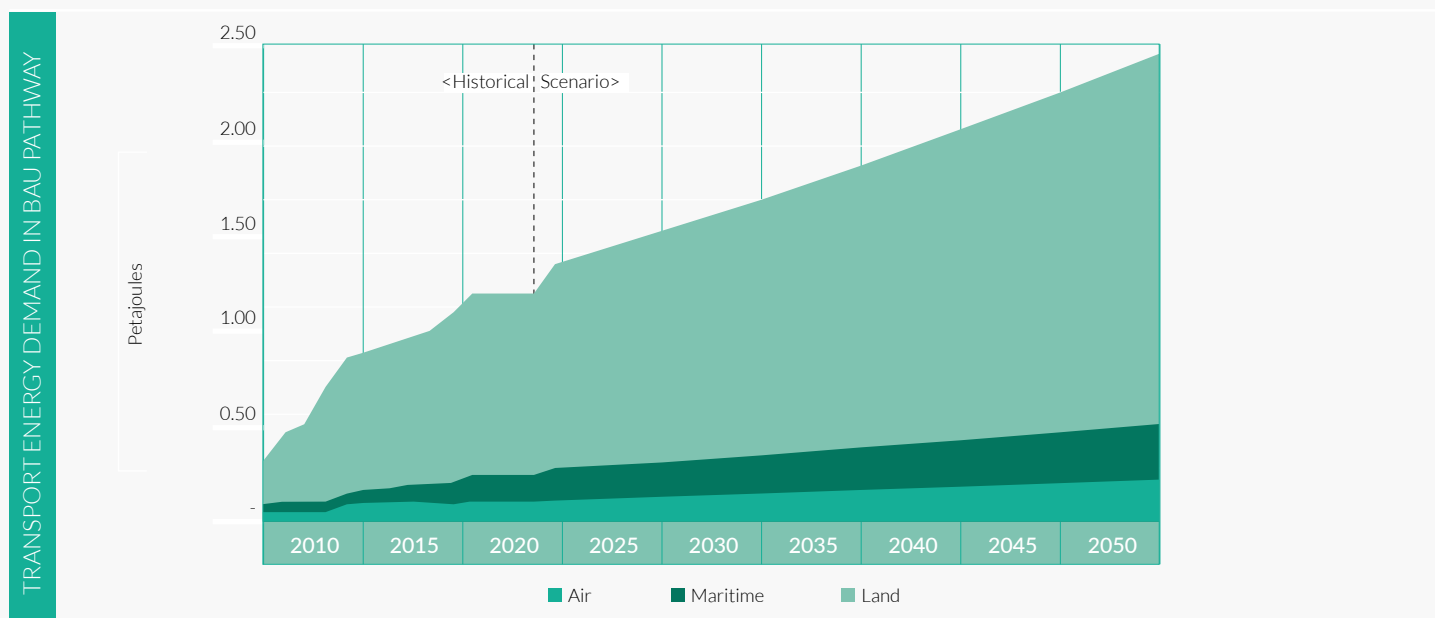


Table 6: Energy intensity

Mode	Fuel source	Value	Units	Source
Land vehicle	Diesel	11.8	L/100km	Fuel use of Ford F-150, selected as representative vehicle
Land vehicle	Petrol	12.6	L/100km	Fuel use of Toyota Tacoma (Hilux), selected as representative vehicle
Sea ship	Diesel	82.0	Litres/hour	Consultation with Vanuatu's shipping industry
Sea boat	Petrol	16.4	Litres/hour	Average fuel consumption 15-50HP 2-stroke and 4-stroke outboard motors
Small plane	Avgas	90.0	Litres/hour	Fuel use of Britten-Norman islander, selected as representative plane
Large plane	Jet Kerosene	762.0	kg/hour	Fuel use of ATR72 with Pratt & Whitney PW100, selected as representative plane

Table 7: Per capita energy demand, estimated from fuel consumption 2007–2015 and energy intensities identified above

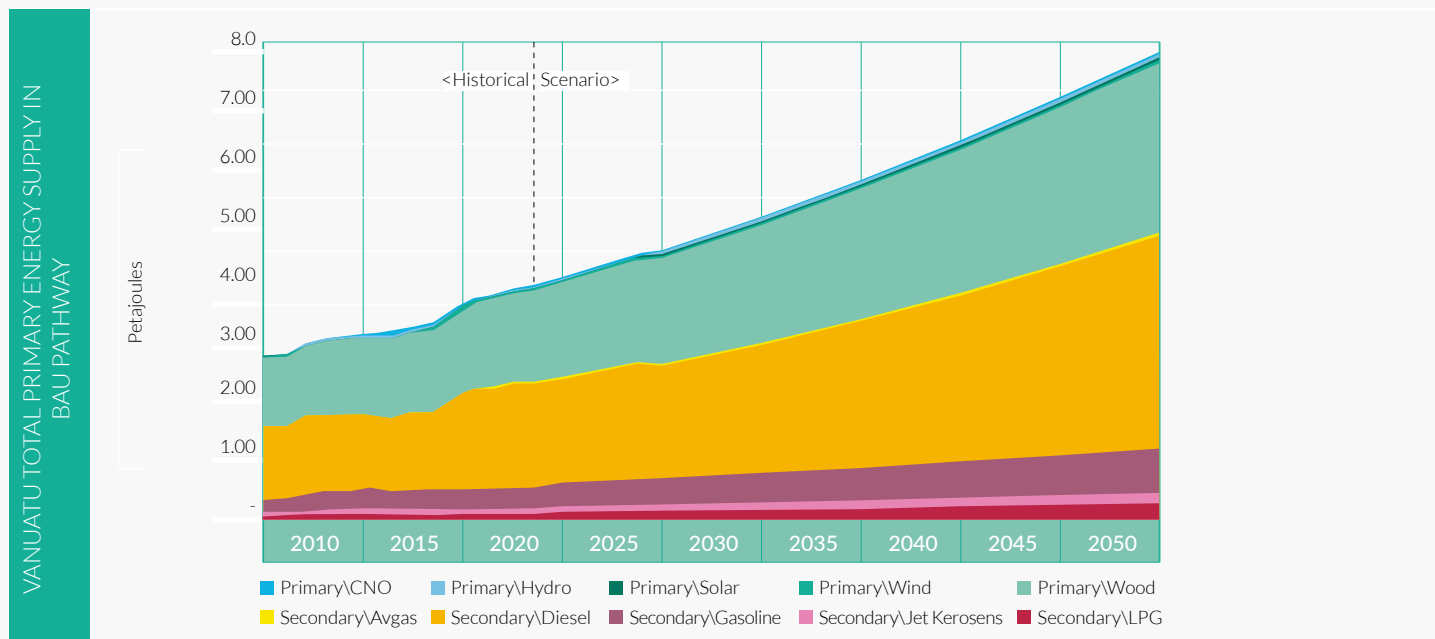
Mode	Value	Units
Land vehicle, diesel	548	km per capita
Land vehicle, petrol	216	km per capita
Sea ship	0.15	hours per capita
Sea boat	0.06	hours per capita
Small plane	0.03	hours per capita
Large plane	0.01	hours per capita



2.3 Energy supply in the BAU pathway

In the BAU pathway, Vanuatu continues to draw heavily from domestic fuel wood to supply cooking energy for the residential sector (Figure 11). In the context of overall energy supply (8 PJ), fuel wood provides 37% of energy and diesel imports 45%.

Figure 11: Primary energy supply under the BAU pathway (source: own calculations)



Source: own calculations

In the BAU pathway, fuel imports are expected to grow from 2.4 PJ in 2020 to 4.9 PJ in 2050. The majority of fuel demand is diesel. Of total diesel demand of 3.7 PJ, the transport sector uses 1.7 PJ, electricity uses 1.3 PJ and industry uses 0.7 PJ.

By 2050, increasing petroleum demand and energy security concerns may necessitate expansion of storage facilities to maintain a minimum onshore reserve at any time. Australia and New Zealand adopt a minimum reserve of 28 days for diesel¹⁰, which if implemented in Vanuatu, would necessitate a resupply ship as often as every two weeks by 2050.

¹⁰ Government of New Zealand, Discussion Paper on Minimum Onshore Stockholding (Jan 2022): <https://www.mbie.govt.nz/dmsdocument/18594-consultation-paper-onshore-fuel-stockholding>



2.4 Agriculture, forestry, and land use in the BAU pathway

In the BAU pathway, forest area remains constant but is degraded due to increasing fuel wood losses. The currently reported forest area of 440,000 hectares (36.3% of land area)¹¹ is maintained but forest fuel wood losses increase with population growth. Fuel wood consumption climbs from 182,000 m³ in 2020 to 269,000 m³ in 2050. Fuel wood consumption is estimated at 2.23 m³ per household per year.

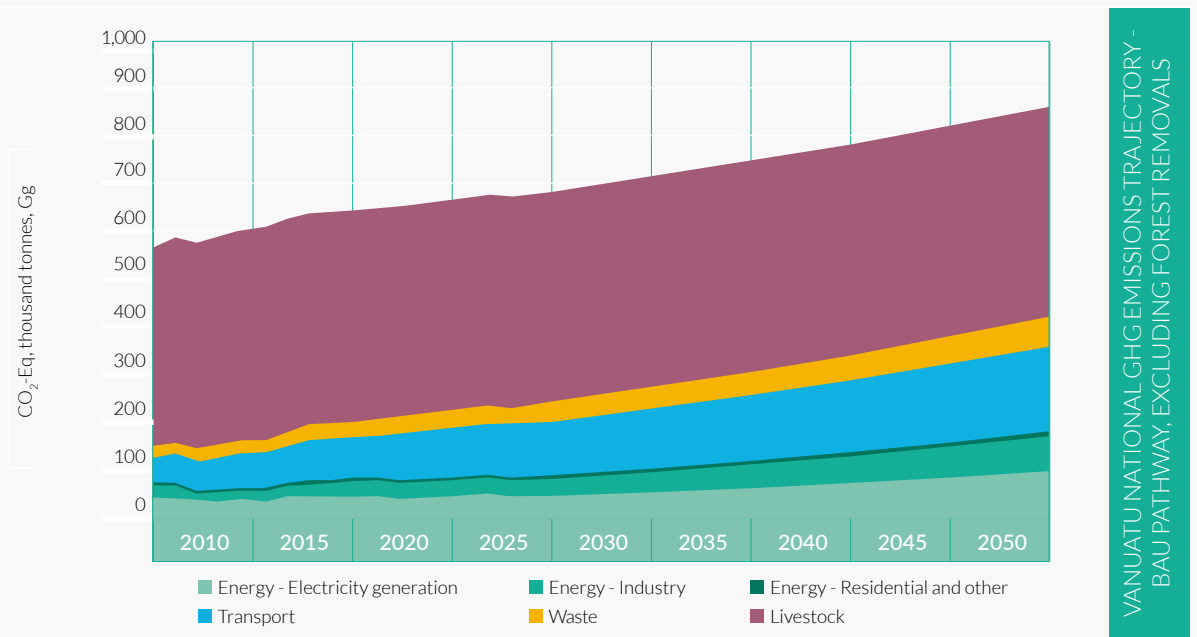
Other drivers of forest degradation and deforestation in Vanuatu include human-induced activities such as agricultural expansion (e.g. small-scale subsistence farming, semi-commercial farming), forestry (e.g. logging), infrastructure development (e.g. tourism, residential settlements), as well as natural occurrences (e.g. tropical cyclones, invasive species)¹².

In the BAU pathway, livestock production continues with the same herd and flock size and practices as the latest estimates available¹³.

2.5 Emissions in the BAU pathway

Vanuatu's GHG emissions in the BAU pathway is dominated by livestock-sector emissions (Figure 12). Though the livestock sector is modelled as consistent in the size of herd and flock, and practices, the substantial weight of emissions from this sector continue to outweigh emissions from electricity generation, industry, residential, transport, and waste sectors. By 2050, the emissions from these sectors (419,000 tonnes CO₂-e) approaches the current emissions from the livestock sector (428,000 tonnes CO₂-e). Overall emissions are 39% higher in 2050 than at the most recent GHG inventory (610,000 tonnes CO₂-e in 2015).

Figure 12: Vanuatu's GHG emissions under the BAU pathway (excluding forest removals)



11 FAO, FAOSTAT: <https://www.fao.org/faostat/en/> and Vanuatu's Enhanced NDC 2020-2030 (Nov 2020): <https://www.nab.vu/sites/default/files/documents/Vanuatu%20NDC%20Update%20Report%20r2.pdf>

12 UNIQUE forestry and land use GmbH, Policy Brief: REDD+ in Vanuatu, Addressing Drivers of Deforestation (July 2017): https://www.researchgate.net/profile/Sophia-Carodenuto/publication/324822898_Reducing_Emissions_from_Deforestation_and_Forest_Degradation_REDD_in_Vanuatu_Addressing_the_Drivers_of_Deforestation_POLICY_BRIEF/links/5ae4679baca272ba507ef05b/Reducing-Emissions-from-Deforestation-and-Forest-Degradation-REDD-in-Vanuatu-Addressing-the-Drivers-of-Deforestation-POLICY-BRIEF.pdf

13 Government of Vanuatu, Third National Communication (TNC) to the UNFCCC (Nov 2020): https://www4.unfccc.int/sites/SubmissionsStaging/NationalReports/Documents/419680_Vanuatu-NC3-1-Vanuatu%20Third%20National%20Communication%20Report.pdf

Under the BAU pathway, Vanuatu's forests absorb a declining amount of forest carbon in the years 2030 to 2050. The decline in forest carbon removals is due to increased demand for fuel wood, principally for cooking. The volume of fuel wood consumption increases to almost 270,000 m³ of wood per year in 2050. Declining forest productivity due to climate change impacts are not modelled.

The overall impact on Vanuatu's net emissions, after accounting for growing emissions and shrinking removals, is a steep decline in net carbon removals. Net carbon removals decrease from approximately 6,340,000 tonnes in 2020 to 5,880,000 tonnes in 2050 (Figure 14). The BAU development pathway, with loss of carbon removals, contrasts with Vanuatu's ambitions to lead global climate action.

2.6 Climate change impacts

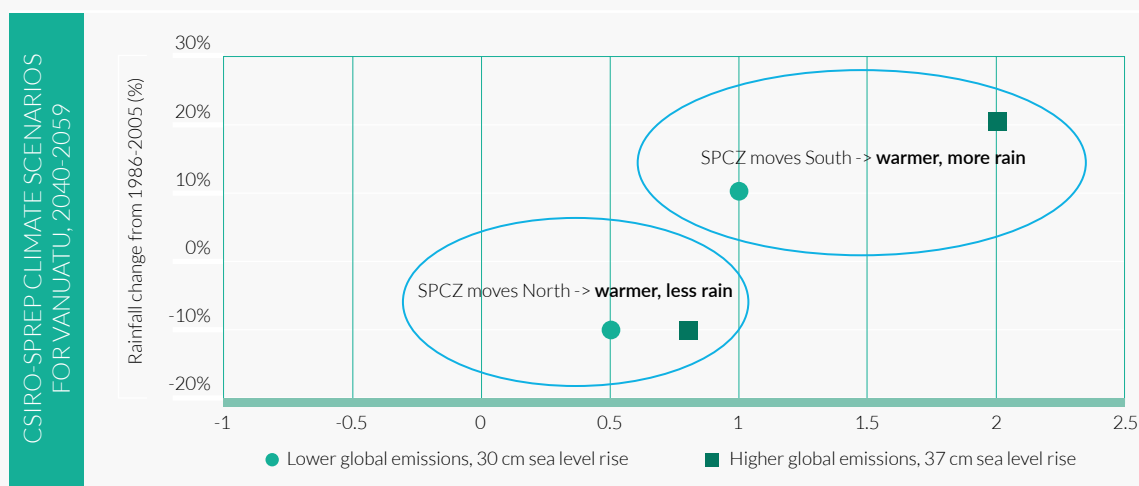
The major climate driver for Vanuatu is the strength and location of the South Pacific Convergence Zone (SPCZ). The SPCZ is a dominant rainband and origin of tropical cyclones. Vanuatu is located on the southern edge of the SPCZ, and any movements north or south will impact the pattern and magnitude of rainfall, as well as temperature.

The available climate change projections for Vanuatu provide several scenarios and probabilistic outcomes for temperature change, rainfall change, and sea level rise. The 2021 updates to the CSIRO, Australian Bureau of Meteorology and Secretariat of the Pacific Regional Environment Programme (SPREP) climate projections for Vanuatu¹⁴ provide four potential scenarios with varying expected change for Vanuatu. These are represented in Figure 13 below.

Sea level rise presents a fundamental challenge to Vanuatu economy, society, and environment. The World Risk Report observes that over 25% of the population is at risk of sea level rise¹⁵.

Assessments of long-term climate change impacts to 2050 remain to be developed at a smaller scale. The country of Vanuatu, comprised of 83 volcanic islands with a land area of 12,200 km², is spread over an Exclusive Economic Zone of ocean 663,000 km² that stretches almost 1500 km from 12 degrees South to 21 degrees South latitude of the equator. The large geographic expanse means that climate change projections at national level will hide the variations at a smaller scale.

Figure 13: Vanuatu's climate scenarios 2040–2059, updated by CSIRO–SPREP 2021



14 Commonwealth Scientific and Industrial Research Organisation (CSIRO) and Secretariat of the Pacific Regional Environment Programme (SPREP), 'NextGen' Projections for the Western Tropical Pacific, Current and Future Climate for Vanuatu, Technical Report (Oct 2021): <https://www.rccap.org/uploads/files/2c538622-72fe-4f3d-a927-7b3a7149e73f/Vanuatu%20Country%20Report%20Final.pdf>

15 Bundis Entwicklung Hilft, WorldRisk Report 2022: <https://weltrisikobericht.de/weltrisikobericht-2022-e/#>



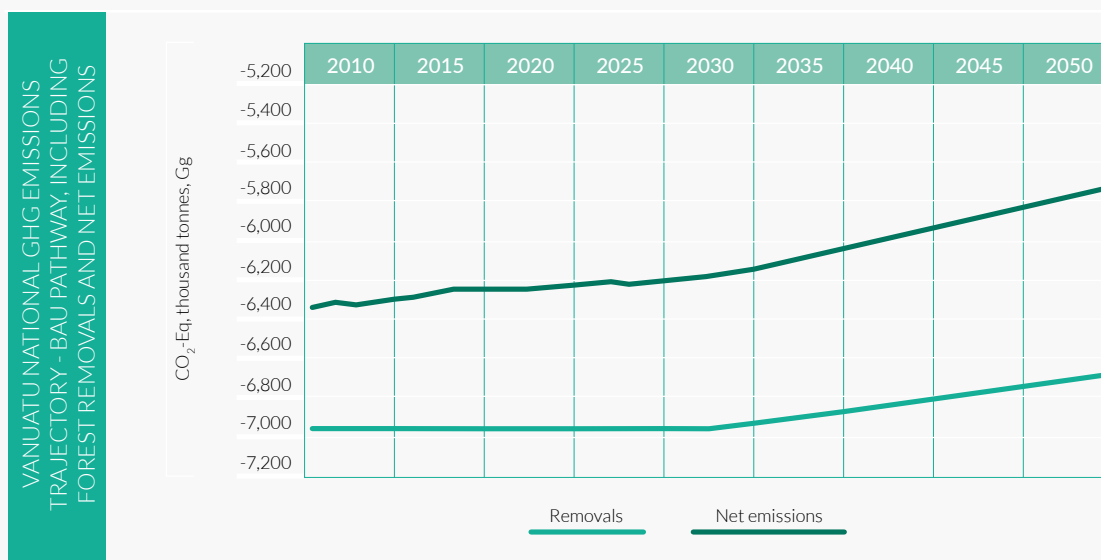
2.7 Vulnerability

Vanuatu is located in a geologically and climatologically active zone of the South Pacific. The combination of low income and subsistence livelihoods with high exposure to extreme events leaves Vanuatu as one of the most vulnerable countries in the world. Despite recent improvements in Vanuatu's economic circumstances and evolving measures of vulnerability, Vanuatu consistently ranks amongst the world's most vulnerable. Vanuatu ranked 8th for climate losses per unit GDP over the 1999–2018 period¹⁶. In the 2020 ND-GAIN index, Vanuatu ranked in the lower third of countries for resilience¹⁷. The WorldRisk Index 2021 ranks Vanuatu as the world's most vulnerable country to climate and disaster risk based on very high exposure to natural hazards and low coping and adaptative capacities¹⁸. The updated WorldRisk Index 2022 ranks Vanuatu amongst the top 25% most at-risk nations¹⁹.

Recent experience with Category 5 cyclones has demonstrated vulnerability. In March 2015, Tropical Cyclone Pam caused economic damage and losses estimated at over US 450 million or 60% of Vanuatu's GDP²⁰. In addition to loss of infrastructure, there was loss of livelihoods, agriculture, and shelter. Close to 70% of the population were impacted by this cyclone²¹.

In April 2020, Tropical Cyclone Harold struck central Vanuatu. Though damage was widespread in Sanma province, the recovery was hampered by COVID-19 restrictions. The Post Disaster Needs Assessment identified damages totalling 61% of Vanuatu's GDP. Recognising the compound challenges, the Government of Vanuatu produced a combined TC Harold and COVID-19 Recovery Strategy 2020–2023²².

Figure 14: Vanuatu's GHG removals (sequestration from forests) and net annual emissions under the BAU pathway



16 Germanwatch Global Climate Risk Index 2020: https://www.germanwatch.org/sites/default/files/20-2-01e%20Global%20Climate%20Risk%20Index%202020_16.pdf

17 World Bank, Vanuatu Climate Risk Country Profile (2021): https://climateknowledgeportal.worldbank.org/sites/default/files/country-profiles/15825-WB_Vanuatu%20Country%20Profile-WEB.pdf

18 Bundis Entwicklung Hilft, WorldRisk Report 2021: https://weltrisikobericht.de/wp-content/uploads/2021/09/WorldRiskReport_2021_Online.pdf

19 Bundis Entwicklung Hilft, WorldRisk Report 2022 ranks Vanuatu 49th out of 192 nations: https://weltrisikobericht.de/wp-content/uploads/2022/09/WorldRiskReport-2022_Online.pdf

20 Government of Vanuatu, TC Pam Post Disaster Needs Assessment (PDNA) (May 2015): <https://www.gfdrr.org/sites/default/files/publication/pda-2015-vanuatu.pdf>

21 World Vision, fast facts: <https://www.worldvision.org/disaster-relief-news-stories/2015-vanuatu-cyclone-pam-facts>

22 Government of Vanuatu, Vanuatu Recovery Strategy 2020–2023, TC Harold and COVID-19 (July 2020): <https://dsppac.govvu/images/roc/vanuatu-recovery-strategy.pdf>

VANUATU'S LEDS VISION: REDUCE EMISSIONS ACROSS ALL SECTORS IN A WAY THAT SUPPORTS RESILIENT, SUSTAINABLE, AND EQUITABLE GROWTH FOR ITS PEOPLE

3.1 Vision development

3.2 Energy demand and composition

3.3 Lower emissions

3.4 Sustainability and equitable growth through
resilience and adaptation



3.1 Vision development

The vision guiding the Vanuatu LEDES is the following:

Reduce emissions across all sectors in a way that supports resilient, sustainable, and equitable growth for its people.

This vision was developed through consultation with the Government of Vanuatu, private sector, not for profit sector, and development partners. The process to develop the vision for the Vanuatu LEDES considered the existing statements of strategic policy to 2030, the Paris Agreement goals for mid-century net zero and Vanuatu's unique position of net negative emissions. Appendix 1 describes the LEDES development process.

There is complementary overlap between LEDES vision and the National Sustainable Development Plan (NSDP) vision for a stable, sustainable, and prosperous Vanuatu. The NSDP defines stability as the political, policy, programme, and economic stability; sustainable as the resilience and effective long-term management of resources; prosperous as the general wellbeing including education, health, and wealth.

Further information on the vision development process, communications, participation, and capacity building is contained in Appendix 1.

3.2 Energy demand and composition

In the low emissions pathway, Vanuatu's energy supply composition is redirected towards lower emissions, cleaner and local fuel sources. The LEDES pathway sees substantial reductions in the supply of fuel wood (-2.5PJ), diesel (-2.3 PJ) and gasoline (-0.3 PJ) compared to BAU. These energy sources are substituted by solar, wind, hydro, coconut oil, biogas, and biomass (collectively 2.3 PJ) (Figure 15).

In addition to changing fuel supply composition, improvements in end use efficiency reduce overall energy demand. End use efficiency gains are made through adoption of technology with greater efficiency for the same fuel sources, such as replacing open fires with efficient wood stoves, and as well as technology with greater efficiency from alternative fuel sources, such as replacing diesel vehicles with electric vehicles. The overall impact of improvements in end use efficiency in residential, industrial, services, and transport sectors are a reduction in the required annual energy supply by 2.7 PJ, from 8.0 PJ to 5.3 PJ by 2050 (Figure 16).

Figure 15: Energy supply mix, BAU vs. LEDES pathways

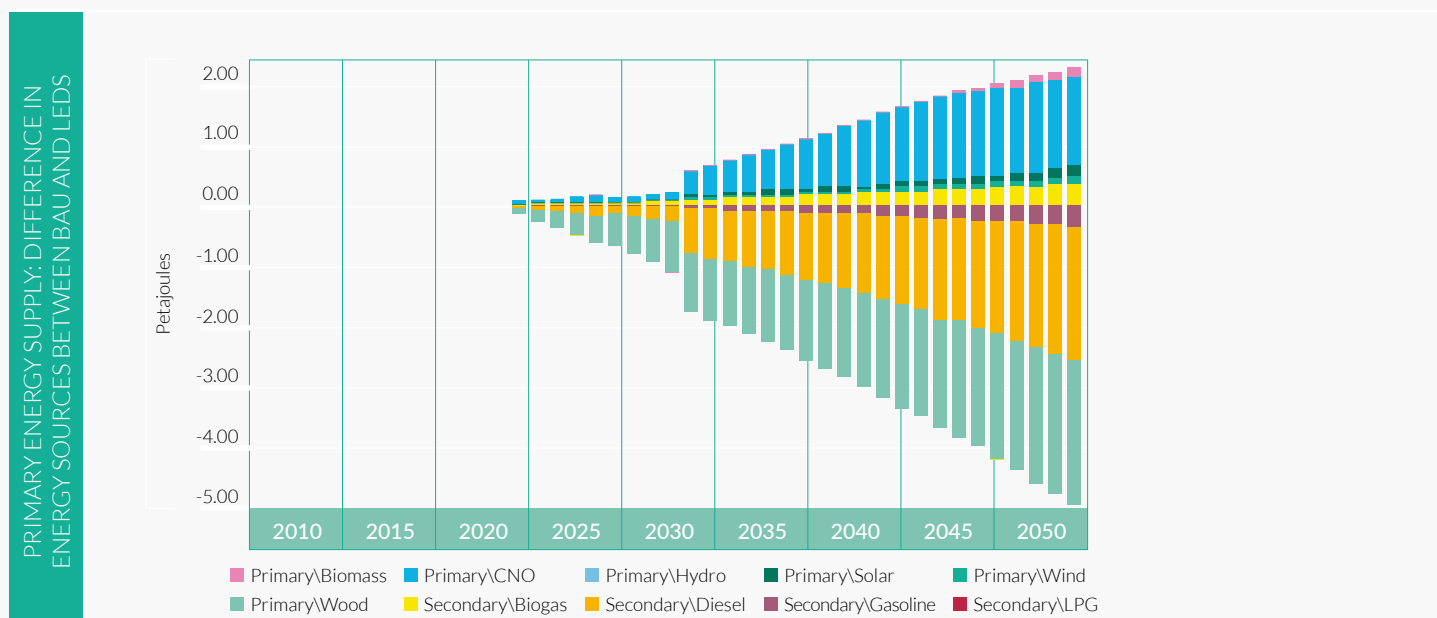
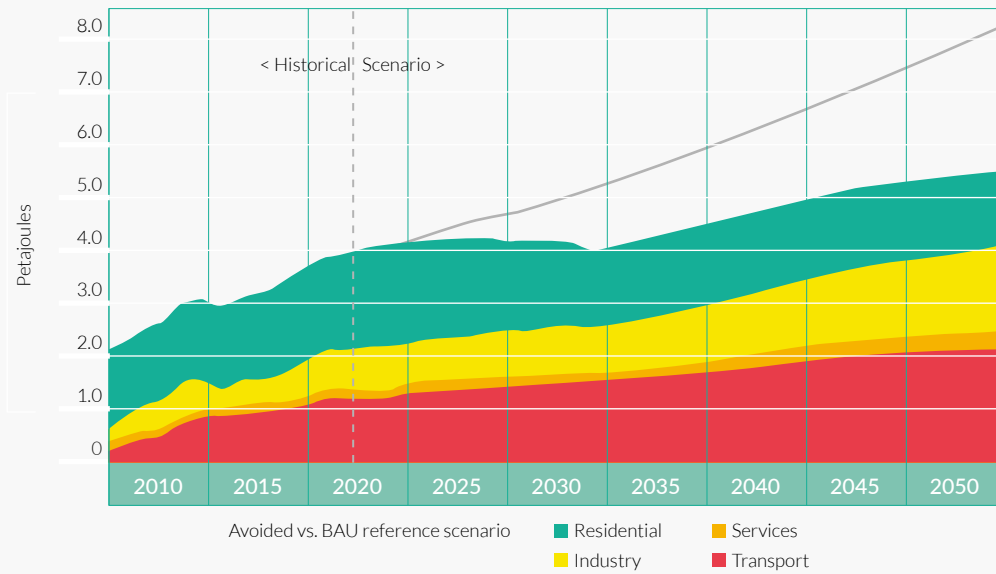


Figure 16: The LEDS pathway has lower energy requirement than the BAU pathway



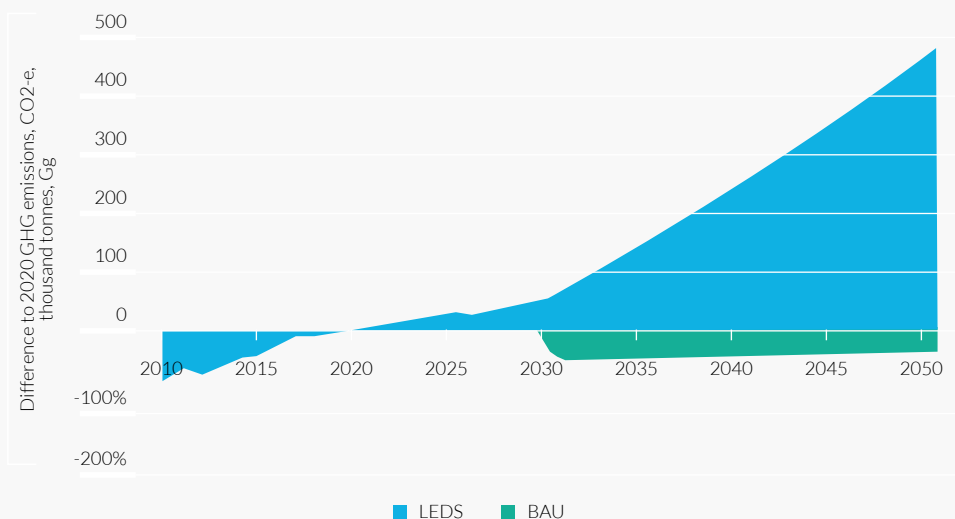
ENERGY REQUIREMENTS OF LEDS PATHWAY

3.3 Lower emissions

In addition to lower energy demand and cleaner fuel sources, Vanuatu plans additional emissions reductions actions in the livestock, waste, and forestry sectors to assist and reduce overall emissions from the BAU pathway and the overall balance of Vanuatu's emissions. Compared with a 2020 baseline of emissions, the LEDS pathway decreases net emissions by 25,000 tonnes CO₂-e by 2050 while the BAU pathway increases net emissions by 460,000 tonnes CO₂-e by 2050 (Figure 17).

In both the BAU and LEDS pathways, Vanuatu remains net negative emissions due to the forest sector carbon removals.

Figure 17: Annual net emissions, BAU vs. LEDS, relative to 2020 baseline of 6,341,000 tonnes carbon removals (negative emissions)



EMISSIONS PATHWAY RELATIVE TO 2020 LEVELS

Figure 18: Vanuatu's GHG emissions under the LEDS pathway

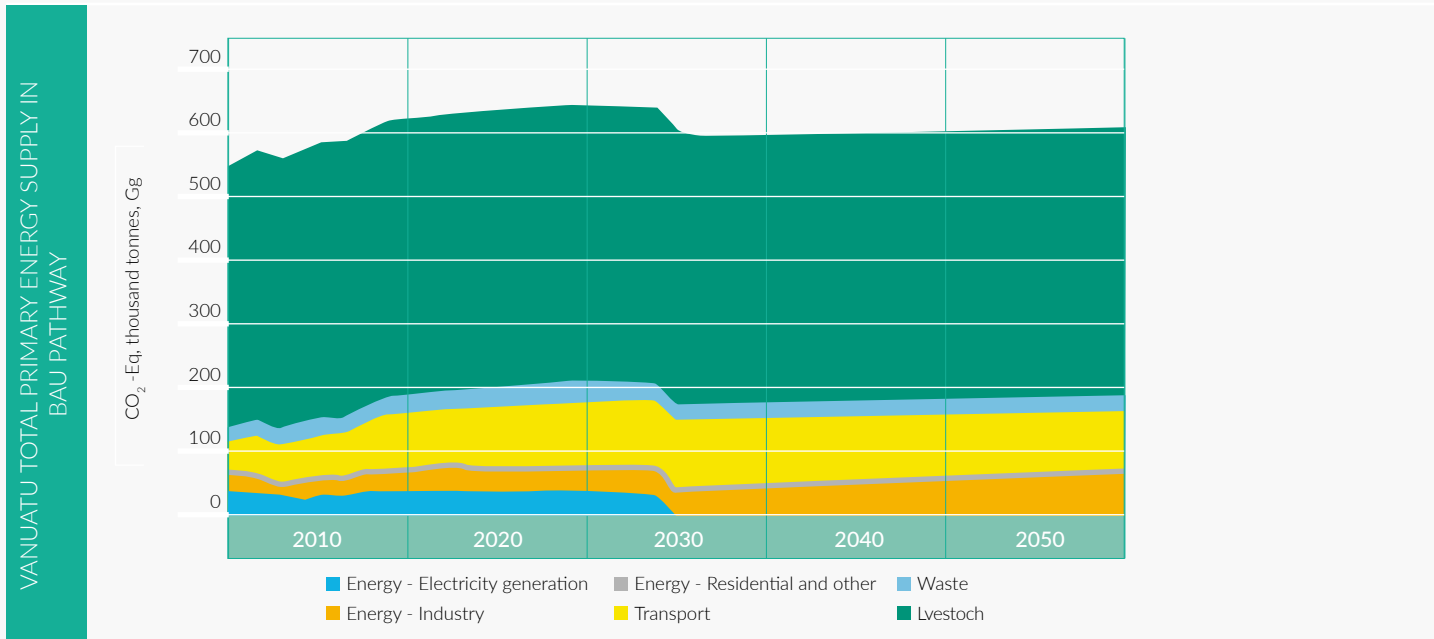
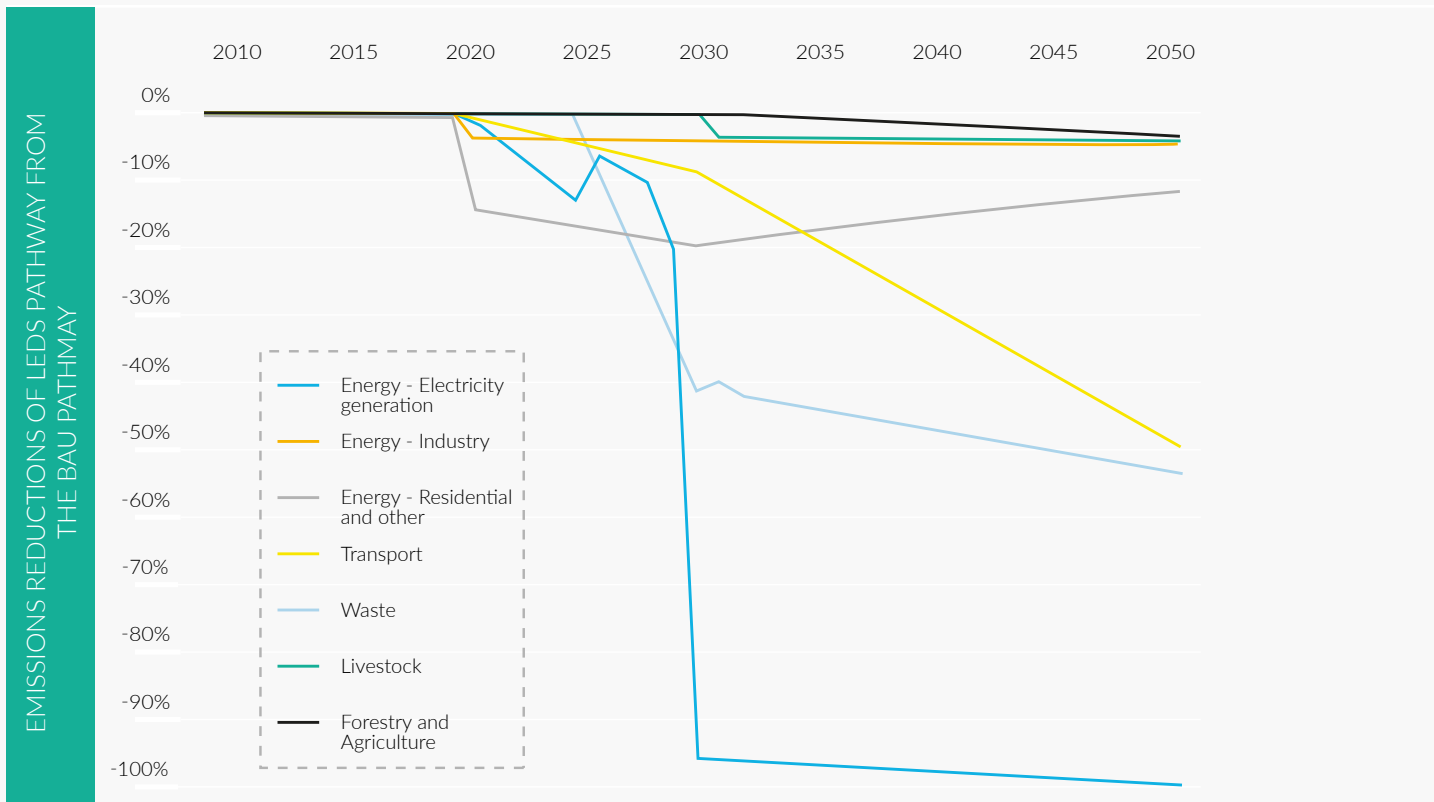


Figure 19: Emissions reductions of the LEDS pathway from the BAU pathway





3.4 Sustainability and equitable growth through resilience and adaptation

The LEDS vision is for resilient, sustainable, and equitable growth for the people of Vanuatu. To deliver this vision in the context of a changing climate requires increased resilience and adaptive capacity for the people of Vanuatu.

Resilience and adaptive capacity cannot be modelled in the same way as emissions reductions due to their qualities in multiple dimensions. For example, one resilience framework utilised by the local non-governmental sector, the 'Vanuatu Community Resilience Framework'²³ considers: basic needs, livelihoods, and equitable resource access, inclusive governance, information access, cultural capacity, social networks, and responsive government²⁴. Another example resilience framework developed by the local private sector, the 'Business Resilience Framework'²⁵ considers: business development and planning, disaster risk reduction, climate change adaptation, as well as community, family, and kinship ties.

The evolving work in vulnerability assessments in Vanuatu may yield a better measure of resilience and adaptive capacity. The National Climate Change and Disaster Risk Reduction Policy (2022–2030) recognises the need for standardised methodology and guidelines for multi-hazard risk and vulnerability assessment²⁶. With these methodologies, the assessment and implementation of the Vanuatu LEDS could show a pathway towards the vision for 2050. Measurable resilience and adaptation remain to be developed. Notable examples include the ongoing work of the UNFCCC Glasgow–Sharm el-Sheikh work programme on the global goal on adaptation (2022–2023)²⁷, as well as the Government of Vanuatu's intent to begin operationalising the National Vulnerability Assessment Framework (NVAF), begin development of a National Adaptation Plan (NAP), and continued inclusion of quantifiable metrics for adaptation and resilience goals within the country's NSDP 2016–2030 Monitoring and Evaluation Framework²⁸.

Equitable growth is included in the Vanuatu LEDS vision. It has multiple interpretations, such as equitable economic growth, gender empowerment, and cultural growth. The Vanuatu LEDS seeks to capture equitable growth through use of the framework in the National Sustainable Development Plan 2030 (NSDP) and alignment of LEDS actions with NSDP targets and implementation plan. The NSDP contains goals and targets in more areas than considered in the LEDS such as vibrant cultural identity, quality education, social inclusion, stable and equitable economic growth.

Furthermore, the Vanuatu LEDS document supports the Revised and Enhanced NDC (2022), which includes youth, gender, and social inclusion commitments and targets that align with the United Nations Sustainable Development Goals (SDGs). Vanuatu's progress on the SDGs, which include broader sustainability and equity goals, is aided by implementation of the NDC and the LEDS.

The Vanuatu LEDS vision guides actions and priorities to support a resilient, sustainable, and equitable future for Vanuatu through the lens of resilience and climate adaptation. Within each sector, resilience and climate adaptation is considered and actions identified.

23 Information on the local NGO 'Community Resilience Framework' can be found here: <https://www.nab.vu/sites/default/files/documents/OXF020%20Ex-Post%20Evaluation%20PRINT.pdf> on page 9, as well as here: https://www.nab.vu/sites/default/files/event_attachments/Day%202%20-%20Resilience%20Framework.pdf and here: https://www.oxfam.org.au/wp-content/uploads/2015/07/2015-12-CC-case-study-vanuatu_FA.pdf

24 Oxfam and SEI, Vanuatu Adaptation and Resilience Study (2016): <https://mediamanager.sei.org/documents/Publications/Climate/Oxfam-SEI-2016-Vanuatu-adaptation-resilience.pdf>

25 Information on the local private sector 'Business Resilience Framework' can be found here: https://drive.google.com/file/d/1iPOYnKgEN_luRgB7uXLK1k4cZZTih1Wi/view on page 10.

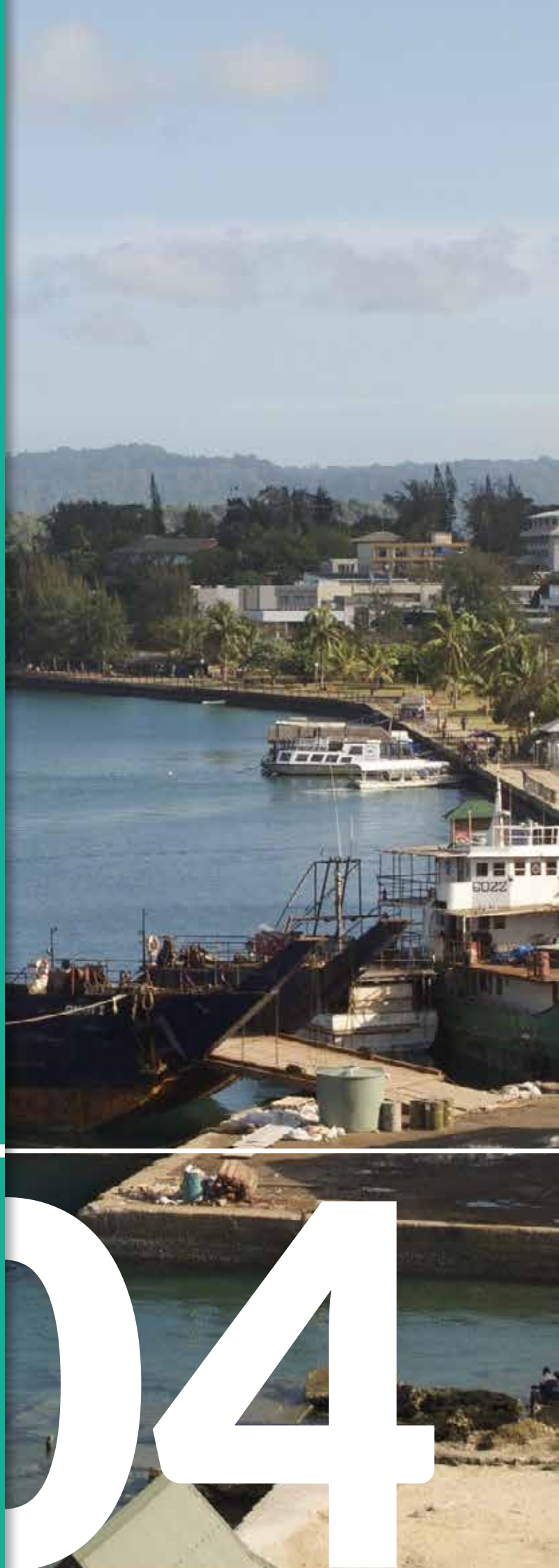
26 Government of Vanuatu, Climate Change and Disaster Risk Reduction (CCDRR) Policy 2022–2030: <https://www.nab.vu/sites/default/files/documents/National%20CCDRR%20Policy%202022-2030.pdf>

27 Information on the UNFCCC GGA can be found here: <https://unfccc.int/topics/adaptation-and-resilience/workstreams/glasgow-sharm-el-sheikh-WP-GGGA>

28 Government of Vanuatu, National Sustainable Development Plan (NSDP) M&E Framework: <https://www.gov.vu/images/publications/NSDP%20M&E%20Framework.pdf>

PUTTING SECTORS ON THE PATHWAY TO A LOW EMISSIONS RESILIENT FUTURE

- 4.1 Approach
- 4.2 Electricity generation and stationary energy use
- 4.3 Transport
- 4.4 Waste
- 4.5 Livestock
- 4.6 Forestry, agriculture, and land use
- 4.7 Water and public health



04

4.1 Approach

The LEDS vision is to *reduce emissions across all sectors in a way that supports resilient, sustainable, and equitable growth for Vanuatu's people.*

Charged with this vision, the LEDS consultation and analysis sought to assess progress towards this pathway, with focus on emissions and adaptation. Assessment followed the sector ambitions, policy framework, and progress needed to achieve the low emissions and resilient future. Noting the purpose of long-term strategies under the Paris Agreement, analysis was consolidated within sectors that reflect emissions sources and climate impacts relevant to the vision. Particular attention was given the vision to reduce emissions across all sectors, which was interpreted as absolute emissions reduction from baseline (2020). The sectors considered were:

1. Electricity generation and stationary energy use
2. Transport
3. Waste management
4. Livestock
5. Forestry and land use
6. Water and health

The selection of these sectors does not reflect the ambitions of wider engagement of Vanuatu in global governance. Dimensions of global climate justice and reparations for loss and damage are not explicitly considered in the domestic policy analysis that is undertaken through the LEDS.

As a long-term strategy to 2050, the LEDS actions are intended to be additional and complementary to existing sector strategies and NDC. The LEDS supports the implementation of NDC actions, though it may recognise gaps and needs beyond the 2030 horizon of the NDC. The scope and costs of implementation of the identified long-term actions, and the needs for international assistance, will be refined through further policy development. With further refinement and endorsement, the actions identified in this long-term strategy will feature in future iterations of both short- and medium-term strategies.

Note the 'summary assessment / traffic light' system utilised below provides a simple, high-level overview of a given sector's alignment to the low emissions (LEDS) pathway, looking at both: a) current policy (e.g. sector policy, strategies, or actions) and b) current emissions trajectory and adaptive capacity (e.g. increasing, decreasing, stabilising, or unclear). The timeline for the 'traffic light' assessment is to 2050, noting current NDC policy targets only extend to 2030, reflecting the need for an 'additional interventions' section to provide actions in addition to existing short- and medium-term policies.

4.2 Electricity generation and stationary energy use

4.2.1 Integrated context assessment and direction from current policy and national consultations

Vanuatu's electricity sector has been the focus of development and emissions reductions priorities. Targets for the electricity sector are the focus for the Updated National Energy Road Map (NERM) 2016-2030, the NERM Implementation Plan (NERM-IP), the Nationally Determined Contribution (initial 2016, enhanced in 2020, and further revised in 2022). The key NERM and NDC policy targets for electricity and stationary energy are shown in Table 8 below.

Table 8: Relevant NERM and NDC policy targets for electricity and stationary energy

National Energy Road Map (NERM)		2030 target
Indicator 1	Increase electricity access by households in concession areas	100%
Indicator 2	Increase electricity access by households in off-grid areas	100%
Indicator 3	Increase electricity access by public institutions (on- and off-grid)	100%
Indicator 4	Improve the efficiency of diesel generation, % reduction in g/kWh fuel use from 2012	20%
Indicator 5	Reduce the cost of distributing petroleum costs in Vanuatu	-15%
Indicator 6	Increase the proportion of electricity generated from renewable energy sources	100%
Indicator 7	Improve electricity sector end-use efficiency, % saving on BAU projection	14%
Indicator 9	Improve biomass end use (cooking and drying) efficiency	14%
Indicator 10	Ensure all energy infrastructure projects comply with government and donor environmental and social safeguard requirements	100%
Indicator 11	Increase the proportion of electricity generated from biofuels	14%
Indicator 12	Increase renewable electricity use by rural tourism bungalows	65%
Enhanced NDC 2020		Target
NDC Action 1 (existing measure)	Renewable energy capacity addition. To approach 100% renewable energy in the electricity subsector contingent upon appropriate financial and technical support.	100%
NDC Action 2 (existing measure)	Substitute and/or replacement fossil fuels with coconut (copra) oil-based electricity generation	100%

These policy targets fall under the strategic areas of the NERM: accessible energy, affordable energy, secure and reliable energy, sustainable energy, and green growth. The targets are a mix of expanding energy access, increasing end use efficiency, as well as altering electricity supply and energy sources.

Supporting implementation of the NERM is the independently established National Green Energy Fund (NGEF). The NGEF directs concessional finance towards achieving NERM goals, particularly in off-grid (out of concession) areas.

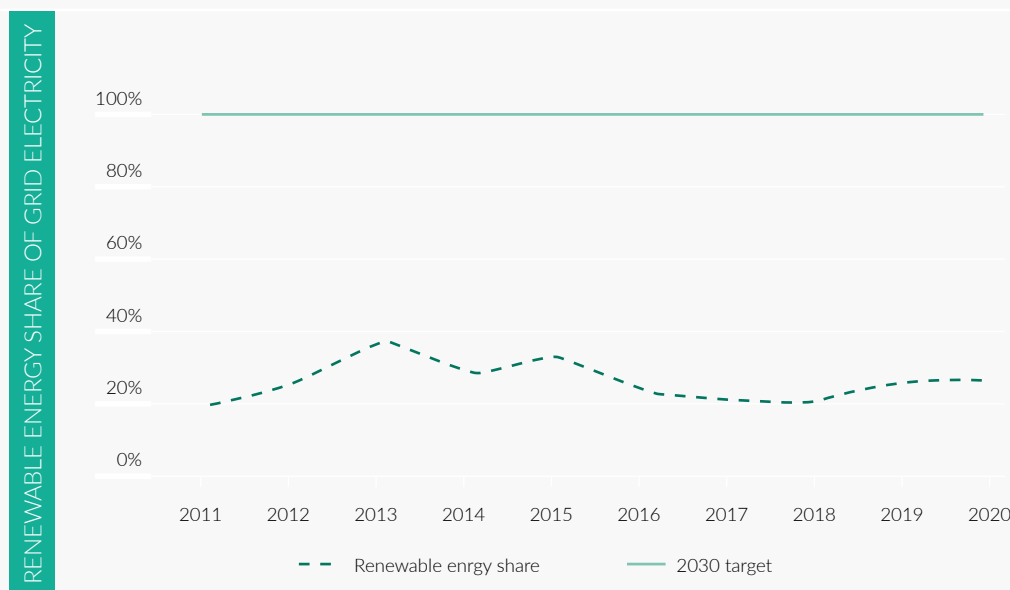
In addition to NERM and NDC targets, there are a range of donor and utility funded infrastructure options and plans that align with the LEDS vision for the energy sector. The World Bank-managed Vanuatu Rural Electrification Project (VREP) Phase I and II is deploying solar resources at the scale to generate about 0.5 to 1 GWh per year. Japan International Cooperation Agency is supporting the extension to Sarakata hydroelectric scheme²⁹. UNELCO, the monopoly utility for Efate, produced the Efate Energy Road Map 2018–2030³⁰ as a complementary plan to reach NERM goals for 100% renewable electricity.

When reviewed by stakeholders, the near-term policy targets set out in the NERM and NDC were considered to align with the LEDS vision. Some stakeholders raised the challenges of implementation of the policy targets. Particularly for renewable energy sourcing of electricity (NERM indicator 6 and NDC Action 1), stakeholders noted the lagging rates of renewable energy integration into grid electricity (Figure 20).

29 JICA: https://www.jica.go.jp/english/news/press/2021/20220208_30.html

30 UNELCO, Roadmap 2030 for Vanuatu: <https://www.unelco.engie.com/en/commitments/roadmap2030eng>

Figure 20: RE share of electricity generation for Efate, Luganville, Lakatoro, and Lenakal grids (URA, 2017 and 2021)



Further consultation with stakeholders through development of the LEDS recognised evolving technology options and costs since the NERM was published, including advances in affordable small-scale biogas, the growing uptake of integrated solar-appliance systems (such as solar-powered freezers) and new developments in pico- and micro-hydroelectric systems. Consultation with the private solar industry indicated that private purchases of solar and solar battery systems through off-the-shelf retail or installation by an electrical contractor were bringing in a similar scale of capacity to the World Bank-funded VREP initiative (between 500 kW and 1 MW capacity of photovoltaic cells).

Resilience and climate adaptation requirements of the energy sector could be more meaningfully explored in future studies. Stakeholders identified the need to integrate resilience and adaptation needs into infrastructure investment, design, and construction. Better design and construction will lower costs and risks of subsequent disaster events. Vanuatu’s Revised and Enhanced NDC (2022) identifies the need for climate proofing of infrastructure through design and construction (adaptation action A67). The increased intensity of cyclones, even if less frequent, would increase the need to buttress the energy infrastructure and access to ensure climate proofing. Consideration of the energy sector’s resilience has recently been brought to the fore in Tonga following the Hunga Ha’apai eruption in May 2022.

Future studies could include assessment of the vulnerability of the tourism sector accommodation and services, inclusive of energy usage and emissions from tourism-related assets and the goods and services provided. The ongoing GCF Van-KIRAP³¹ project includes tourism as a priority sector, including development of climate information services (CIS) tools for sector end-users and stakeholders. Consultations with government stakeholders suggest near-term plans to begin new, annual primary data collection of tourism sector businesses and their goods and services (potentially including emissions intensity and energy usage of assets).

It was identified during stakeholder consultations that different projects and donors use a variety of different data and risk methodologies to assess vulnerability. A notable example of this project-specific approach is the recently approved GCF Vanuatu Community-Based Climate Resilience Project (VCCRP)³², the design of which included development of a national vulnerability assessment at the

31 Green Climate Fund Project FP035 – *Climate Information Services for Resilient Development Planning in Vanuatu (Van-CIS-RDP)*. Information about the project can be found here: <https://www.greenclimate.fund/project/fp035>

32 Green Climate Fund Project FP184 – *Vanuatu Community-Based Climate Resilience Project (VCCRP)*. Information about the project can be found here: <https://www.greenclimate.fund/project/fp184>

sub-national level (Area Councils) which will only be applicable for this one investment, reflecting the significant resources involved in individual approaches to vulnerability assessments and the need for greater alignment and standardisation with all stakeholders. This should be resolved in part following operationalisation of the National Vulnerability Assessment Framework (NVAF) and development of a National Adaptation Plan (NAP), such as consistent risk mapping for the country and harmonisation of language and metrics to assess impact and aid in investment prioritisation, as well as reduce overall transaction costs for project developers.

4.2.2 Summary assessment

The emissions policy and targets for the electricity generation sector and stationary energy are in line with the 2050 LEDS vision for Vanuatu. The 2030 targets of renewable energy and the actions underway support equitable energy access, sustainability, and low emissions. There is recognised tasking and clear strategies from the Department of Energy and National Green Energy Fund, as well as external energy projects and programmes.

Implementation of the emissions policy and targets remains an area of further attention. There are currently low rates of renewable energy penetration in grid electricity. The low base serves to increase the scale of systems change needed to reach the 2030 targets of 100% renewable energy (even 'approaching 100% renewable').

The current policy and targets for resilience and adaptation in the electricity generation sector and stationary energy are less clear and forward looking to the impacts of climate change. The need to appraise climate proofing in infrastructure is a recognised priority for the Government of Vanuatu in the Revised and Enhanced NDC (2022) as well as the Vanuatu Infrastructure Strategic Investment Plan 2015–2024³³, but this could be further mainstreamed into energy sector planning, policy, and regulations.

The actual energy infrastructure resilience to climate change is uncertain at this time. Energy infrastructure sustained some damaged in recent category 5 tropical cyclones (TC Pam in 2015 and TC Harold in 2020) but the impact on generation assets (wind farms, solar farms, hydroelectric schemes, and diesel generators) have not been catastrophic. An industry-supported vulnerability assessment would assist to clarify whether resilience gaps and adaptation needs for the energy sector have been affected.

Table 9: Assessment summary for the energy sector

	Policy, strategy and actions alignment to the LEDS vision	Current emissions trajectory and adaptive capacity
Emissions reductions	●	●
Resilience and adaptation planning	●	●
Key	<ul style="list-style-type: none"> ● Green = Clear alignment for emissions reductions or adaptation and resilience ● Yellow = Unclear alignment ● Red = No relevant policy or strategies 	<ul style="list-style-type: none"> ● Green = decreasing emissions level or increasing adaptive capacity ● Yellow = uncertain or stable emissions level or adaptive capacity ● Red = increasing emissions or decreasing adaptive capacity

33 Vanuatu Infrastructure Strategic Investment Plan (VISIP) 2015–2024: https://www.nab.vu/sites/default/files/documents/119-visip_2015-2024_report_web.pdf

4.2.3 Additional interventions towards a low emissions climate resilient future

Vanuatu has ambitious energy sector targets to 2030 as described in the NERM and NDC. For the most part, they align with the vision of the LEDS to reduce emissions through to 2050. Some additional actions are needed to meet the LEDS vision to 2050:

1. Enhancing existing programmes to meet the growing electricity demand outside of grid concession areas. Existing programmes provide a strong basis to extend low emissions and climate resilient energy supply. Under the LEDS pathway, renewable energy electricity sources of wind, solar, and hydro are deployed to supply electricity in off-grid areas. In the BAU and current NDC pathways, these are supplied by an equal mix of solar and thermal (diesel generators).
2. Promoting a clean cooking transition to save money, the environment, and lives. Cooking on open fires in the majority of rural and urban areas is consuming ever increasing amounts of forest timber, which is costly at household, society, and environment levels. Under the LEDS pathway, household cooking practices evolve over the period 2020 to 2050 with the initial deployment of fuel-efficient woodstoves to 2030 and then gradual transition towards greater use of cleaner fuel sources of biogas, electricity, and LPG.
3. Scaling up coconut oil production to achieve NERM and NDC targets of renewable energy supply. Coconut oil is a locally available, secure and clean renewable energy source. Under the LEDS pathway to 2050, the coconut oil industry undergoes substantial ramp up in production to substitute coconut oil for diesel in electricity generation.
4. Bolstering climate resilient and adaptation planning in the energy sector. There are benefits from deeper analysis of climate impacts and vulnerabilities as finer scale resolution climate models. Recent advances in climate modelling and regional initiatives offer opportunities for the energy sector to review its resilience and adaptation needs of existing and future infrastructure.

4.3 Transport

4.3.1 Integrated context assessment and direction from current policy and national consultations

Vanuatu's transport sector has come into increasing focus as a target for emissions reduction. Initially with the NERM and subsequently with Vanuatu's Enhanced NDC (2020), a growing list of actions are sought to reduce emissions (Table 10).

Table 10: Relevant NERM and NDC policy targets for the transport sector

National Energy Road Map (NERM)		2030 target
Indicator 8:	Improve transport (land and marine) energy efficiency, % saving on the BAU projection	10%
NDC Action 3 (existing measure)	Improve transport (land and marine) energy efficiency, % saving on the BAU projection	10%
Additional NDC measure 1	Electric vehicles (e-mobility)	
1.1	Electric vehicles (e-buses) for public transportation (10% of total public buses)	10%
1.2	Electric cars (e-cars) in Vanuatu (10% of government fleet)	10%
1.3	1,000 electric two-wheel (e-bikes)/three-wheelers (e-rickshaws)	1,000
Additional NDC measure 2	20% biodiesel (biofuel) blending in diesel	20%
Additional NDC measure 3	Mileage and vehicle emissions standards	

Over the long term to 2050, the emissions reduction benefits of the NERM and NDC actions are overshadowed by increasing transport demand. The annual emissions reductions from NERM and NDC actions are estimated to be 34,000 tonnes CO₂-e per year, but increasing transport demand means that emissions continue to grow by an extra 55,000 tonnes CO₂-e per year even with the actions implemented. To reduce emissions after 2030, further actions need to be taken to guide emissions reduction in the transport sector to meet the LEDS vision.

Electric vehicle transport, including the full variety of vehicles from e-scooters to electric vessels, is a transport and technology system that Vanuatu will likely need to develop if it is to reduce emissions from the transport sector to 2050 from current levels. The electrification of transport must be coupled with renewable electricity generation to reduce overall emissions. Vanuatu's Enhanced NDC (2020) seeks to pilot e-mobility in government fleets and public buses by 2030. As the total distance of transport demand is set to double from 2017 to 2050 (Figure 20), to keep emissions from the transport at the same absolute level, the rate of electrification needs to reach 50%.

The LEDS pathway sees the electric transport share of total demand grow from 0% in 2030 to 50% in 2050 for land and maritime transport. This rate of electrification seems high compared with current, limited experience in Vanuatu. The international experience outside of Vanuatu, including increasing production and choice of low-cost electric vehicles and growing sales and second-hand stock turnover in neighbouring developed markets, indicates a strong international momentum towards electric vehicles. The LEDS pathway sees Vanuatu progressively increasing the use of electric vehicles from 2030, but the policy framework and skills base to support this technology transition remains to be developed.

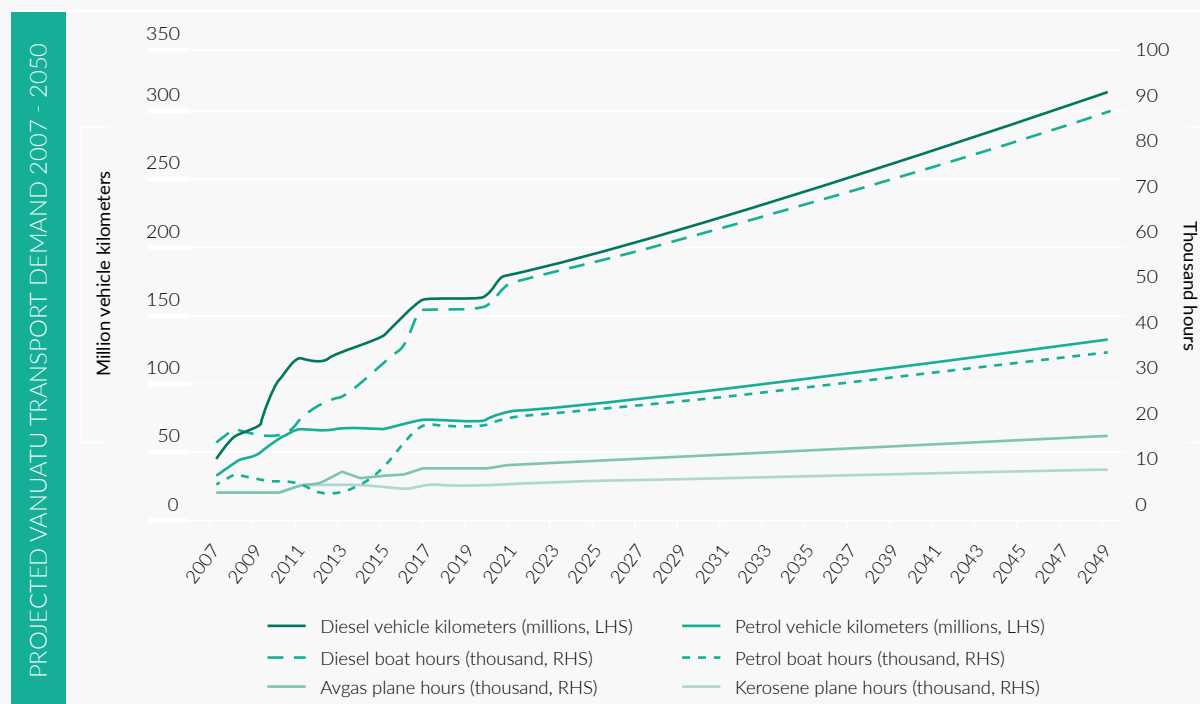
The absence of a Vanuatu national transport policy provides an opportunity to develop a forward-looking policy framework to guide transport service supply in a way that is low cost, low emissions, equitable, and resilient. Equitable, affordable, and efficient transport is an objective (Eco 2.6) under Vanuatu's National Sustainable Development Plan (NSDP).

A forward-looking national transport policy should be informed by the experience of electric vehicle pilots, which can yield synergies if coordinated. The e-mobility pilots proposed in the Enhanced NDC (2020) span several modes and there are potential synergies in coordinating pilots to provide a template for scaling up under a national transport strategy, as well as joint planning of charging infrastructure and updating government regulations in alignment with a long-term transport policy.

In addition to the public and private infrastructure needed to support electric vehicles, private sector operators will need access to a skilled labour market in order to meet the needs of the transport technology transition required. Skilled labour is needed in electrical engineering, automotive servicing, and maritime servicing. Computer skills will be needed to service electric vehicles, which require software updates and diagnosis. A sufficiently large labour pool will be needed to service the several thousand electric vehicles envisioned in operation by 2050.

A forward-looking national transport policy would consider institutional arrangements to build the fixed infrastructure needs of a growing population: roads and bus stops, wharves and docks, petrol and charging stations. At current per capita demand, a nation of 580,000 people in 2050 requires 542 million kilometres of vehicle travel and 87,000 hours of interisland shipping. Transport infrastructure and services are enabling factors to economic growth as well as important tools to address social equity issues such as regional access to services and business opportunities. Donor, public, and private sector funding will be needed to build the required infrastructure. Though many necessary works are delivered through Public Works Department (PWD) within the Ministry of Infrastructure and Planning Utilities (MIPU), and 2013 legislative reforms assisted with public road designation and delegation to provincial government, there remain opportunities to update institutional arrangements to better plan and invest in Vanuatu's transport infrastructure development.

Figure 21: Projected Vanuatu transport demand to 2050 using constant per capita demand, noting the total length of Vanuatu roads was 2,609 km in 2018 (World Bank 2020 VCRT Project Appraisal)



In the absence of a national transport policy, the framework and goals for resilience and adaptation in the transport sector are found in other sectors or in strategic policy documents. For example, Vanuatu’s 2015 agriculture sector policy framework recognises the importance of transportation for agricultural produce and the risks that climate events and natural hazards pose to transport³⁴. The need to appraise climate proofing in infrastructure is a recognised priority for the Government of Vanuatu in the Revised and Enhanced NDC (2022). Some donor programmes have considered and addressed resilience of the transport infrastructure, such as the DFAT funded road maintenance programme³⁵, Millennium Challenge Corporation Transport Infrastructure Project (TIP)³⁶, the World Bank funded Vanuatu Infrastructure Reconstruction and Improvement Project (VIRIP)³⁷, and the Vanuatu Climate Resilient Transport Project³⁸.

4.3.2 Summary assessment

Vanuatu’s Enhanced NDC and NERM set targets for efficiencies and emissions reduction in the transport sector. This is a step in the right direction towards the LEDS vision of reduced emissions. Similarly, the Revised and Enhanced NDC (2022) sets a commitment to climate proofing infrastructure that provides a step in the right direction towards the LEDS vision of climate resilience.

The absence of a national transport policy and accompanying legislative framework leaves the transport sector without a framework to guide transport sector development towards a low carbon and resilient future in line with the LEDS vision.

34 Vanuatu Agricultural Sector Policy 2015–2030, Page 13: <https://www.nab.vu/sites/default/files/documents/Vanuatu%20Agriculture%20Sector%20Policy%202015-2030.pdf>

35 DFAT COVID-19 Response Development Plan: <https://www.dfat.gov.au/development/australias-development-program/covid-19-development-response-plans/vanuatu-covid-19-development-response-plan> and Aid partnership arrangement here: <https://www.dfat.gov.au/sites/default/files/vanuatu-australia-aid-partnership-arrangement.pdf>

36 MCC Vanuatu Compact 2006–2011: <https://www.mcc.gov/resources/pub-full/report-vanuatu-closed-compact>

37 Project Appraisal Document available here: <https://documents.worldbank.org/en/publication/documents-reports/documentdetail/413441467989512699/vanuatu-infrastructure-reconstruction-and-improvement-project>

38 Project Appraisal Document available here: <https://documents.worldbank.org/en/publication/documents-reports/documentdetail/784011580094043492/vanuatu-climate-resilient-transport-project>

Table 11: Assessment summary for the transport sector

	Policy, strategy, and actions alignment to LEDS vision	Current emissions trajectory and adaptive capacity
Emissions reductions	●	●
Resilience and adaptation planning	●	●
Key	<ul style="list-style-type: none"> ● Green = Clear alignment for emissions reductions or adaptation and resilience ● Yellow = Unclear alignment ● Red = No relevant policy or strategies 	<ul style="list-style-type: none"> ● Green = decreasing emissions level or increasing adaptive capacity ● Yellow = uncertain or stable emissions level or adaptive capacity ● Red = increasing emissions or decreasing adaptive capacity

With increasing transport demand and no framework to increase efficiency of services, the emissions from the transport sector are increasing and projected to increase. Similarly, the absence of a climate proofing framework or support programmes to Vanuatu’s current and future infrastructure means that resilience and adaptive capacity is decreasing over time.

4.3.3 Additional interventions towards a low emissions climate resilient future

The transport sector plays an important role to enable economic activity, support equitable growth and, if proactively guided, reduce emissions and increase resilience.

1. *Development of a national transport sector policy*

To better support the development of the Vanuatu transport sector, a national transport policy and accompanying institutional arrangements should be developed. This policy and framework would assist Vanuatu in several areas, and for the purpose of the LEDS pathway, provide the necessary framework to support technology change and investment in the transport sector.

2. *Coordination of e-mobility pilots*

The multiple electric vehicle pilots should be coordinated to better inform the development of transport policy and infrastructure as well as realise synergies across pilot types. Synergies include project management tasks, government approvals, and importation permits, utility engagement, and support for a charging infrastructure. Options for coordination include harmonisation of all trials as projects under a single programme, or development of an e-mobility strategy which would prioritise technology and locations for trial. Stakeholder consultations included discussion of an expected e-mobility pilot project be developed by VNPF with the support of AFD, with a preliminary business case study to be completed by mid-2023.

3. *Introduction of vehicle and fuel efficiency standards*

Implement complementary vehicle and fuel standards. The NDC recognises the merits of vehicle mileage and emissions standards. Introducing vehicle standards will be more effectual in conjunction with fuel standards. For example, high efficiency vehicles are impaired by long-term use with high sulphur and poor fuels. Complementary reforms to vehicle and fuel standards will achieve greater efficiency benefits at a lower cost.

4. *Industry skills development and capacity building within the electric transport sector*

Vanuatu’s transition to a low emissions climate resilient transport future requires a skills base and labour pool to support new technologies. Feedback from industry consultation recognised shortfalls in electrical engineering and computer skills, as well as availability of equipment for hands-on learning as part of new technical training curriculum for servicing hybrid and electric vehicles currently under development by the Vanuatu Qualifications Authority (VQA) as limiting the capacity of private sector to offer services. Vanuatu’s National Human Resources Development Plan should be augmented with a clean technology skills focus.

4.4 Waste

4.4.1 Integrated context assessment and direction from current policy and national consultations

Vanuatu's waste sector GHG emissions are principally from organic and human waste contained or landfilled. The rate of emissions is driven by population growth. With the population to double between 2017 and 2050, without actions to reduce emissions, we might expect a doubling of emissions. Vanuatu's Enhanced NDC (2020) and Circular Economy Strategy identify a series of actions to 2030 that will reduce emissions. These are reproduced in Table 12 below.

Table 12: Relevant NDC policy targets for the waste sector

Number	Description	2030 target
Additional NDC measure 7	Waste-to-energy (WTE) plants for Municipal Solid Waste	
Additional NDC measure 7.1	WTE plant for Port Vila	1
Additional NDC measure 7.2	WTE plant for Luganville	1
Additional NDC measure 7.3	WTE plant for Lenakel	1
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	
Additional NDC measure 8	Wastewater management system in Vanuatu	
Additional NDC measure 8.1	Centralised 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	

Sector strategies such as the National Waste Management and Pollution Control Strategy and Implementation Plan 2016–2020 and National Waste Minimisation Plan align with the NDC for waste management initiatives that reduce environmental pollution and health risks from waste, while also reducing emissions. The National Sustainable Development Plan 2030 sets a high-level objective to reduce waste and pollution through effective waste management and pollution control (ENV 2.4).

In addition to waste sector targets, waste to energy plants are included as a potential energy source in UNELCO's Efate Energy Roadmap³⁹ as a potential source of energy, alongside biomass, for thermal generation through incineration.

Further analysis and policy design are needed to link municipal-scale waste to energy plants with municipal solid waste (MSW) management plans. There are five major types of process to generate energy from MSW: incineration, coprocessing, anaerobic digestion, landfill gas (LFG) harvesting, and pyrolysis/gasification⁴⁰. The selection of waste to energy process should be made in conjunction with the design of urban waste collection system and landfill sites, to ensure adequate and consistent feedstock supplies for the waste to energy system.

Composting of municipal organic waste offers opportunities for households and small-scale operators to participate. It provides an alternative disposal means to open fire burning, which is commonly used and leads to high noxious pollutant loads. Approximately 50% of waste arriving at landfill is organic waste⁴¹.

39 UNELCO, Roadmap 2030 for Vanuatu: <https://www.unelco.engie.com/images/doc/roadmap2030.pdf>

40 GIZ: https://www.giz.de/en/downloads/GIZ_WasteToEnergy_Guidelines_2017.pdf

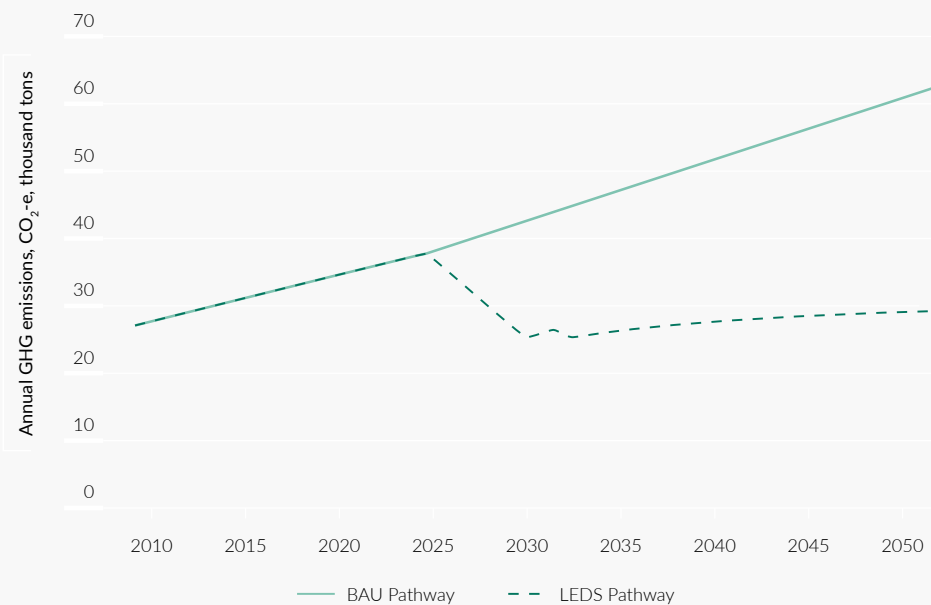
41 Vanuatu Enhanced NDC 2020: <https://www.nabvu/sites/default/files/documents/Vanuatu%20NDC%20Update%20Report%20r2.pdf>

Diversion of organic waste to composting or other disposal means (including biogas) would lower costs and extend the life of existing landfill sites.

In addition to solid waste management, Vanuatu's Enhanced NDC identifies further actions to reduce emissions from wastewater (please also see Section 4.7 Water and public health) collection and treatment systems. The technological solution and financial means to implement these remain to be developed. The technological and systems solution should meet the needs of a growing population, increased risk of climate events, and emergence of green infrastructure solutions.

Over the long term to 2050, the emissions reduction benefits of the NDC actions reduce emissions substantially and, in a manner to meet the LEDS vision of absolute reductions to 2050. The annual emissions reductions from NDC actions are estimated to be 33,000 tonnes CO₂-e per year by 2050 from a total of 62,000 tonnes CO₂-e per year under the BAU pathway (Figure 22).

Figure 22: The LEDS pathway sees emissions reduced by 33,000 tonnes CO₂-e per year by 2050 from the BAU pathway



WASTE SECTOR EMISSIONS: BAU AND LEDS PATHWAY

Resilience and climate change adaptation is an important aspect of waste management. The National Waste Management and Pollution Control Strategy and Implementation Plan 2016–2020 recognises the pollution caused by natural disaster impacts on human settlements and the need to manage disaster waste pulses. The Bouffa Landfill extension has plans for a disaster waste holding area, but this is not currently operational. Forward looking strategy for waste that considers resilience and climate change adaptation may consider changes in waste management practices in response to rising temperature, sea level rise, and intensity of rainfall events. This is particularly the case where waste management infrastructure is located in vulnerable areas such as adjacent to rivers or coasts.

There is insufficient data to assess the current resilience and adaptive capacity of the waste sector. A vulnerability assessment and coping mechanisms for climate impacts on solid and wastewater would inform a national adaptation strategy or plan.

4.4.2 Summary assessment

There is alignment between sector strategies for improved waste management and climate strategies for reduced emissions and increased resilience and adaptive capacity. The implementation of sector policy actions and the current trajectory towards lower emissions and increased resilience is uncertain.

Table 13: Assessment summary for the waste sector

	Policy, strategy, and actions alignment to the LEDS vision	Current emissions trajectory and adaptive capacity
Emissions reductions	●	●
Resilience and adaptation planning	●	●
Key	<ul style="list-style-type: none"> ● Green = Clear alignment for emissions reductions or adaptation and resilience ● Yellow = Unclear alignment ● Red = No relevant policy or strategies 	<ul style="list-style-type: none"> ● Green = decreasing emissions level or increasing adaptive capacity ● Yellow = uncertain or stable emissions level or adaptive capacity ● Red = increasing emissions or decreasing adaptive capacity

4.4.3 Additional interventions towards a low emissions climate resilient future

The waste sector, including municipal solid waste and wastewater, is a driver of emissions as well as a source of vulnerability in natural disasters. While the policy frameworks are supportive of the LEDS vision for *reduced emissions across all sectors in a way that supports resilient, sustainable, and equitable growth for its people*, there is more that could be done to enhance the policy framework and trajectory. These are the following:

1. *Scaling up biogas production and consumption in urban and rural areas*

Biogas (primarily methane (CH₄)) provides a clean and readily available renewable energy source for cooking, while also providing a safe means of disposal of household organic waste and potentially wastewater. Scaling up biogas is an opportunity to provide an alternative source of cooking energy to inefficient wood fires. Demonstration sites are already in operation in Port Vila central markets. There is opportunity to leverage climate finance to reduce the cost of biogas units purchased or possibly in future, made locally. There are already pilot projects in Santo and Efate of large units producing biogas for use in institutional kitchens (like school canteens).

2. *Increase waste management awareness and support cultural norms of safe waste management*

Practical waste management action starts at household level. The National Waste Management and Pollution Control Strategy and Implementation Plan 2016–2020 references the need for a national awareness plan to complement government and donor efforts to improve waste management.

In addition to broadcasting messages about reducing, reusing, and recycling (3Rs) or home composting or biogas, there are opportunities to work with communities around existing cultural norms of waste management. This is particularly the case in rural and remote communities a long way from municipal waste management. Community practices may be long standing such as burning waste or using beaches for wastewater disposal, but as waste composition changes and climate change impacts coastal inundation, these long-standing practices may increase vulnerability, may be maladaptive or harmful for the environment and society. A practical component of public awareness is understanding cultural norms of waste management in villages, townships and communities and how these might be made more resilient under climate change projections.

4.5 Livestock

4.5.1 Integrated context assessment and direction from current policy and national consultations

The livestock sector is the largest single contributor to Vanuatu's GHG emissions. Vanuatu's most recent GHG inventory (2015) showed the direct and indirect emissions from the livestock sector contributed 73% (443,000 tonnes CO₂-e) of Vanuatu's national emissions before forest sector removals. Beef cattle production, which is the largest contributor to Vanuatu's livestock emissions, generated exports of Vatu 85 million (USD 700,000) or 1.8% of national exports in 2020⁴².

There is alignment between climate strategy (Vanuatu's Enhanced NDC) and sector strategy (Livestock Industry Strategy 2015–2030) to increase productivity in the livestock sector. Increasing productivity would reduce emissions if the livestock herd size remained the same⁴³. The Enhanced NDC (2020) are shown in Table 14 below.

Table 14: Enhanced NDC and circular economy actions

Number	Description	2030 target
Additional NDC measure 6	Training and capacity-building for livestock farming and pasture management	Not specified
Additional NDC measure (CE strategy 3.1)	Converting pastures to silvopastoral livestock systems	11473 ha, 31,000 tonne CO ₂ -e
Additional NDC measure (CE strategy 3.14)	International collaboration to improve livestock efficiency	Not specified

High productivity beef cattle systems use herds with superior stock genetics, a diet of high-quality forage or improved pastures plus concentrates, in order to produce high rates of daily weight gain. Low productivity systems have inferior stock genetics and feed quality, which result in low rates of daily weight gain⁴⁴. In addition to high livestock production systems, improved manure management systems such as aerobic composting reduce CH₄ and nitrous oxide (N₂O) emissions per head of stock.

Under the Vanuatu LEDS emissions pathway, a small proportion of farmers adopt high productivity systems as a result of the training and international collaboration. In the LEDS emissions pathway, the reduction in emissions is equivalent to 16,000 tonnes CO₂-e or 4.6% reduction (Figure 21)⁴⁵. Vanuatu's Livestock Industry Strategy 2015–2030 includes ambitions to grow the national cattle herd to 500,000 head by 2025. The enhanced NDC and the LEDS adopted the 2015 estimated herd size of 176,000 while the FAO has imputed a herd size of approximately 100,000 head. An increase in herd size as envisaged in the Livestock Industry Strategy would substantially increase emissions from Vanuatu's livestock sector. If the herd size were to increase, then there are actions that can be taken to reduce the emissions impact: use high productivity systems and better management of manure waste. The current Livestock Industry Strategy 2015–2030 does not include these actions.

The maximum herd size while maintaining the current emissions levels is estimated at 235,000 cattle, while there is 250,000 tonnes CO₂-e emissions difference between low and high productivity systems (Figure 24). Changing production system impacts the emissions, however the size of the herd has a much greater impact and is an area of uncertainty for the Vanuatu LEDS pathway.

42 Government of Vanuatu, VNSO International Merchandise Trade Statistics report: https://vnso.govvu/images/Public_Documents/Statistics_by_Topic/Economics/Merchandise_Trade/2020/IMTS_Press_Release_Vanuatu_2020_FINAL_190421.pdf

43 Calculation of livestock sector emissions, both enteric fermentation and manure management, are based on animal stock counts and averages size, production systems, and average temperature. Increasing the productivity of the cattle system from low to high would reduce emissions.

44 Definitions of high and low productivity sourced from IPCC 2019 revisions of 2006 guidelines: <https://www.ipcc-nggip.iges.or.jp/public/2019rf/index.html>

45 The calculated emissions impacts differ from those modelled under the Enhanced NDC 2020 due to different methodologies.

Figure 23: The livestock sector emissions under the BAU and LEDS pathways, noting increased use of high productivity systems in 2030 reduce livestock sector emissions by 19,000 tonnes or 4.6%

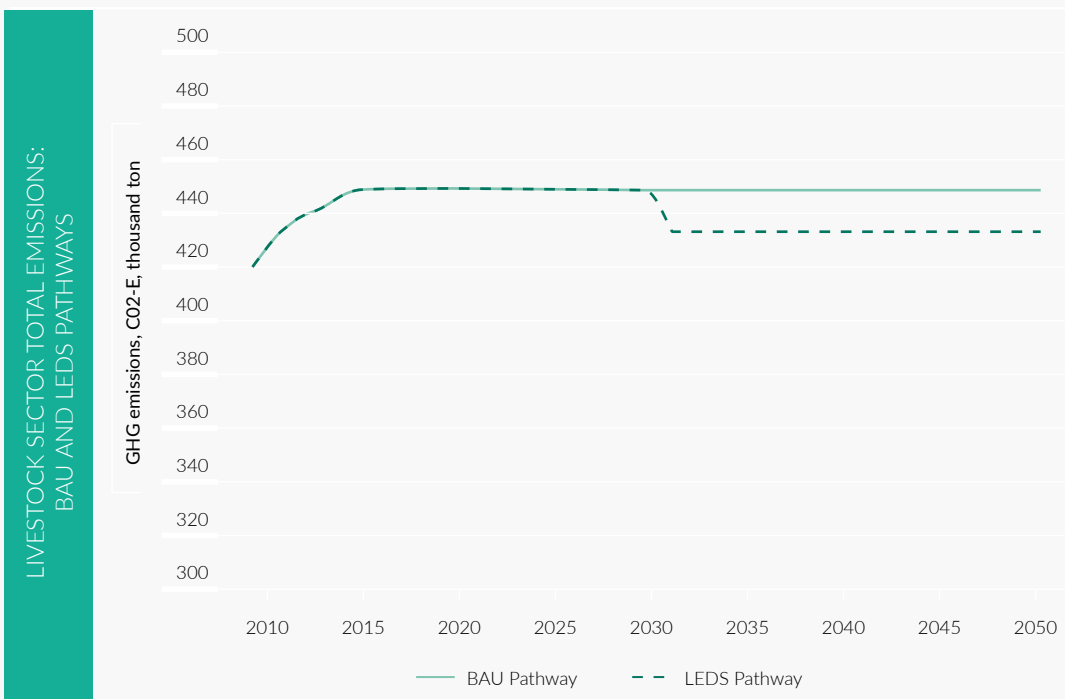
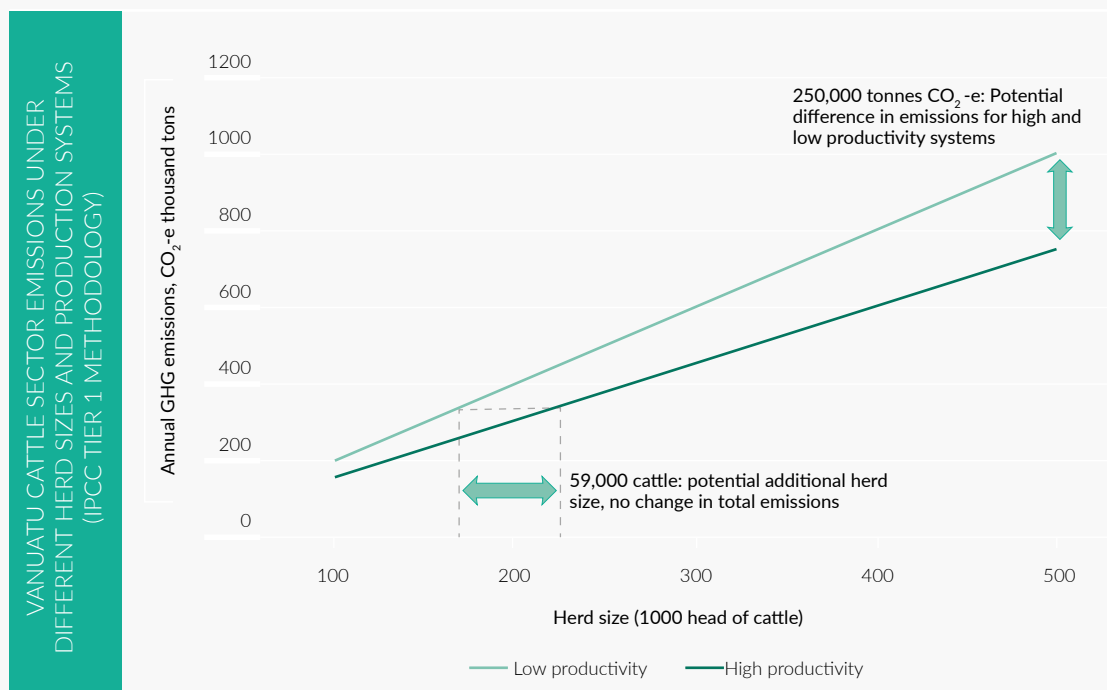


Figure 24: Impact of high and low productivity systems on emissions



Converting pasture-only systems to combined coconut and pasture has the potential to reduce emissions through the carbon sequestration in biomass (trees). The carbon sequestration benefits of conversion to silvopastoral systems are similar to other afforestation projects where rates of carbon sequestration peak and fall as the carbon stock in established trees reaches a peak. The IPCC tier 1 methodology indicates a peak sequestration rate of 9 tonnes carbon per hectare for a 20-year programme of land conversion, before carbon removals return to zero (Table 15).

Table 15: Carbon sequestration for land conversion of grassland into grass and coconut

Carbon sequestration actions	IPCC tier 1 estimate
Land conversion from pasture-only to coconut and pasture: peak annual sequestration rate over 20-year implementation	9.2 tonnes CO ₂ -e per year
Land conversion from pasture-only to coconut and pasture: cumulative sequestration per hectare benefit	155.6 tonnes CO ₂ -e

Source: Own calculations based on FAO Nationally Determined Contribution Expert Tool (NEXT)⁴⁶

The climate resilience and adaptive capacity of Vanuatu’s livestock sector is uncertain at this point. The National Livestock Industry Strategy 2015–2030 recognises the vulnerability of farmers with overstocked land or poorly managed herds and proposes an information-provision and skills-improvement approach to reduce disaster risks. Further analysis of the vulnerability of livestock production may generate further opportunities for resilience and adaptation enhancement.

4.5.2 Summary assessment

Table 16: Assessment summary for the livestock sector

	Policy, strategy, and actions alignment to the LEDS vision	Current emissions trajectory and adaptive capacity
Emissions reductions	●	●
Resilience and adaptation planning	●	●
Key	<ul style="list-style-type: none"> ● Green = Clear alignment for emissions reductions or adaptation and resilience ● Yellow = Unclear alignment ● Red = No relevant policy or strategies 	<ul style="list-style-type: none"> ● Green = decreasing emissions level or increasing adaptive capacity ● Yellow = uncertain or stable emissions level or adaptive capacity ● Red = increasing emissions or decreasing adaptive capacity

46 FAO: <https://www.fao.org/climate-change/our-work/how-we-do-it/ndcs/research-tools/next/ru/>



4.5.3 Additional interventions towards a low emissions climate resilient future

The livestock sector is the largest single contributor to Vanuatu's GHG emissions. The ambitions to grow this sector must consider other national ambitions to reduce emissions. The LEDS development process has identified several further actions which should be undertaken to enhance the livestock sector's emissions mitigation and resilience and adaptation ambitions:

1. *Introduce livestock sector emissions target and strategy*

Vanuatu's livestock sector is a major economic contributor. Vanuatu's beef industry is recognised for quality produce in the region, exports generate valuable national income, and create economic opportunities in rural areas. Sector strategies have sought to grow this sector and the benefits it generates.

The ambitions to grow this sector must consider other national ambitions to reduce emissions. Future livestock sector strategies should consider the opportunities for synergies between production and emissions mitigation. Promoting 'no regrets development' actions now, such as improving existing livestock production systems which can be undertaken, while development of future livestock strategies should consider the national emissions ambition. If the herd size were to increase then there are actions that should be taken to reduce the emissions impact: use high productivity systems and better management of manure waste.

There may be opportunities for landholders to benefit from carbon sequestration in land conversion from pasture-only to coconut and pasture systems. The carbon sequestration may offset increased emissions from a larger herd size or generate additional revenue sources from carbon credits.

2. *Further engagement with the livestock sector to understand hazards, vulnerability, resilience, and adaptation options*

Actions to support climate resilience and adaptation in the cattle industry have focused on information provision for farmers about climate risks as well as other environmental risks of poor management practices. For example, the Van-KIRAP project has assessed information provision for the agriculture and livestock sectors⁴⁷.

Further analysis of climate impacts and hazards, through downscale modelling overlaying livestock production areas, would inform a vulnerability assessment for this sector. This sector focus would complement the national and community focus of other climate vulnerability and adaptation assessments, such as the Vanuatu Community Based Resilience Project⁴⁸.

With results of downscaled modelling, such as available through the CLIPSSA Project⁴⁹, further engagement around farm management practices may identify opportunities to improve resilience and adaptation of the sector. Engagement at a technological level can miss opportunities to support resilience and adaptation at individual, household, community, sector, and national levels. This would complement the actions identified in the Revised and Enhanced NDC on climate adaptation to maintain a good balance between livestock farming and effective environmental management, including keeping farmers well informed about climate risk measures they may employ related to cyclones or ENSO events.

The engagement with the industry on vulnerability would improve the information provision outlined in the Livestock Strategy and Vanuatu's Revised and Enhanced NDC. Information design may consider the content guidance notes, the frequency and timing, modes of communication, and types of information most useful for the industry.

47 Green Climate Fund, Van-KIRAP Agriculture and Livestock Action Plan, 2019: https://www.nab.vu/sites/default/files/documents/VAN-KIRAP_Agricultural_Final_10.04.2019.pdf

48 Green Climate Fund, Concept Note: <https://www.greenclimate.fund/document/vanuatu-community-based-climate-resilience-project>

49 AFD, CLIPSSA Project: <https://umr-entropie.ird.nc/index.php/portfolio/projets-en-cours/projet-clipssa>

4.6 Forestry, agriculture, and land use

4.6.1 Integrated context assessment and direction from current policy and national consultations

Vanuatu's forests, in their current estimated extent, remove almost 11 times the emissions generated from human activities. At 440,000 hectares in area, these forests are estimated to remove almost 7 million tonnes of carbon dioxide per year.

Long distances, rugged terrain, limited high value tree sizes and varieties, and traditional land ownership mean there are limited commercial forestry practice to date. The last national forest survey was undertaken in 2007, with limited new data on forest land conversion or degradation of forests available since this time. Discussions with stakeholders indicate significant change in forest cover area on some islands. The national picture remains to be presented through an updated Forest Reference Level (FRL) within the national strategy for Reduced Emissions from Deforestation and Forest Degradation (REDD+).

The forthcoming REDD+ strategy provides an important contribution to the national GHG emissions picture. In addition to providing a valuable update to the forest area and carbon removals, it provides a baseline measure to assess forest carbon removals. The REDD+ strategy is funded under the Readiness Grant from the Forest Carbon Partnership Facility and is intended to support realisation of carbon credits from forest carbon removals. Policy briefs produced for the REDD+ Strategy indicate opportunities for integrated forest management practices⁵⁰.

Vanuatu's forests make a significant contribution to the national economy through domestic material supply. Forests provide a wide range of non-timber forest products such as tubers, fruits, nuts, fibres, grass, and leaves for roofing thatch and building materials. Large volumes of fuel wood are collected from forests, primarily for residential sector cooking. Forests play an important spiritual role in Vanuatu's traditional societies, by providing materials for ceremonies and supporting rural communities on custom lands. The National Forest Policy 2013–2023 recognises the importance of forests to the national economy, as well as economic empowerment and social equity⁵¹.

But Vanuatu's forests are under pressure from expansion of agriculture, timber and fuel wood gathering, and settlements.

The agriculture sector is by far the most important primary sector in Vanuatu, with a contribution of 75% of the GDP. The Vanuatu's agriculture sector is divided into three subsectors, namely the subsistence (75%), semi-commercial (15%), and commercial (10%). The subsistence sub-sector is predominantly centred around root crops (Taro, Yam, Cassava and sweet potato) for consumption and cultural purposes and characterised by rain irrigation and non-mechanised agricultural practice. Semi-commercial agricultural activities are concentrated near urban centres, which provide a local market for perishable products. Spice, herb, and leafy vegetables cultivation provides potential economic opportunities for vulnerable groups. The commercial cash crops are kava, cocoa, coconut, vanilla, and coffee.

With limited application of inorganic fertilisers, the direct contribution of the cropping to Vanuatu's GHG emissions is insignificant and is therefore not included in the official GHG inventory. However, the indirect effect of forest land clearing on emissions balance is potentially substantial. Stakeholders voiced concerns about the expansion of kava (*Piper methysticum*) cultivation in forests areas during the LEDS consultation. Kava is Vanuatu's largest single export, responsible for Vanuatu 2,601 million (USD 21.5 million) in 2020. Land cover changes and conversion data that will be published through the REDD+ Strategy will enable further assessment of the underlying drivers of forest degradation that have not been assessed through the LEDS.

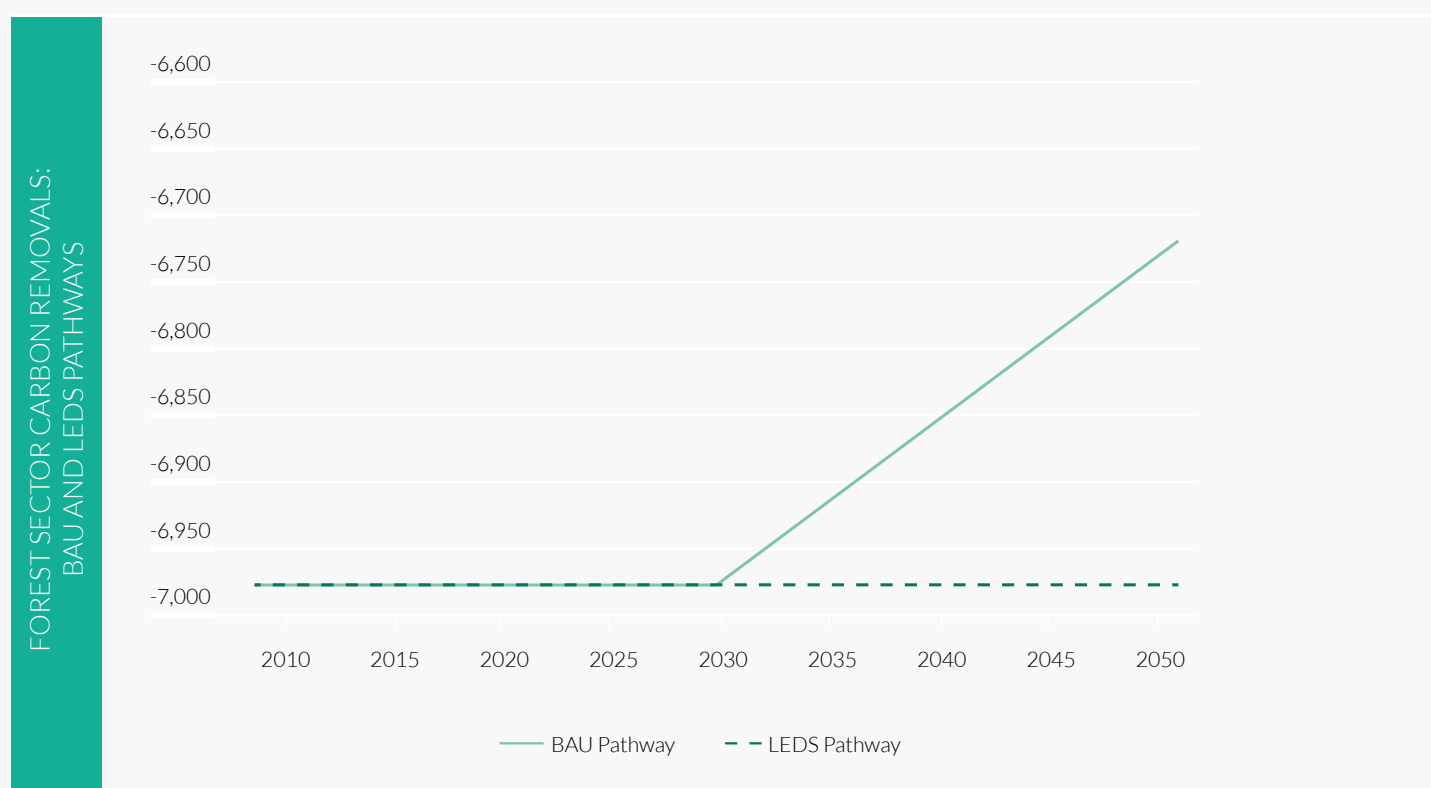
50 Policy Brief: REDD+ in Vanuatu, Strategy Options for the National REDD+ Strategy (July 2017): <https://www.forestcarbonpartnership.org/system/files/documents/Policy%20Brief%20Strategy%20Options%20GoV.pdf>

51 Vanuatu's National Forest Policy 2013–2023 (Nov 2011): <https://malffb.gov.vu/doc/forests/Vanuatu%20National%20Forest%20Policy.pdf>

In addition to agricultural expansion, Vanuatu's forests are challenged by increasing fuel wood demand. It is estimated that 50% of urban households and 97% of rural households use open fires (three stone fires) as their primary cooking method⁵². An average household is estimated to use between 1.4 to 3.6 m³ per household per year. The Vanuatu LEDS uses the value of 2.2 m³ per household per year as the baseline consumption rate. The increasing population drives forest degradation and deforestation.

To protect Vanuatu's forests from degradation, the Vanuatu LEDS pathway includes a clean cooking technology change for the residential energy sector. By 2050, under the BAU pathway, the total fuel wood demand will reach close to 270,000 m³ and degrade up to 7% of the forest land each year. Vanuatu's clean cooking technology transition from wood fuel stoves is discussed in the energy sector section of the LEDS. The LEDS emissions pathway is shown in Figure 24.

Figure 25: The forest sector carbon removals under the BAU and LEDS pathways, noting the LEDS pathway reduces household fuel wood demand, which stabilises and protects forest carbon removals



The agriculture sector is recognised as one of the drivers and solutions to vulnerability to climate change impacts. In the 2020 Census, agriculture, forestry, and fishing employed just under half the national working age population (31,000 out of 78,000). Small scale subsistence agriculture provides nutrition for 80% of the population and climate resilience needs are recognised in both the Vanuatu Agriculture Sector Policy (2015) and in the Revised and Enhanced NDC (2022).

Land use policy in both urban and agriculture sector settings offers opportunity to increase resilience and adaptation. During development of the Vanuatu LEDS, stakeholders recommended prioritising development actions that minimise threats and incorporates climate solutions from the 'ridge to the reef' of island communities, and to strengthen local authorities and municipal planning authorities to enact and enforce land use planning laws and regulations.

52 Government of Vanuatu, VNSO 2016 Mini-Census: <https://vnso.govvu/index.php/en/census-and-surveys/census/2016-mini-census>

Land use for biodiversity conservation was recognised during the LEDES development process, as stakeholders identified the goals of the National Biodiversity Strategy and Action Plan 2018–2030⁵³. These goals include conserving at least 17% of important biodiversity areas, at least 30% of natural forest, and at least 10% of wetland areas, and 10% of marine areas through effective community and government management measures by 2030.

4.6.2 Summary assessment

A high-level review of relevant policies shows that a comprehensive framework has been explicitly established to reduce emission levels and increase adaptive capacity, contributing positively to the long-term LEDES vision. Vanuatu's NDC mitigation contribution includes a sector-specific target for transitioning to near 100% renewables in the power sector as early as 2030. Opportunities to reduce high emissions in agriculture should be pursued simultaneously through collaborative programmes with countries with similarly high emissions in this sector, although emissions are expected to remain relatively low. As for the forestry sector mitigation, it is to be treated as part of the existing REDD+ programme.

Vanuatu's Climate Change Disaster Risk Reduction Policy 2022–2030 seeks to increase the adaptive capacity of the forestry, land use and agriculture sectors. The recently released updated and expanded NDC is further evidence of this, with more than 32 associated actions to be implemented by 2030. Adaptation in the agriculture sector is one of the government's top priorities, with the goal of ensuring that agriculture is able to support household income and food needs in a changing climate. The government is also aware of the synergies that climate adaptation measures in the forestry sector have in mitigating climate change. Carbon conservation and sequestration through measures such as afforestation, reforestation, and reduction of forest degradation can also provide opportunities for additional mitigation potential.

Table 17: Assessment summary for agriculture, forestry, and land use

	Policy, strategy, and actions alignment to the LEDES vision	Current emissions trajectory and adaptive capacity
Emissions reductions	●	●
Resilience and adaptation planning	●	●
Key	<ul style="list-style-type: none"> ● Green = Clear alignment for emissions reductions or adaptation and resilience ● Yellow = Unclear alignment ● Red = No relevant policy or strategies 	<ul style="list-style-type: none"> ● Green = decreasing emissions level or increasing adaptive capacity ● Yellow = uncertain or stable emissions level or adaptive capacity ● Red = increasing emissions or decreasing adaptive capacity

4.6.3 Additional interventions towards a low emissions climate resilient future

Although a high-level summary assessment indicates that existing policies are most likely well suited to support the long-term vision of the LEDES, continued efforts are needed to sustainably address the problem of growing population and climate change. As many of the policies expire in 2030, there may be an opportunity to shape the policies that follow after 2030. In addition to existing policies and those identified in the updated and expanded NDC, the following actions can help further support the realisation of the LEDES vision in 2050.

53 Government of Vanuatu, DEPC: <https://environment.gov.vu/index.php/projects/nbsap-project>

1. *Implement a REDD+ forest strategy and submit the Forest Reference Level to UNFCCC.*

The main aim of the Vanuatu REDD+ programme is to sustainably manage the forest resources in addressing an improved livelihood of the people of Vanuatu and in particular the rural population living and depending on the forests. The strategy is also particularly crucial for Vanuatu to access carbon markets. The REDD+ strategy is currently under development by the Department of Climate Change in collaboration with the Department of Forests as the main implementing government agency.

Producing a Forest Reference Level would enable measurement and estimation of further emissions actions in the NDC. There are currently no emissions targets or mitigation actions for Vanuatu's forests in the NDC, such as 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.

2. *Develop a consolidated programme to access forest carbon markets*

The Government of Vanuatu has ambitions to access carbon markets and there is high potential from forest sequestration. Legislative and institutional reforms are required to scale up access. A consolidated programme would provide a pathway and steps to market access. For example, a carbon sequestration property right may be necessary to realise carbon offsets from customary land. There is a strong need in capacity development and understanding of carbon market mechanisms.

3. *Mainstream climate smart agriculture (CSA) strategy to address changing climate and sustainable agriculture.*

The extreme vulnerability of the agriculture sector to climate change can already be felt by the impact on crop productivity. CSA practices are an integrated approach to managing landscapes that addresses the interlinked challenges of food security and accelerating climate change. While being able to increase productivity, enhance resilience, and reduce emissions, they also unlock new financing opportunities to close the investment gap⁵⁴. This approach will deliver on some of the adaptation commitments identified in the Revised and Enhanced NDC such as introducing higher tolerance cultivars (A13) and to develop funding support mechanisms to assist recover (A16).

4. *Increasing land use efficiency through integrated practices*

Increasing demand for land in agriculture with population growth and emissions reductions target in the forestry and land-use sector is a major challenge in Vanuatu. Integrated practices such as agroforestry, where woody perennials are deliberately used on the same land-management units as agricultural crops, have the capacity to simultaneously generate food, biomass and raw products that can be utilised in other economic activities. Another example of integrated practices is silvopastoral system, such as cattle under coconut trees, in an attempt to optimise the productivity of the system as a whole. Integrated practices encourage diversification of the rural economy and create new socioeconomic opportunities for rural populations.

5. *Framework for land use planning and climate response in the context of Vanuatu's custom land practices*

Through international assistance, Vanuatu may receive downscale climate projections and risk mapping. Without a framework to engage custom landowners (who manage over 90% of the land), detailed climate risk reports and hazard mapping will not be used by those most exposed to hazards. This project seeks to establish a framework for land use planning and climate response that includes 1) desktop review, 2) expert validation, and 3) a pilot of framework in one or more locations.

⁵⁴ Vanuatu's Revised and Enhanced NDC (2022) provides an approximate investment need for full implementation of USD 1.2 bn (VUV 145 bn), with mitigation investments (26%) equating to USD 315 m (VUV 37.8 bn) and adaptation investments (74%) equating to USD 721 m (VUV 86 bn).

4.7 Water and public health

4.7.1 Integrated context assessment and direction from current policy and national consultations

Vanuatu recognises that climate change has significant impacts in the water sector, that there is great vulnerability due to negative impacts on secure access to safe water⁵⁵, especially on the most arid areas and small islands depending entirely on rainwater. Consequently, Vanuatu's NDC targets aim to strengthen coordination between sectors and partners impacting, or being impacted by, the use of freshwater to understand, predict, design, and invest to secure Vanuatu's water future. Currently the Department of Water Resources (DoWR) is reviewing their community water access data⁵⁶ and channelling donors support through the National Implementation Plan (NIP)⁵⁷, and Capital Assistance Programme⁵⁸ mechanisms, being a pre-requisite for communities to access funds to have a Drinking Water Safety and Security Plan already developed.

Vanuatu, like other countries in the Pacific, faces the 'triple burden' of disease: communicable diseases such as dengue and malaria, combined with increasing rates of non-communicable diseases and the effects of climate change⁵⁹. Regular natural disasters create public health emergencies such as water and food shortages, contamination, and increased incidences of waterborne diseases⁶⁰. Climate change related events will continue to threaten Vanuatu with the potential to impact on health service planning and delivery.

There are overlapping department responsibilities for wastewater (please also see section 4.4 Waste and sanitation). The Department of Environmental Health, under the Ministry of Health, is responsible for safe water sanitation and hygiene, food safety, wastewater management, and public health during emergencies and disasters⁶¹. The Department of Environmental Protection and Conservation (DEPC) is responsible for waste management policy, including wastewater treatment. Provincial and municipal governments have devolved responsibilities for waste collection and treatment.

The need to ensure a sustainable water supply is a water policy objective. But sustainability has not yet captured decarbonising the sector. There are clear opportunities to integrate renewables into the water sector, such as providing the lifting power to distribute water. No specific GHG emission reduction targets are mentioned in DoWR strategies and laws. The DoWR is aware but not captured by NERM measurement or targets. Stakeholder consultations included discussion of the DoWR creating a new dedicated unit focused on urban water supply given the significant differences in scope compared with rural water supply.

As a result of a lack of framework, integration of renewables in the water sector is uneven. Technology decisions are made on a case-by-case basis. In the big urban centres, most water supply systems rely on fossil fuel energy sources through pumping systems connected to diesel generators or diesel-powered grids. Decarbonisation of water pumping would be acquired through the decarbonisation of the electricity grids. In rural areas the sources of energy for water supply are variable, though there are some programmes specifically established for solar powered water supply⁶².

It is possible to estimate the current emissions from urban water pumping. The sole water pumping station in Port Vila responsible for approximately 4 GWh electricity consumption per year, which is equivalent to 7% of Efate grid total energy demand (4 GWh out of 60.8 GWh). Given composition of electricity generation

55 Government of Vanuatu, MoLNR: <https://mol.gov.vu/images/News-Photo/water/C---Vanuatu-Water-Policy-with-Annexures.pdf>

56 <https://exchange.riscon.solutions/>

57 Government of Vanuatu, DoWR: https://mol.gov.vu/images/News-Photo/water/DoWR_File/Management_Plans/Vanuatu-NIP-Guide-annual-CAP-210818.pdf

58 Government of Vanuatu, MoLNR: <https://mol.gov.vu/images/News-Photo/water/Vanuatu-CAP-Guide-annual-CAP-241018.pdf>

59 WHO, Vanuatu country brief, 2017

60 Government of Vanuatu, NAB, 2019

61 Government of Vanuatu, MoH: <https://moh.gov.vu/index.php/public-health/environment-unit>

62 GGGI: <https://ggi.org/project/enhancing-resilience-to-climate-change-through-solar-power-driven-access-to-water-in-rural-areas-of-outer-islands-vanuatu/>

and diesel use, the estimated diesel use for water pumping at 870,173 litres per year with GHG emissions of 2,349 tonnes per year or 0.4% of national emissions at the most recent inventory (2015).

Similarly, the Ministry of Health acknowledges possible climate change related impacts on public health. The recently announced National Health Plan for Disaster Risk Management and Climate Change Adaptation 2021–2025 is not publicly available.

Even though many actions are reflected in the NAP, enhancing Integrated Water Catchment Management Plans would probably cover important gaps, as per their nature they include a broad spectrum of water related interventions touching many sectors and stakeholders, as Ridge to Reef Programmes⁶³.

Their main focus would be on water supply for domestic and productive uses (considering both, surface and underground sources) whereas safeguarding ecological integrity within basins and analysing risks related to flooding, runoff discharges impacting marine ecosystems, and wastewater treatment/discharge. Key stakeholders to be involved would be the ones dealing with drinking water supply, agriculture and health, followed by fisheries, forestry, and municipalities.

4.7.2 Summary assessment

Table 18: Assessment summary for the water and public health sector

	Policy, strategy, and actions alignment to the LEDS vision	Current emissions trajectory and adaptive capacity
Emissions reductions	●	●
Resilience and adaptation planning	●	●
Key	<ul style="list-style-type: none"> ● Green = Clear alignment for emissions reductions or adaptation and resilience ● Yellow = Unclear alignment ● Red = No relevant policy or strategies 	<ul style="list-style-type: none"> ● Green = decreasing emissions level or increasing adaptive capacity ● Yellow = uncertain or stable emissions level or adaptive capacity ● Red = increasing emissions or decreasing adaptive capacity

4.7.3 Additional interventions towards a low emissions climate resilient future

In addition to existing policies and strategies, the following actions can help further support the realisation of the LEDS vision in 2050.

1. Enhance mitigation efforts in the water sector through inclusion of priorities and frameworks in sector strategies. The existing strategies and activities in the sector are supporting climate action. These could be better supported through sector emissions targets or frameworks, such as developing a renewables-first energy supply for water sector energy demands.
2. Further develop adaptation plans for the water and health sectors through integration of updated climate change projections into sector plans and strategies. Water sector strategies such as integrated basin management strategies provide a more sector-specific framework for adaptation response. The National Health Plan for Disaster Risk Management and Climate Change Adaptation 2021–2025, once published, may be updated as more detailed climate projections become available.

63 GEF: <https://www.pacific-r2r.org/sites/default/files/2020-03/Vanuatu.pdf>

TAKING STEPS TOWARDS A LONG-TERM LOW EMISSIONS CLIMATE RESILIENT FUTURE

5.1 Summary of sector analysis

5.2 Additional interventions summary



05

5.1 Summary of sector analysis

The preceding sector analysis had reviewed the policies and strategies relevant to each of the key sectors against the LEDS vision to *reduce emissions across all sectors in a way that supports resilient, sustainable, and equitable growth for its people*. Focusing particularly on the emissions mitigation and resilience and adaptation policy and trajectory, each of the sectors was assessed in a simple score card for alignment with the LEDS vision.

The summary of sector scoring is illuminating for the gaps and opportunities for greater alignment. Alignment may be interpreted as mainstreaming of climate change priorities into sector policies. Those sectors without overarching policies or with overarching policies without emissions or adaptation goals are flagged red in the 'Policy, strategies, and actions alignment' column.

The current trajectory for emissions and adaptive capacity has revealed opportunities to improve the results on the ground, or where data is unavailable, to seek evidence of results and change. Only in the transport sector, where emissions increase with time and vulnerability increase with climate impacts, is there a clear trend away from the intended vision of the LEDS. The majority of sectors surveyed have limited information on the current adaptive capacity which indicates the need for basic information on climate hazards, vulnerabilities and risk assessments at sector level.

Table 19: Emissions mitigation policy and trajectory alignment to the LEDS vision

	Policy, strategy, and actions alignment to low emissions	Current emissions trajectory
Electricity and energy use	●	●
Transport	●	●
Waste	●	●
Livestock	●	●
Forestry, agriculture, and land use	●	●
Water and public health	●	●

Table 20: Resilience and adaptation policy and trajectory alignment with the LEDS vision

	Policy, strategy, and actions alignment to increased adaptive capacity	Current adaptive capacity
Electricity and energy use	●	●
Transport	●	●
Waste	●	●
Livestock	●	●
Forestry, agriculture, and land use	●	●
Water and public health	●	●

The summary scoring is illuminating for the high integration of mitigation into the policy frameworks for most of the emissions intensive sectors, while the low-level integration of climate resilience and adaptation in more vulnerable sectors. The low level of integration of adaption needs is indicative of necessary groundwork on relevant climate projections, vulnerability assessment, and risk mapping at sector level.

5.2 Additional interventions summary

The Vanuatu LEDS is intended as a long-term strategy⁶⁴ that shows the low emissions, climate resilient pathway for Vanuatu to meet the goals of the Paris Agreement and the ambitions of the Government of Vanuatu for climate action. As Vanuatu is net negative emissions already, this does not mean that no further action can or should be taken. Through wide engagement in the development of the LEDS, there was revealed a clear ambition for actions at sector level to reduce emissions and make each sector more resilient.

The review of each sector identified existing actions and commitments for each of the sectors. Additional interventions are intended to be complementary to existing actions and commitments, and that combined with existing actions, they would support each sector to take steps towards the low emissions pathway.

These actions are summarised in Table 21 below, based on sector, description, and action type. The types of actions for the LEDS implementation reflect their complementary role to existing sector and overarching strategy actions. Several of the actions identified in the LEDS are 'scaling up' type actions that recognise successful programmes and the foundation they provide. Scaling up type actions may be lower risk than 'technology change' or 'policy and institutional change' as actors in the sector are already implementing the same or similar actions. Further descriptions and scope information is available in each sector summary and in Sector Annexes. Note that cross-sectoral actions, such as capacity building, education, institutional enhancement, or awareness raising were not an explicit focus of this assessment and could present an opportunity for inclusion in future strategy updates.

⁶⁴ For the purposes of this strategy, 'long-term' public policy covers time periods of 10+ years, in comparison to short-term (1–2 years) or medium-term (5–10 years) policies.



Table 21: Summary of additional actions (further detail contained in sector sections)

#	Sector	Action	Action type	Implementation period
1	Electricity and energy use	Enhancing existing programmes to meet the growing electricity demand outside of grid concession areas.	Scaling up programmes	2025–2050
2		Promoting a clean cooking transition to save money, the environment, and lives.	Technology change	2025–2040
3		Scaling up coconut oil production to achieve NERM and NDC targets of renewable energy supply.	Policy and institutional change	2025–2050
4		Bolstering climate resilient and adaptation planning in the energy sector.	Study	2025–2030
5	Transport	Develop a national transport policy and accompanying institutional arrangements.	Policy and institutional change	2025–2030
6		Develop national vehicle and fuel standards.	Policy and institutional change	2025–2025
7		Coordinated electric mobility pilots.	Scaling up programmes	2025–2040
8		Green technology skills plan for Vanuatu.	Scaling up programmes	2025–2040
9	Waste	Scaling up biogas production and consumption.	Scaling up programmes	2025–2040
10		Increase waste management awareness and support cultural norms of safe waste management.	Public communication	2025–2040
11	Livestock	Introduce the livestock sector emissions target and strategy.	Policy and institutional change	2030–2050
12		Livestock sector analysis of hazards, vulnerability, resilience, and adaptation options.	Study	2025–2050
13	Forestry, agriculture, and land use	Implement the REDD+ forest strategy and submit the Forest Reference Level to UNFCCC.	Policy and institutional change	2025–2050
14		Consolidated programme to access forest carbon markets	Policy and institutional change	2025–2040
15		Mainstream climate smart agriculture (CSA) strategy to address changing climate and sustainable agriculture.	Scaling up programmes	2025–2040
16		Increasing land use efficiency through integrated practices.	Policy and institutional change	2025–2040
17		Framework for land use planning and climate response in the context of Vanuatu's custom land practices.	Policy and institutional change	2025–2030
18	Water and public health	Enhance mitigation efforts in the water sector through inclusion of priorities and frameworks in sector strategies.	Policy and institutional change	2025–2030
19		Further develop adaptation plans in water and health sector plans and strategies.	Policy and institutional change	2025–2030

IMPLEMENTATION, GOVERNANCE, AND MONITORING

- 6.1 Sector engagement on actions implementation through Sector Annexes
- 6.2 Leveraging existing institutions and policy processes
- 6.3 Emissions pathway to 2050
- 6.4 Leverage existing monitoring, reporting, and verification (MRV) framework and systems
- 6.5 Financing strategy



6.1 Sector engagement on actions implementation through Sector Annexes

From careful sector analysis and engagement, the LEDS identifies a range of additional complementary actions to put Vanuatu on the pathway to a low emission, climate resilience future.

These complementary actions are additional to existing sector plans and strategies. Their implementation will require support and engagement of government, private sector, not for profits, and development partners. Some actions are intended to assist sector strategy development in the long term and their application may be in future iterations of strategies or scaling up of existing programmes.

Alongside the development of the LEDS are a series of discussions within and across sectors about the actions identified and their implementation. Sector Annexes are prepared for this purpose and provide further information on the challenges addressed, the intervention options and means.

6.2 Leveraging existing institutions and policy processes

6.2.1 National Advisory Board on Climate Change and Disaster Risk Reduction (the NAB)

Some LEDS actions require coordination across government and sectors. On climate change issues, the NAB provides an institution for government coordination. The NAB is the intergovernmental committee responsible for policy coordination, approval, and communication across government regarding climate change and disaster risk reduction. The NAB is established under the Meteorology, Geological Hazards, and Climate Change Act 2016 with the following statutory functions:

- (a) to act as an Advisory body for all disaster risk reduction and climate change projects, initiatives and activities in Vanuatu;
- (b) to endorse a project proposal made to it and to make recommendations and set requirements in relation to the proposed project;
- (c) to support the development of disaster risk reduction and climate change projects, initiatives, activities, priorities, and policies for Vanuatu;
- (d) to provide technical advice to the Council of Ministers on matters relating to climate change and disaster risk reduction; and
- (e) to advise any person on matters relating to the United Nations Framework Convention on Climate Change in which Vanuatu is a party, or matters relating to disaster risk reduction.

The NAB has a 17-member board comprised of directors from across government, as shown below in Figure 24. This forum allows cross sector climate change policy to be discussed and actions coordinated.

In addition to internal coordination, the NAB is a focal point for donor coordination in the climate change and disaster sectors. Effective donor coordination is needed to achieve greatest results from limited resources. The Revised and Enhanced NDC identifies opportunities to improve governance in climate change programme implementation that include strengthening the NAB Secretariat (adaptation action 96).

6.2.2 Ministry of Meteorology, Geological Hazards, and Climate Change

The Ministry of Meteorology, Geological Hazards, and Climate Change is established through the Meteorology, Geological Hazards, and Climate Change Act 2016⁶⁵. As relevant to the LEDES, the statutory purpose of the Ministry is to provide services in weather, climate, flood forecasting and geological hazards, promote capacities to understand and respond to risks from these hazards, to protect safety and welfare of the community through informing the government and the public. This Ministry serves a key function through coordinating climate projection information as relevant to dialogue with sectors identified in the LEDES.

6.2.3 Department of Climate Change

Within the Ministry, the Department of Climate Change provides a core coordination function for climate change policy and programmes within the government. As relevant to the implementation of the LEDES actions, the statutory responsibilities of the Director include:

- increasing awareness within Vanuatu about the causes and implications of climate change and climate variability in Vanuatu;
- supporting the collection, analysis, and interpretation of data relevant to climate change and its impacts in Vanuatu;
- supporting Vanuatu's effective participation in regional and international schemes relating to the Clean Development Mechanism and Reducing Emissions from Deforestation and Forest Degradation and other related arrangements; and
- supporting the monitoring and evaluation of climate change adaptation and climate change mitigation strategies, projects, and programmes, in collaboration with the Department of Energy and the Department of Forests.

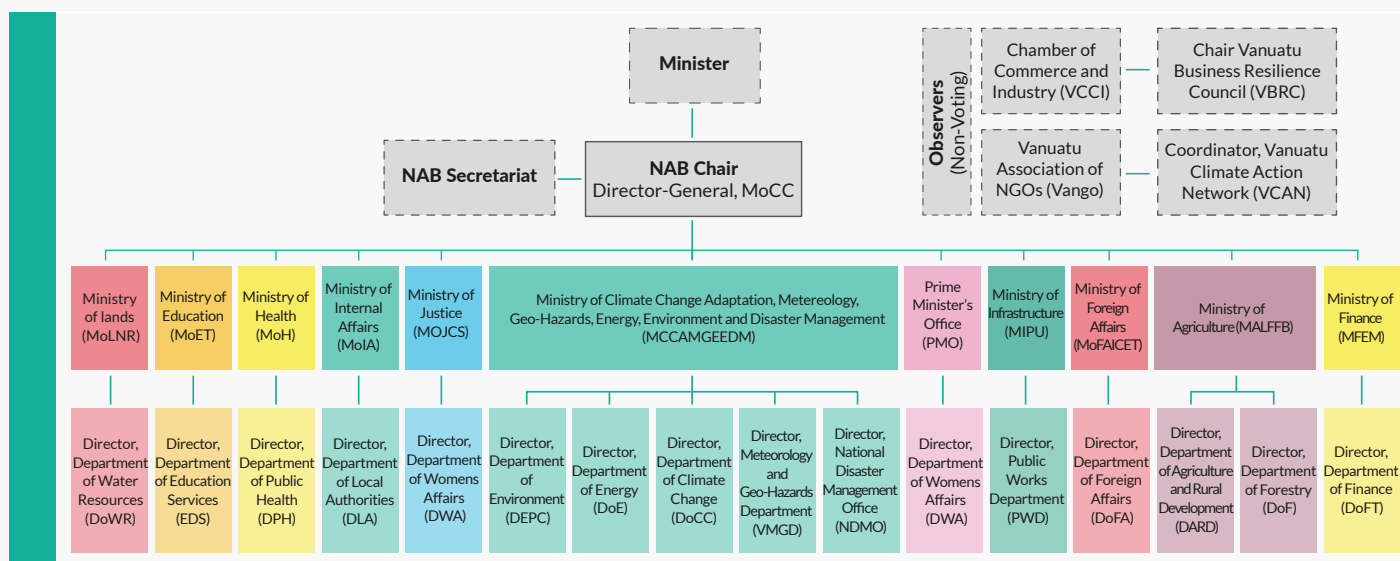
The statutory responsibilities of the Director and Department align with implementation of the LEDES actions.

6.2.4 Department of Strategic Policy, Planning, and Aid Coordination.

The Department of Strategic Policy, Planning, and Aid Coordination (DSPPAC) is the technical office within the Ministry of the Prime Minister that assists and enables the Prime Minister to develop, implement, and monitor the vision of the government, and to provide strategic leadership for cross-sectoral policies or programmes, for both government and donors. DSPPAC's role includes strategic policy, planning, and oversight of significant administrative decisions. In policy processes, DSPPAC maintains the National Sustainable Development Plan (NSDP) which includes assessing projects against the goals and targets of the NSDP. For each LEDES action, the relevant NSDP goal and target is identified.

65 Act available here: <https://www.vmgd.gov.vu/vmgd/images/admin-media/docs/Official-Gazette-No.-6-of-2017-dated-1-February-2017.pdf>

Figure 26: Membership of Vanuatu's NAB⁶⁶



6.3 Emissions pathway to 2050

Through implementation of the sector policies and additional actions, Vanuatu will reduce emissions in all sectors to 2050. The overall emissions pathway is described in section 3. The relevant sector policies and additional actions are described in section 4.

The estimated emissions from each key sector are shown in Table 22. Accounting for emissions through regular GHG inventory reporting will provide opportunity to check progress against the low emissions pathway. They are presented here in the same format as the national GHG inventory report. The national GHG inventory reporting, as required under the Paris Agreement, provides a means of monitoring progress. Measurement, reporting, and verification systems are described further below.

Table 22: Low emissions pathway for Vanuatu to 2050 (figures in Gg CO₂-e)

Sector	IPCC 2006 Guideline categories	2020	2030	2040	2050
Energy	1.A.1, 1.A.2, 1.A.4, 1.A.5	84	46	60	78
Energy (transport)	1.A.3, excluding bunkers	88	110	105	90
Waste	4.A, 4.B, 4.C, 4.D, 4.E	34	25	27	29
Livestock	3.A, 3.C	443	443	427	427
Forestry and Agriculture	3.B	6,974	6,974	6,974	6,974
Net emissions (removals)		6,326	6,351	6,354	6,350

The sector emissions are estimated using the data available at the time. Some sectors are not currently estimated in the GHG inventory, such as emissions from biomass burning (3.C.1) and cropland (3.B.2). Potential expansion of the GHG inventory or revision to the methodology and parameters will vary the assumptions and inputs to the emissions pathway. Future updates to the GHG inventory, NDC, and LEDS may present results in a comparable way to the estimates used in this study.

66 Vanuatu's NAB: <https://www.nab.vu/national-advisory-board-secretariat-members-0>

6.4 Leverage existing monitoring, reporting, and verification (MRV) framework and systems

6.4.1 Role of the MRV systems

Effective policy processes integrate learning and adaptation. Though it is a long-term strategy, Vanuatu's LEDS is intended to be reviewed and updated in future years. Reviews and revisions informed by the outcomes of the MRV processes would assist the Government of Vanuatu in achieving the LEDS pathway to 2050.

6.4.2 Vanuatu's Integrated Monitoring, Reporting, and Verification (MRV) Tool

Vanuatu's existing integrated MRV systems could be used in the review and revision cycles of NDCs and LEDS. This intention is stated in Vanuatu's BUR and Revised and Enhanced NDC.

Vanuatu initially developed and implemented an Integrated Monitoring, Reporting, and Verification (MRV) Tool for the Energy Sector. The MRV Tool is currently being enhanced to cover additional mitigation sectors according to the updated NDC. The integrated MRV system featured in the Biennial Update Report (BUR) in 2021.

Vanuatu's integrated MRV Tool is a first of its kind initiative to integrate most of the domestic and international climate action monitoring, tracking, and reporting requirements. Furthermore, it supports government agencies, development partners, and NGOs towards evidence-based decisions and data insights reporting. Vanuatu's integrated MRV Tool has been customised to track, monitor, and report data critical for climate actions and sustainable development goals.

There are five elements of Vanuatu's integrated National MRV Framework:

- Component 1: National GHG Inventory
- Component 2: NDC Implementation/Mitigation Actions
- Component 3: NDC Adaptation Actions
- Component 4: Climate Finance Flow
- Component 5: Sustainable Development Goals (SDG)

The integrated MRV also fulfils the requirements of transparency under the Paris Agreement and can be used for market and non-market approaches under Article 6. Further, the resultant GHG emission reductions may be used as internally transferred mitigation outcomes (ITMOS) under Article 6 of the Paris Agreement.

Beyond tracking of GHG emissions and the progress of climate actions and NDCs, MRV supports integrated national planning and the assessment of transformational impacts resulting from processes and outcomes of policies and actions, that drive structural changes in society towards climate change mitigation, adaptation, and sustainable development.

Vanuatu's integrated MRV tool is a web-based MRV Tool (deployed on cloud server – AWA, AZURE, Google Cloud, etc.) designed specifically considering the domestic and international reporting requirements on climate actions. The Department of Climate Change is responsible for implementing and operationalising the web-based integrated MRV system for the national GHG inventory. While Vanuatu's integrated MRV has multiple modules, a registry system could be integrated so that the following additional components or information could be added:

- Implementation status of NDC and LEDS actions and the mitigation outcomes and emission reduction units.
- Trade in emission reduction units.
- Co-benefits of actions.

6.4.3 Capacity Building Institute for Transparency (CBIT) Project

The Vanuatu CBIT project was approved for funding by the Global Environment Facility in July 2022 under GEF-7. The intended purpose is to strengthen capacity in the energy, waste, agriculture, forestry, and other land-use sectors for enhanced transparency in the implementation and monitoring of Vanuatu's Nationally Determined Contribution.

The CBIT project aims to develop Vanuatu's institutional and human capacities for complying with Enhanced Transparency Framework (ETF) reporting requirements of the Paris Agreement, and implementation and monitoring of Vanuatu's Nationally Determined Contribution focusing on energy, agriculture, forestry, and other land-use sectors.

The project will be implemented by the FAO and executed by the Ministry of Climate Change and the Ministry of Agriculture (MALFFB). This is a three-year project with a completion date of May 2025.

The project has two components and ten outputs. The first component is to strengthen institutional arrangements and the outputs include sectoral transparency guidelines and protocols for enhanced NDC climate change mitigation, adaptation, and addressing L&D for observed and potential climate change impacts (e.g. extreme weather events and slow onset events). The second component includes provision of an online platform, tools, and training for a robust MRV system focusing on energy, agriculture, forestry, and other land-use sectors.

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

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

6.4.5 Vanuatu's National Vulnerability Assessment Framework (NVAF)

The Vanuatu National Vulnerability Assessment Framework (NVAF) was developed to enable the channelling of finance to people who live in places that are most vulnerable to climate change and disasters.

The NVAF is designed to facilitate a more systematic and robust collation and analysis of existing and forthcoming climate and disaster vulnerability data from multiple sources (stakeholders) and methods (qualitative, quantitative, subjective, objective) to more effectively inform resilience decision-making, planning, project prioritisation, and financial allocation at national and sub-national levels.

The NVAF is generically structured to categorically assess the current and future effects of climate change and disasters on a wide and varied set of variables that are broadly categorised according to livelihood assets (LAs) capacities and sustainable development objectives (SDOs). The five categorical LAs of the VAF include natural (environmental) resources, infrastructure and services, finance, human resources and institutions, and governance and these are assessed according to their capacity to address each of the seven SDOs including healthy ecosystems, healthy communities, security of place, water security, food security, income security, and energy security.

6.5 Financing strategy

The Vanuatu LEDS does not provide costings for policy and programme responses. The LEDS identifies the long-term vision, reviews policy alignment, and develops actions to meet the gap between BAU and the low emissions, and the climate resilient development pathway. Alongside the LEDS document, the Sector Annexes are intended to provide further analysis and options for LEDS actions, which may be costed through concept notes and proposals. This is an area for further development and refinement alongside publication of the LEDS.

Vanuatu continues to work on financing strategies for climate goals. An example is the upcoming NDC Investment Plan. Figures on the scale of climate finance needs, the costing of implementing Vanuatu's most recent NDC, and potential sources of finance are provided below.

6.5.1 Climate Finance Needs Assessment

Globally, the climate finance landscape has steadily increased over the last decade, reaching USD 632 billion in 2019/2020. However, an increase of at least 590% in annual climate finance flows is required to meet internationally agreed climate objectives before the end of the decade (2030), and thus, to avoid the most dangerous impacts of climate change. The majority of climate finance (61% or USD 384 billion) was raised as debt, of which 12% (USD 47 billion) was low-cost or concessional debt. Equity investments accounted for 33% of total climate finance, reflecting an increase from 29% from 2017/2018. Grant finance accounted for 6% (USD 36 billion) of total climate finance flows, reflecting an increase from 5% in 2017/2018. Unfortunately, total climate finance flows are nowhere near the estimated needs, conservatively estimated at USD 4.5–5 trillion annually⁶⁷. Estimates for costed needs in NDCs for the Asia-Pacific region equate to between USD 3.2–3.3 trillion based on available financial information⁶⁸.

Nationally, the determination of climate finance needs to meet the Government of Vanuatu's ambitious public policy goals on climate change, including those championed in various national and sectoral policies, which is captured succinctly in the most recent NDC⁶⁹ submitted to the UNFCCC in Q3 of 2022, including:

- The **total approximate cost** of achieving the country's updated NDC, including all targets and commitments, is USD 1.21 billion or VUV 145 billion.
- **Mitigation targets** are estimated to cost USD 315.6 million or VUV 37.8 billion. It should be noted that the mitigation activities are 100% conditional upon international finance, action, support, technology transfer, and capacity development. This cost estimation does not cover the costs of existing measures, such as measures included in the first NDC of Vanuatu as these measures are already under implementation and already budgeted under NERM. Furthermore, the costs for additional measures are tentative and based on similar international experiences, national circumstances of Vanuatu and other assumptions. A detailed scoping and feasibility study of enhanced NDC measures will be conducted under the NDC implementation roadmap development to determine the exact additional investment requirements.
- **Adaptation targets** are estimated to cost USD 721 million or VUV 86 billion. **Loss and damage targets** are estimated to cost USD 177.7 million or VUV 21 billion. Adaptation and loss and damage activities are a mix of fully or partially conditional, ranging from 70–100% conditionality, depending on each sector and sub-sector. These figures represent the highest priority placed by Vanuatu on resilience, and the extremely high costs associated with failure to adapt, as exemplified by the devastating financial, social, and environmental losses and damages experienced already and expected to increase exponentially as climate change accelerates.

67 Climate Policy Initiative (CPI), Global Landscape of Climate Finance (2021).

68 UNFCCC SCF, First Report on the Determination of the Needs of Developing Country Parties related to implementing the Convention and the Paris Agreement (2020).

69 Vanuatu's Revised and Enhanced Nationally Determined Contribution (NDC), page 4.

The costs for these measures are tentative and based on similar international experiences, national circumstances of Vanuatu, and other assumptions. Finance and technical support are urgently required to undertake detailed scoping and feasibility studies of these enhanced NDC to determine the exact additional investment requirements.

6.5.2 Implementation and Sources of Finance

To achieve all mitigation, adaptation, and loss and damage conditional targets within the revised and enhanced NDC, Vanuatu anticipates financial, technological, and capacity building support from global funds such as the Green Climate Fund, Global Environment Facility, and Adaptation Fund, as well as bilateral/multilateral agencies and development partners. These funds will be utilised to bolster limited national resources and technical capacities for scaling up climate action. The activities identified under this LEDS will be implemented in part by integrating them under the government's recurrent budgets as various subsidy policies, projects, or programmes. As these targets are well aligned with the country's existing policies and plans, they will have high ownership and will be implemented in a timely manner.

6.5.3 Carbon Markets

Vanuatu's forest sector is a potential source of carbon credit revenue. Global carbon markets are thriving, though highly fragmented. By the end of 2021 more than 21% of the world's emissions were covered by some form of carbon pricing, with trading on these markets growing by over 160% to USD 897 billion.

Vanuatu has made some progress towards accessing carbon markets. Though projects to date have been limited, there is potential and ambition to expand participation in the several markets available. Relevant carbon market experience to date includes:

- Vanuatu's *Forestry Rights Registration and Timber Harvest Guarantee Act 2000* defines carbon property rights on leased land. About 10% of Vanuatu's land area is leased land⁷⁰.
- Under the Kyoto Protocol, Vanuatu had a Programme of Activities (PoA) project 'Disseminating Efficient Cookstoves in Vanuatu' registered on 5 September 2014 with a renewable crediting period of 7 years (from October 2014 to October 2021). Vanuatu does not have any Clean Development Mechanism (CDM) projects as per Article 12 of the Kyoto Protocol to date.
- The Nakau Programme's Loru Forest Project on Santo, established in 2016, as a performance-based forest carbon offset project. The Loru project generates 2,442 carbon offsets annually and is certified under the Plan Vivo standard. The Loru project is an avoided deforestation project with an eligible forest area of 147 ha.
- With an ambition to participate in the Article 6.2 mechanism of the Paris Agreement under the UNFCCC, an Implementing Agreement to the Paris Agreement was signed between the Swiss Confederation and the Republic of Vanuatu during COP26 in Glasgow (November 2021). The objective of the Agreement is to establish the legal framework for the transfers of Mitigation Outcomes to use towards NDC achievement or for mitigation purposes other than achievement of the NDC.

70 World Bank, 2012 Vanuatu National Leasing Profile: A Preliminary Analysis: <https://documents1.worldbank.org/curated/en/652341468124775547/pdf/699940BRIOP1170IOLeasing0Profile0BN.pdf>

APPENDIX 1. THE LEDS DEVELOPMENT PROCESS AND METHODOLOGY

Process
Modelling
Communication



AM

Process

The LEDS development process required adaptation to changing circumstances as the impacts of COVID-19 were experienced in the Pacific. Travel into Vanuatu was greatly restricted from March 2020 until July 2022. Preparatory work for the Vanuatu LEDS began in May 2021 with the formation of the Project Steering Committee. The Project Steering Committee is led by the following government ministries and departments, in collaboration with development partners:

Ministry of Climate Change (MoCC)

1. Director, Department of Climate Change (DoCC)
2. Director, Department of Energy (DoE)
3. Director, Department of Environmental Protection and Conservation (DEPC)

Ministry of Lands (MoLNR)

4. Director, Department of Forests (DoF)
5. Director, Department of Water Resources (DoWR)

Ministry of Agriculture (MALFFB)

6. Director, Department of Agriculture and Rural Development (DARD)

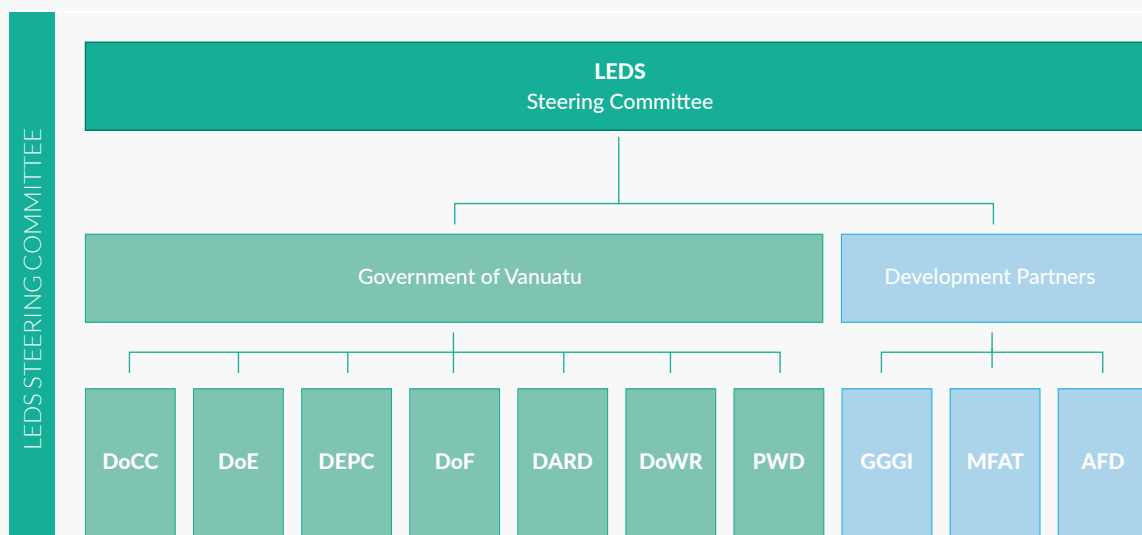
Ministry of Infrastructure (MIPU)

7. Director, Public Works Department (PWD)

Development Partners

8. Representative, Global Green Growth Institute (GGGI)
9. Representative, New Zealand Ministry of Foreign Affairs and Trade (MFAT)
10. Representative, Agence Francaise de Developpement (AFD)

Figure 27: Membership of the LEDS Steering Committee



The LEDS was developed through a multiphase process of vision development, pathway identification, and actions prioritisation. At each of these stages, stakeholder input was sought through meetings with the project delivery team, workshops or site visits. Several public workshops occurred in July, August, and September 2022.

The LEDS project team sought to communicate the LEDS development through engagement with stakeholders, advertising notices and following up with event summaries, establishing a webpage on the Department of Climate Change website, and producing six videos each in English and Bislama spoken language, and another with French subtitles.

Modelling

Sectoral analysis and modelling of emissions occurred alongside stakeholder engagement through 2022.

The modelling for the Vanuatu LEDS focused on emissions and net emissions balance towards 2050, in keeping with the purpose of the LEDS under Article 4 of the Paris Agreement. This assists the international community to assess Vanuatu's contribution to global efforts for net zero emissions by 2050.

The emissions modelling undertaken has additional highly valuable application to support domestic strategic policy:

- The development of an energy and transport sector model for LEAP is intended to support ongoing work of government and utilities in Vanuatu. The modelling supports strategic choices for long-term expansion of electricity in geography and uses, as well as renewable generation sources.
- The analysis of the waste sector is intended to support ongoing dialogue of government, development partners, donors, and private sector by providing an independent set of projections that can be referenced.
- The forest sector emissions model, with recognition of fuel wood use outside of the forest sector, is intended to support the design and implementation of forest policy, particularly the REDD+ Strategy.

Energy and transport sector modelling were undertaken using Low Emissions Analysis Platform (LEAP)⁷¹. Bespoke models were developed for the forestry, livestock, and waste sectors which used IPCC 2019 Revision to 2006 Guidelines and associated calculation templates⁷².

IPCC-consistent carbon emissions accounting methodology was used for GHG emissions and mitigation actions across sectors. Different sector models were constructed to project emissions generating activities and intensities. Though consistent with IPCC, there are emissions estimations in the current period that differ from Vanuatu's GHG inventory due to different population estimates and parameter values.

Unlike GHG emissions and mitigation actions, there is not a single measure of climate change vulnerabilities and adaptation actions. The climate change vulnerabilities differ with context and location. The approach of the LEDS is to integrate adaptation in each sector of the LEDS through consideration alongside mitigation actions.

Further detail on inputs for modelling, including gaps where data was not available, are provided below in Table 23.

71 SEI: <https://leap.sei.org/>

72 IPCC: <https://www.ipcc-nggip.iges.or.jp/public/2019rf/index.html>

Table 23: Information and details on LEAP modelling inputs

BAU scenario		
Sector	Modelling details	
Energy	See 'LEAP Inputs - Vanuatu National' spreadsheet for parameter inputs	
	Constant parameters with the exception of population and economic growth	
	thermal only expansion in capacity for all grids, with the exception of advanced projects Brenwe hydro, Sarakata hydro extension, and Wintua Solar	
	Population driven growth in transport, residential energy demand (no change in practices)	
Waste	Population driven growth in solid waste and wastewater	
Forestry and Agriculture	Population-driven increase in fuel wood collection, impacting sector emissions from 2030	
	No change in forest area	
	No increase in merchantable wood extraction	
	No introduction of substantial fertiliser use	
	No introduction of intensive agriculture or flood irrigation	
Livestock	Stable herd size, with stable emissions from livestock	
NDC scenario (Enhanced NDC 2020)		
Sector	Actions by 2030	Modelling details
Energy	NDC Action 1: Renewable energy capacity addition. To approach 100% renewable energy in the electricity subsector contingent upon appropriate financial and technical support.	Modelled under NERM Target 6
	NDC Action 2: Substitute and/or replacement fossil fuels with coconut (copra) oil-based electricity generation	Modelled under NERM Targets 6 and 11
Waste	Additional NDC Measure 7: Waste-to-energy (WTE) plants for MSW	Waste emissions modelled in waste model. Some energy from biomass/waste incineration modelled in UNELCO roadmap scenario for LEDS.
	Additional NDC Measure 7.1: WTE plant for Port Vila	Waste emissions modelled in waste model. Some energy from biomass/waste incineration modelled in UNELCO roadmap scenario for LEDS.
	Additional NDC Measure 7.2: WTE plant for Luganville	Waste emissions modelled in waste model. Some energy from biomass/waste incineration modelled in UNELCO roadmap scenario for LEDS.
	Additional NDC Measure 7.3: WTE plant for Lenakel	Waste emissions modelled in waste model. Some energy from biomass/waste incineration modelled in UNELCO roadmap scenario for LEDS.
	Additional NDC Measure (CE Strategy 3.2): Compost municipal organic waste to produce soil enhancer	Waste emissions modelled in waste model.
	Additional NDC Measure (CE Strategy 3.9): Collect, sort, and export recyclable materials (indicative) for first phase for Port Vila	Waste emissions modelled in waste model.
	Additional NDC Measure (CE Strategy 3.10): National plastics strategy	Waste emissions modelled in waste model.
Wastewater	Additional NDC Measure 8: Wastewater management system in Vanuatu	Waste emissions modelled in waste model.
	Additional NDC Measure 8.1: Centralised wastewater collection and treatment system in municipal areas, including awareness and capacity-building	Waste emissions modelled in waste model.
	Additional NDC Measure 8.2: Improvements to public and communal toilet facilities including bio-toilets	Waste emissions modelled in waste model.

Livestock	Additional NDC Measure 6: Training and capacity-building for livestock farming and pasture management	Not modelled, data on impact unavailable
	Additional NDC Measure (CE Strategy 3.1): Converting pastures to silvopastoral livestock systems	Not modelled, emissions impact uncertain
	Additional NDC Measure (CE Strategy 3.14): International collaboration to improve livestock efficiency	Not modelled, data unavailable
Transport	NDC Action 3: Improve transport (land and marine) energy efficiency	Modelled under NERM Target 8
	Additional NDC Measure 1: Electric vehicles (e-mobility)	Modelled combined scenario with additional measures 1, 2, 3
	Additional NDC Measure 1.1: Electric vehicles (e-buses) for public transportation (10% of total public buses)	Modelled combined scenario with additional measures 1, 2, 3
	Additional NDC Measure 1.2: Electric cars (e-cars) in Vanuatu (10% of government fleet)	Modelled combined scenario with additional measures 1, 2, 3
	Additional NDC Measure 1.3: 1,000 electric two-wheel (e-bikes)/three-wheelers (e-rickshaws)	Modelled combined scenario with additional measures 1, 2, 3
	Additional NDC Measure 2: 20% biodiesel (biofuel) blending in diesel	Modelled combined scenario with additional measures 1, 2, 3
	Additional NDC Measure 3: Mileage and vehicle emissions standards	Modelled combined scenario with additional measures 1, 2, 3
Other sectors	Additional NDC Measure 4: Biogas plants for commercial and residential use (1,000 biogas plants)	Modelled – 5% biogas cooking in urban areas by 2030. There are 1,000 biogas systems between 18,000 households in Port Vila, Luganville, Lenakel, and Lakatoro
	Additional NDC Measure 5: Energy efficiency in the commercial and residential sectors	Modelled under NERM Target 7
	Additional NDC Measure 5.1: Increase energy efficiency in the commercial and residential sectors by 5%	Modelled under NERM Target 7
	Additional NDC Measure 5.2: Convert/design 10 buildings to be energy efficient (green buildings)	Not modelled, data unavailable
	Additional NDC Measure (CE Strategy 3.15): Ecotourism supported by local communities	Not modelled, data unavailable
Low Emission (LEDS) scenario		
Sector	Modelling details	
Energy	See 'LEAP Inputs - Vanuatu National' spreadsheet for parameter inputs	
	NERM goals for energy access (Indicators 1. concession and 2. rural areas) achieved by 2030. This increases electricity demand, and until the grid is decarbonised in 2030.	
	NERM goals for industry efficiency (Indicator 7) achieved by 2030	
	NERM goals for transport efficiency achieved (Indicator 8) achieved by 2030	
	NDC + LEDS transport: introduction of fuel standards in 2030	
	LEDS transport: introduction of electric cars and boats from 2030, 50% of cars and boats by 2050	
	NDC + NERM goal for 100% grid RE (Indicator 6) achieved by 2030 through UNELCO roadmap (Efate) and 100% CNO for Malekula, Tanna, and Santo concessions	
	LEDS cooking: transition to efficient wood stoves, LPG, biogas, and electricity as main energy sources.	
Waste	LEDS: from 2030, reduction in thermal energy electricity in out of concession areas, by 2050 and 100% supply by RE sources in future (hydro, wind, or solar)	
	NDC: Soil composting or home biogas action identified in the NDC and Circular economy strategy (saving 10.9 Gg in 2030)	
	NDC: Waste to energy (such as CH ₄ harvesting) capturing at least 560 out of 1,610 tonnes CH ₄ generated from urban landfill, commencing 2040.	

Forestry and Agriculture	No change to forest area
	No increase in merchantable wood extraction
	No increase in fuel wood harvesting
	No conversion of grassland to silvopastoral use (NDC action)
	No introduction of substantial fertiliser use
	No introduction of intensive agriculture or flood irrigation
Livestock	LEDS: improved feed system to reduce CH ₄ from 2031, reducing CH ₄ and N ₂ O emissions by 5% each in aggregate

Communication

The project delivery team were conscious of capacity building and knowledge sharing throughout the LEDS development. The use of LEAP for energy and transport sector modelling was complemented by training sessions for staff from government, regulators, and utilities in the use of LEAP and extending the application to related projects. Technical appendices and knowledge sharing events assisted to record and communicate the insights developed.



The Department of Climate Change
Ministry of Climate Change Adaptation, Meteorology,
Geo-Hazards, Environment, Energy and Disaster Management
Government of Vanuatu

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