



TECHNICAL ASSISTANCE REPORT

PAPUA NEW GUINEA

Climate Policy Diagnostic

November 2024

Prepared By

Suphachol Suphachalasai, Junko Mochizuki, Karlygash Zhunussova, Sylke von Thadden-Kostopoulos, and Danielle Minnett

Fiscal Affairs Department

The contents of this document constitute technical advice provided by the staff of the International Monetary Fund to the authorities of Papua New Guinea (the "CD recipient") in response to their request for technical assistance. Unless the CD recipient specifically objects to such disclosure, this document (in whole or in part) or summaries thereof may be disclosed by the IMF to the IMF Executive Director for Papua New Guinea, to other IMF Executive Directors and members of their staff, as well as to other agencies or instrumentalities of the CD recipient, and upon their request, to World Bank staff, and other technical assistance providers and donors with legitimate interest (see [Staff Operational Guidance on the Dissemination of Capacity Development Information](#)). Publication or Disclosure of this report (in whole or in part) to parties outside the IMF other than agencies or instrumentalities of the CD recipient, World Bank staff, other technical assistance providers and donors with legitimate interest shall require the explicit consent of the CD recipient and the IMF's Fiscal Affairs department.

The analysis and policy considerations expressed in this publication are those of the IMF's Fiscal Affairs Department.

International Monetary Fund, IMF Publications
P.O. Box 92780, Washington, DC 20090, U.S.A.
T. +(1) 202.623.7430 • F. +(1) 202.623.7201
publications@IMF.org
IMF.org/pubs

Contents

Acronyms and Abbreviations	5
Preface	8
Executive Summary	9
Recommendations	12
I. Context	14
II. Climate Adaptation Policy	21
A. National Adaptation Policy Landscape	21
B. Climate Resilience of Water	22
C. Disaster Risk Management and Disaster Risk Financing	27
D. Climate Resilience of Agriculture	34
III. Climate Mitigation Policy	38
A. GHG Emissions and Mitigation Targets in PNG	38
B. Agriculture, Forestry, and Other Land Use (AFOLU)	40
C. Energy Sector	45
D. Methane	50
E. Evaluating the Impact of Mitigation Policies	51
IV. Enabling Institutions	55
A. Legislative Framework	55
B. Policy Framework	58
C. Institutions	62
D. Climate Finance	64
Boxes	
1. Rationale for Government Intervention in Climate Adaptation	21
2. Alternative Approaches to Pricing Water	25
3. Strengthening End-to-End Early Warning Systems Based on People-Centered Approach	30
4. National Disaster Risk Financing Strategy to Foster Financial Resilience Against Disasters	33
5. Bundling of Risk Management, Credit and Agronomical Knowledge/Inputs to Foster Climate Resilience	37
6. International Experience of Integrating Climate Aspects into Subnational Legislation	58
7. Some Key Conclusions from the Review of the First 29 Long-Term Climate Strategies Submitted to the United Nations Framework Convention on Climate Change (UNFCCC)	61
8. Strengthening the Role of Ministries of Finance in Driving Climate Action	64
9. Fiscal Policies to Incentivize Private Investment	66
Figures	
1. Average Annual Climatology (1991-2020)	14
2. Trends in Annual Temperature (left) and Precipitation (right) in Port Moresby	15
3. People Affected by Disasters	15

4. PNG's Projected Climatology – Temperature (top) and Precipitation (bottom)	16
5. Global Sea Level Rise (Relative to 2000, meters, m).....	17
6. Projected Sea Level Rise in PNG	17
7. Estimated Economic Cost of Sea Level Rise – No Adaptation.....	18
8. PNG's Surface Water Streams	22
9. Percent Share of Urban (left) and Rural (right) Population with Access to Safe Drinking Water in the Pacific.....	23
10. Breakdown of AAL per Hazard (left), Percent of AAL Due to Climatic Disasters per Asset Category (right).....	28
11. Disaster Risk Financing Instruments in PNG.....	33
12. Area, Production and Yield of Major Cereals (left) and Number of Undernourished (right)	35
13. GHG Emissions per Capita and GHG Intensity of GDP, 2022	39
14. GHG Emissions and Primary Energy Consumption	39
15. IMF Estimates of Historical and Projected GHG Emissions, 2019-2030.....	40
16. Land Use (left) and Historical GHG Emissions (right)	41
17. Drivers of Forest Degradation and Deforestation in 2001-2015	42
18. Electricity Generation and Capacity by Fuel Source, 2000-2022	46
19. PNG Electrification Potential	48
20. Additional Revenues and Avoided Losses, Compared to Baseline.....	52
21. GDP Growth Impact Decomposition in 2030	53
22. Impact on Emissions	54
23. National Regulations Governing NDC Sectors	56
24. PNG's Climate Policy Framework.....	59

Tables

1. Natural Disasters in PNG, 2000-2024.....	16
2. Potential Inundation Coverage for Five Provinces by 2100.....	18
3. Selected Climate and Development Indicators of PNG	19
4. Tariff for Urban Water Supply and Sewerage Service.....	24
5. Components of Volumetric Abstraction Charges	25
6. ICCC Service Level Indicators Reviewed and Selected Business KPIs by Water PNG	26
7. Selected DRM Legal Policy and Planning Documents and Key Gaps	29
8. Current Ex-Ante DRM Activities Taken by Selected Government Entities and SOEs	31
9. Projected Climate Change Impacts on Yields of Key Crops Relative to Present.....	35
10. Forestry Emission Factors	43
11. Electricity Tariffs.....	47
12. Planned and Proposed Projects (MW).....	47
13. Proposed Carbon Levy	49
14. Impact on Energy Prices.....	53
15. Summary Table.....	54

Annexes

I. Disaster Response Expense in 2024.....	68
II. Climate Policy Assessment Tool.....	69
III. Options for Recycling Carbon Tax	70

Acronyms and Abbreviations

AAL	Annual Average Loss
ADB	Asian Development Bank
AFOLU	Agriculture, Forestry, and Other Land Use
BCM	Billion Cubic Meters
BUR	Biennial Update Report
CARD	Climate Adaptation in Rural Development
CCDA	Climate Change and Development Authority
CCMA	Climate Change Management Act
CD	Capacity Development
CEPA	Conservation and Environment Protection Authority
CFSC	Climate Finance Steering Committee
CPAT	Climate Policy Assessment Tool
CPD	Climate Policy Diagnostic
DAL	Department of Agriculture and Livestock
DoWH	Department of Works and Highways
DMA	Disaster Management Act
DPLGA	Department of Provincial and Local-Level Government Affairs
DRFS	Disaster Risk Financing Strategy
DRM	Disaster Risk Management
DRR	Disaster Risk Reduction
DSIP	District Service Improvement Program
EIA	United States Energy Information Administration
EOC	Emergency Operating Center
ENSO	El Niño-Southern Oscillation
EWS	Early Warning System
GAEZ	Global Agro-Ecological Zoning
GDP	Gross Domestic Product
GHG	Greenhouse Gas
GIRI	Global Infrastructure Resilience
GoPNG	Government of Papua New Guinea
ha	Hectare
FAD	Fiscal Affairs Department
FAO	Food and Agriculture Organization

FCA	Forest Clearance Authorities
ICCC	Independent Consumer Competition Commission
IFAD	International Fund for Agricultural Development
IGFP	Inclusive Green Finance Policy
IMF	International Monetary Fund
IPP	Independent Power Producer
IWRM	Integrated Water Resources Management
K	Kina
KPI	Key Performance Indicator
LNG	Liquefied Natural Gas
LULUCF	Land Use, Land Use Change, and Forestry
LTS	Long Term Strategy
m	Meters
mm	Millimeters
MTDP	Medium Term Development Plan
MOU	Memorandum of Understanding
MtCO _{2e}	Million Tonnes CO ₂ Equivalent
MW	Megawatt
M&E	Monitoring and Evaluation
MRV	Measurement, Reporting, and Verification
NAP	National Adaptation Plan
NCCB	National Climate Change Board
NDC	Nationally Determined Contribution
NFA	National Fisheries Authority
NFMS	National Forestry Monitoring System
NGO	Non-Governmental Organization
NRW	Non-Revenue Water
NTRAA	Non-Tax Revenue Administration Act
PES	Payment for Environmental Services
PNG	Papua New Guinea
PNGFA	Papua New Guinea Forestry Authority
PPL	Papua New Guinea Power Limited
PSIP	Provincial Service Improvement Program
RCP	Representative Concentration Pathway
REDD+	Reducing Emissions from Deforestation and Forest Degradation
R&D	Research and Development

SABL	Special Agricultural Business Leases
SDG	Sustainable Development Goal
SNG	Subnational Government
SLR	Sea Level Rise
SSP	Shared Socioeconomic Pathway
SOE	State-Owned Enterprises
SOP	Standard Operating Procedure
SPA	Strategic Priority Area
TAC	Technical Advisory Committee
tCO ₂ e	tonnes CO ₂ equivalent
UNFCCC	United Nations Framework Convention on Climate Change
USAID	United States Agency for International Development
WaSH	Water, Sanitation, and Hygiene
WB	World Bank

Preface

In response to a request from the Government of Papua New Guinea (GoPNG) for capacity development (CD) on climate policy diagnostic (CPD), a CD mission visited Port Moresby during July 2nd—15th, 2024. This mission of the International Monetary Fund’s (IMF) Fiscal Affairs Department (FAD) was led by Mr. Suphachol Suphachalasai and comprised Ms. Junko Mochizuki, Ms. Karlygash Zhunussova, Ms. Sylke von Thadden-Kostopoulos, and Ms. Danielle Minnett (all FAD).

The mission had engaging and productive discussions with the Secretary of Treasury, Mr. Andrew F. Oaeko; the Governor of Bank of PNG, Ms Elizabeth Genia; the Acting Managing Director of the Climate Change and Development Authority (CCDA), Ms. Debra Sungi; and senior officials from Department of Treasury (DoT), Bank of PNG (BPNG), Climate Change and Development Authority (CCDA), Conservation and Environment Protection Authority (CEPA), Papua New Guinea National Forestry Authority (PNGFA), National Fisheries Authority (NFA), National Energy Authority (NEA), Department of Agriculture and Livestock (DAL), Department of Petroleum and Energy (DPE), Department of National Planning Monitoring (DNPM) and District Development, Papua New Guinea Power Limited (PPL), PNG Water Limited, and National Disaster Center.

The mission is grateful for staff of the Economic Policy Wing of Department of Treasury, particularly Ms. Rhoda Karl, Mr. Swartz Buf, Mr. Ismael Sumb, and Ms. Herla Ato, for their efficient support provided in organizing and facilitating the discussions with the government stakeholders. In addition, the mission is grateful to the IMF Resident Representative, Mr. Sohrab Rafiq and his staff, Ms. Loa Anisi for the support and coordination provided before and during the mission.

Executive Summary

Climate-related risks are macro-critical considerations for Papua New Guinea (PNG). The sudden and devastating impact of the landslide in Enga Province in May 2024 that claimed over 2,000 lives and imposed damages reaching US\$130 million is a tragic reminder of PNG's vulnerability to disasters. Hazards such as flooding, drought, and landslide are likely to intensify with climate change, while extreme heat increases human health risk and lower agricultural yields. If the current trends continue, climate change will have considerable negative repercussions on PNG's food and water security, coastal communities, ecosystems, and critical infrastructure, and is likely to cause significant adverse effects on the macroeconomy and people's livelihoods. The severe drought in 2015-2016 affected over 2.5 million people and cost PNG about 0.2 percent of its gross domestic product (GDP). If no action is taken, the economic cost of sea level rise (SLR) could reach 0.3 percent of GDP by 2050 in a moderate scenario, while the economy-wide impact could amount to 4 percent of GDP by 2050 and 15 percent by 2100 under a high emission scenario. In addition, as a large exporter of liquefied natural gas (LNG), PNG's major source of revenue is exposed to macro-transition risks.

PNG faces acute policy challenges in addressing the climate-development nexus. In 2022, 40 percent of the population still lived below the extreme poverty line, with about 86 percent living in the rural areas without access to electricity and safe drinking water. As a country with one of the lowest electrification rates in Asia and the Pacific, PNG's energy demand is expected to grow rapidly while urban development and agricultural expansion are putting pressures on natural resources such as land, forests, and water. The country is highly vulnerable to climate change and emits negligible 0.08 percent of global greenhouse gas (GHG) emissions. In this context, it is important that PNG ramps up policy efforts to mainstream climate adaptation and disaster risk management (DRM) in vulnerable sectors/areas and put in place reforms that help mobilize resources and foster public and private sector adaptation investments. The country should implement policies to maintain forest cover and promote conservation, since forests provide adaptation and environmental benefits. At the same time, PNG should accelerate investment in renewable energy and energy efficiency in response to rising electricity demand.

The Climate Policy Diagnostic (CPD) identifies policy reforms that are good for climate and economic growth and promote fiscal sustainability. The CPD assesses PNG's climate policy and institutional landscape and prioritizes recommendations that (i) create fiscal space and support financial sustainability through revenue generation, broadening the revenue base and sources of climate finance, and/or helping to recover costs, in order to strengthen agencies' capacity to deliver on climate and sustainable development goals (SDGs); (ii) internalize climate externalities associated with economic activities; (iii) provide incentive frameworks and institutional changes to enable private climate investments that align with the Nationally Determined Contribution (NDC) and the National Adaptation Plan (NAP); and (iv) help manage climate-related risks and adverse impact of climate policies on vulnerable/poor households.

A systematic policy approach is needed to strengthen water supply sector and disaster risk management. In the water sector, the main challenges facing the government are to provide adequate and reliable water supply to both urban and rural areas, as well as to ensure that upstream water resources are utilized and managed in a sustainable manner. To this end, the water pricing framework

needs to be updated—water abstraction charges and wastewater discharge fees should be revised to reflect the true economic value of water and environmental externalities associated with water use, while upcoming end-use water tariff review should be updated based on this new cost structure (with allowances for the poor and vulnerable households) and tariff approval made conditional upon utility’s performance on non-revenue water (NRW) and other climate performance indicators. For upstream water resources, the sector would greatly benefit from long-term integrated water resource management planning, as well as regular monitoring of the quantity and quality of surface and ground water. Mobilization of grant/concessional funding is critical for expansion of rural water supply. To effectively manage disaster risks, PNG needs to operationalize its early warning system (EWS) and leverage the new census data to gain a better understanding of disaster risk hotspots and to support targeting of funding allocation for disaster response. Development of a comprehensive national disaster risk financing strategy (DRFS) would help PNG prepare an optimal mix of financing mechanisms for disasters of different levels of severity. Improving financial inclusion in tandem with making available shock-responsive financial products such as microcredits, savings and index-based insurance would go a long way in building resilience of farmers and poorer households.

Carbon pricing can play a major role in the fiscal policy package to encourage climate action in the energy and forestry sectors. Forest degradation driven by commercial logging is the biggest source of emissions in PNG. Forest resources are being depleted faster than restored, while forest conservation is not financially attractive. In response, the government could impose a carbon levy on commercial logging and on deforestation from commercial agriculture, with potential exemptions/deductions for those that meet sustainability standards. The levy could be used to support reforestation efforts and activities to slow down forest degradation. To incentivize forest conservation, the government could consider payment for environmental services (PES). In the energy sector, the main policy challenges are in transitioning electricity generation away from fossil fuels and encouraging investment in renewable energy, while ensuring reliable supply. To address these issues, the government should move ahead with the implementation of carbon levy on liquid fuels, adjust fuel excises to inflation over time, establish regulatory frameworks for off-grid renewables, and adjust end-use electricity tariffs to reach cost-recovery with measures protecting low-income households. It is also important to improve revenue collection rate of the utility and gradually phase out capacity charges, to strengthen its financial position. The government could also introduce regulations and/or fees to internalize environmental costs of emissions from oil and gas production and those from the waste sector.

Increasing the Treasury’s engagement and strengthening cross-sectoral coordination would help to operationalize climate policy and to unlock climate investment. PNG has robust legal, institutional, and policy frameworks to support the implementation of NDC and NAP. However, the climate policy agenda is treated as sectoral policy agenda alongside other sectors. Despite the efforts of the Climate Change and Development Authority (CCDA) to coordinate, there is evidence that climate and other sectoral policies have been developed independent of each other. Furthermore, inadequate partnership between the CCDA and the Treasury has been a roadblock to the implementation of important policies like carbon levy on fuels. A climate unit could be established at the Treasury to engage with stakeholders on climate fiscal policies and climate finance. Coordination bodies under the Climate Change Management Act (CCMA) should be operationalized to enhance coordination, as the new cycle of NDC update approaches. To aid a whole of government approach, PNG should clarify roles and responsibilities of sub-national governments and coordination mechanisms with other government

stakeholders. Climate finance mobilization is also essential. To this end, PNG could leverage on the central banks' green finance policy, consider providing incentives to promote climate investments through the Investment Promotion Act, and further elaborate on regulations to promote climate initiatives under the CCMA, as a coordinated effort to catalyze private climate investments.

Recommendations

This table presents major policy and reform recommendations. A comprehensive list of recommended policies, actions, and measures are provided in respective chapters.

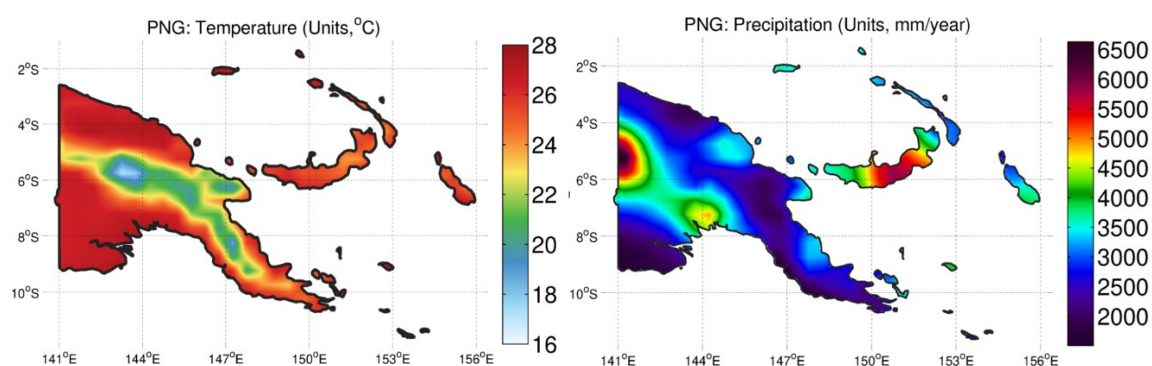
Main Recommendations	Timing	Priority
Climate Adaptation Policy		
Operationalize volumetric water resources abstraction and sewerage charges per Environmental Act (Environmental Regulation 2002).	ST	H
Review and update charges to appropriately internalize environmental externalities and reflect full economic value of water.	MT	M
Incorporate non-revenue water (NRW) reduction and other climate relevant targets as part of service level indicators to be reviewed by the Independent Consumer Competition Commission (ICCC), making an approval of 2027 tariff increase conditional on the successful achievement of revised service level indicators.	MT	H
Update water tariff based on financial cost recovery and abstraction fees reflective of environmental/opportunity cost and make adjustments (such as through block rates and consumer segmentation) to account for distributional impacts.	LT	H
Operationalize the national end-to-end early warning system outlined in the National Disaster Risk Management Plan 2012 with appropriate updates, establishing a clear mechanism to link early warning information with preparedness actions.	MT	H
Develop a disaster risk financing strategy, strengthening ex-ante budgetary planning, use of alternative risk financing instruments by public and private entities including shock-responsive mechanisms.	ST	H
Finalize the adoption of climate smart agriculture policy with a clear monitoring and evaluation (M&E) framework to strengthen sector coordination.	ST	M
Climate Mitigation Policy		
Impose carbon levy on forest degradation and deforestation starting with commercial logging and commercial plantation agriculture, while considering exemptions/deductions for companies that meet certain sustainability standards/criteria.	MT	H
Consider introducing payment for environmental services (PES) schemes on a pilot basis to support conservation efforts.	LT	M
Establish a clear and transparent multi-year regulatory framework for end-use electricity tariff setting and review and gradually adjust the tariff to reach cost-recovery, with measures protecting low-income households.	ST	H
Adopt a regulatory and policy framework for off-grid renewable electricity generation projects that include incentives such as feed-in-tariffs and capacity building.	MT	H
Restore real value of fuel excises (adjust fossil fuel excises to inflation).	ST	M
Implement carbon levy to carbon content of fossil fuels, according to the 2023 amendment to the CCMA.	ST	H
Introduce technical standard and/or fees on fugitive emissions from oil and gas production.	MT	M

Enabling Institutions		
Align the CCMA, the Non-Tax Revenue Administration (NTRA) Act, and the Excise Tariff Act to enable the implementation of carbon levies and climate finance mobilization.	ST	H
Finalize the revision of Disaster Management Act (DMA) 1984 clarifying roles and responsibilities across all phases of disaster risk management (prevention, preparedness, response and recovery), establishing formal mechanisms for DRM coordination below district levels.	MT	M
Operationalize the CCMA's provision to establish the National Climate Change Board (NCCB), Technical Advisory Committee (TAC), and the Climate Finance Steering Committee (CFSC) to support NDC coordination, implementation, and monitoring.	ST	H
Establish a Climate Unit at the Department of Treasury to further enhance coordination at macro level of climate informed policy development and resource mobilization for climate actions.	MT	H
Incentivize private investments in adaption and mitigation by elaborating (i) regulations for the promotion of climate initiatives under the CCMA, (ii) provisions of incentives for green/climate investments in the Investment Promotion Act 2023, and (iii) regulations related to the development of green financial products and services as part of the Inclusive Green Finance Policy (IGFP).	MT	M
Develop regulations to assign clear roles and responsibilities of provincial governments on climate policy and planning, coordination, and reporting.	MT	M
Develop and adopt a long-term strategy that can guide NDCs, transition, and climate finance	LT	M
Recommendations that are characterized as short-term (ST) may be undertaken quickly by the authorities (in a year). Proposals that require longer time to implement are labeled medium-term (MT) which could take over a year but can be done within 3 years, or long-term (LT) which require 3+ years.		

I. Context

1. **PNG is highly vulnerable to climate change.** The country, located in the southwestern Pacific Ocean, occupies the eastern half of the island of New Guinea and shares a border with Indonesia to the west. The country encompasses a diverse range of geographical features, including rugged mountains, dense rainforests, and extensive river systems. The central highlands are characterized by mountain ranges such as the Owen Stanley Range, with peaks exceeding 4,000 meters where temperatures are generally lower compared to other regions in the country (Figure 1). Coastal regions are fringed by coral reefs and numerous islands and archipelagos, contributing to the nation's complex topography. This geographic diversity supports a rich array of ecosystems and cultural groups which will face the risks of climate change.

Figure 1. Average Annual Climatology (1991-2020)



Source: FADCP Climate Dataset (Massetti and Tagklis, 2024), using CRU data (Harris et al., 2020).

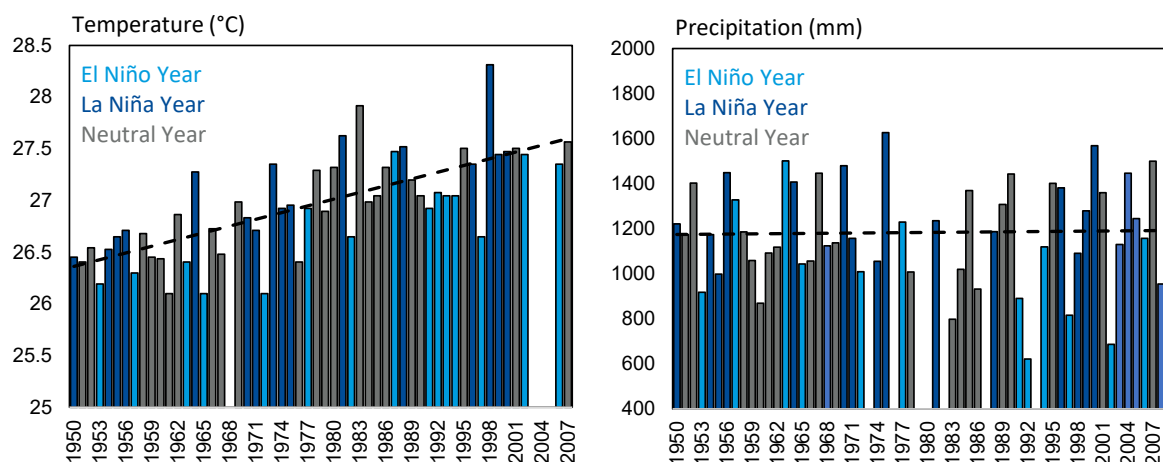
2. **Climate change has already led to increasing temperatures in PNG, while precipitation patterns are influenced by the El Niño-Southern Oscillation (ENSO).**¹ In Port Moresby in particular, average annual temperature has increased by about 1°C from 1950 to 2007, while average annual precipitation has not significantly changed (Figure 2).² PNG has a wet season from December to April and a dry season from May to November. Large temperature differences between the land and the ocean drive monsoons, whose seasonal arrival rapidly transforms the climate from very dry to very wet conditions.³ PNG's climate exhibits significant yearly variability due to the ENSO, a natural climate pattern in the tropical Pacific Ocean that impacts global weather. This oscillation has two extreme phases, El Niño and La Niña, as well as a neutral phase. Typically, El Niño years in PNG are drier than average, potentially causing droughts, while La Niña years are wetter with extended rainfalls that can lead to flooding and landslides.

¹ World Bank Climate Change Portal

² [Current and future climate of PNG](#). Note that data are missing in several years indicating that the data series may not be reliable.

³ [Current and future Climate of PNG: Pacific-Australia Climate Change Science and Adaptation Planning Program](#)

Figure 2. Trends in Annual Temperature (left) and Precipitation (right) in Port Moresby

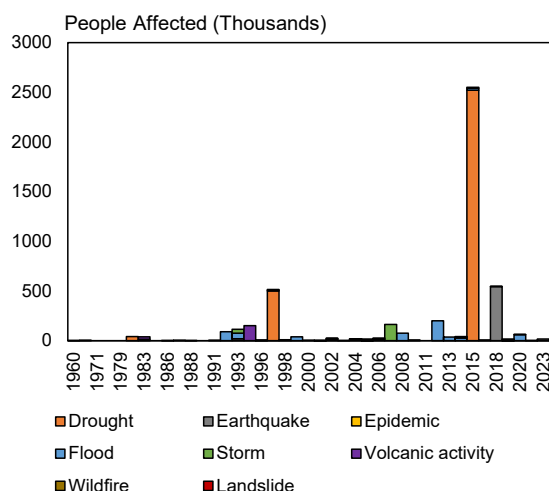


Source: [Current and future climate of PNG.](#)

3. PNG is exposed to disasters that could become more frequent and intense with climate change.

The catastrophic landslide in Enga Province in May 2024, which claimed over 2,000 lives and caused damages exceeding US\$130 million, starkly highlights PNG's vulnerability to natural disasters.⁴ Since 2000, PNG has experienced 47 other disasters, including droughts, epidemics, floods, landslides, storms, wildfires, and volcanic activity (Figure 3, Table 1).⁵ More than 3.8 million people have been affected, injured, or made homeless by natural disasters and 982 lives have been lost over this period. From 2015 to 2016, PNG experienced a severe drought, and, at high altitudes, repeated frosts caused by the El Niño Southern Oscillation. This event affected over 2.5 million people (almost 30 percent of the population) and damages reached USD 60 million (0.3 percent of GDP), imposing large impacts on people's welfare and livelihood. Tropical cyclones affect the country from November to April with a higher frequency during the neutral phases of El Niño-Southern Oscillation. With climate change, cyclones are expected to get less frequent but more intense.⁶

Figure 3. People Affected by Disasters



Source: IMF Staff calculations based on EM-DAT (2024).
Notes: Total affected includes people injured, affected, or made homeless.

⁴ [News article.](#)

⁵ This figure excludes earthquakes which are natural disasters but have no connection to climate change.

⁶ [Current and future Climate of PNG: Pacific-Australia Climate Change Science and Adaptation Planning Program](#)

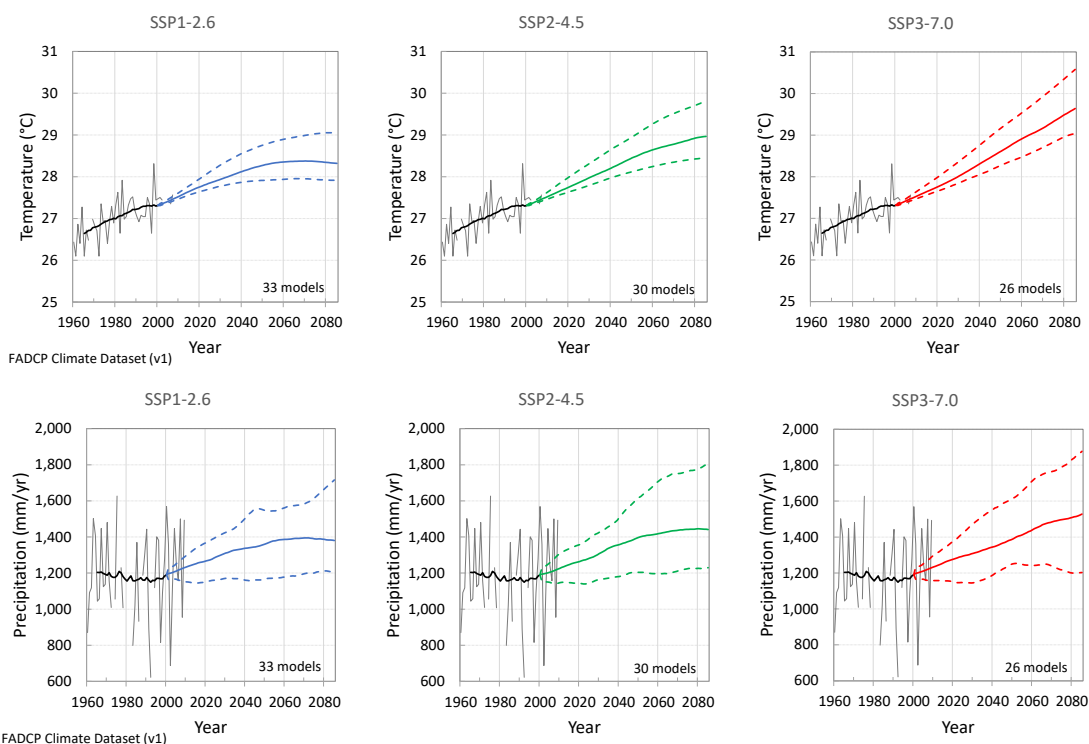
Table 1. Natural Disasters in PNG, 2000-2024

Disaster Type	Disaster Subtype	Event Count	Total Deaths	Total Affected	Total Damage ('000 US\$)
Drought	Drought	1	24	2520000	60000
Earthquake	Ground movement	12	209	579065	61000
Epidemic	Bacterial disease	2	130	2474	n/a
	Viral disease	4	204	8527	n/a
Flood	Coastal flood	2	0	75300	n/a
	Flash flood	2	9	550	n/a
	Flood (General)	3	12	27300	n/a
	Riverine flood	8	7	346893	27000
Landslide	Landslide (dry)	1	10	n/a	n/a
	Landslide (wet)	11	204	18744	60000
	Mudslide	1	1	300	n/a
Storm	Tropical cyclone	4	172	183685	n/a
Volcanic activity	Ash fall	7	0	58079	n/a
	Other activity	1	0	736	n/a

Source: IMF Staff calculations based on EM-DAT (2024).
 Notes: Total affected includes people injured, affected, or made homeless. n/a= not available.

4. Under plausible climate change scenarios, PNG will face increasing temperatures and rainfall over the next 50 years. The first Global Stocktake⁷ estimates that current policies and commitments (i.e., full implementation of the latest nationally determined contributions (NDCs) will lead to a global mean temperature increase of 2.1-2.8°C by 2100 relative to pre-industrial times (1850-1900). This is largely consistent with the Shared Socioeconomic Pathway 2-4.5 scenario (SSP2-4.5)⁸, under which PNG will experience an average warming of 1.5°C by 2030 and 2°C by 2050, relative to only 1950 (as data is not available for the pre-industrial era) (Figure 4, top panels). Projected precipitation patterns are more uncertain, increasing by 7 percent by 2030 and 14

Figure 4. PNG’s Projected Climatology – Temperature (top) and Precipitation (bottom)



Source: IMF Staff. Climate Dataset (Massetti and Tagklis, 2024), [Current and future climate of PNG](#).
 Note: Based on Port Moresby.

⁷ The Global Stocktake, set forth in Article 14 of the Paris Agreement, evaluates collective progress toward the Agreement's objectives and long-term goals, overseen by the Conference of the Parties. The first Global Stocktake was conducted in 2023.

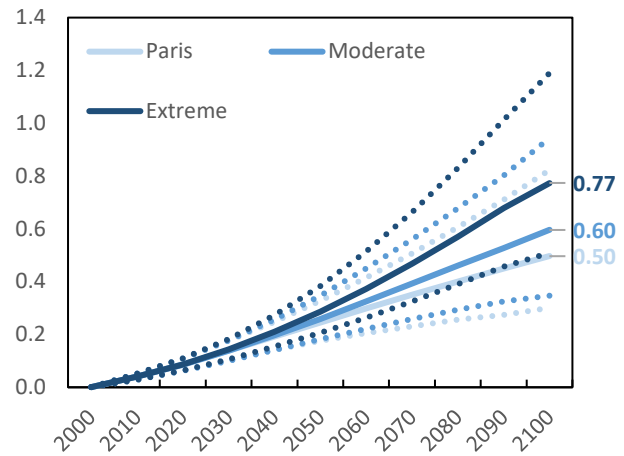
⁸ The SSP2-4.5 scenario is a climate change scenario assuming moderate climate change mitigation efforts and development.

percent by 2050, relative to 1950 (Figure 4, bottom panels). If the current trends continue, climate change will have considerable negative repercussions on crop yields, water resources, health risks, critical infrastructure, biodiversity, and livelihoods.

5. Additionally, PNG is vulnerable to sea level rise (SLR). Satellite data reveals that sea levels near PNG have risen by approximately 7 mm per year since 1993, which is significantly higher than the global average of 2.8 to 3.6 mm per year.⁹ The pace of global sea level rise is accelerating ([IPCC 2023](#)) and is expected to continue to accelerate (Figure 5). Most inundation is expected to occur along the southern central coastline (Figure 6). The country’s coastal flooding hazard maps identifies key households, infrastructure, and social services (health centers and schools) in five provinces that would be vulnerable to inundation by 2100 if action is not taken (Table 2). Without adaptation, estimates show that the economic cost of sea level rise for PNG could reach USD 700 million annually by 2090, about 2 percent of GDP (Figure 7).

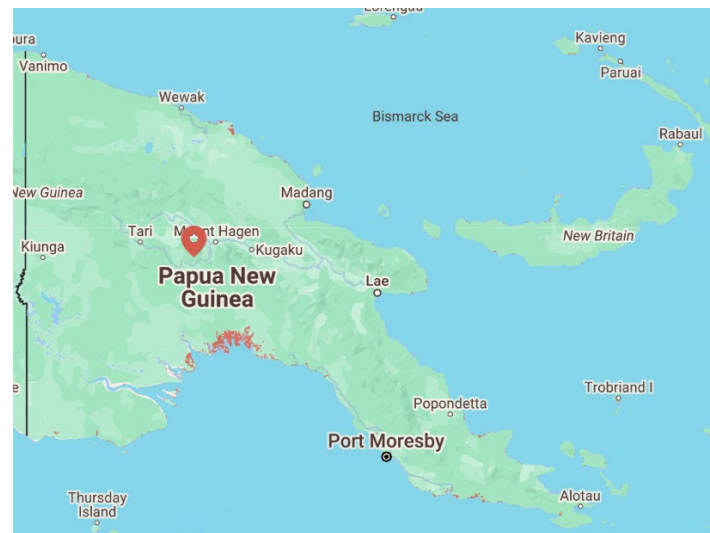
6. Ocean acidification has been increasing in PNG’s waters and threatens coral reef ecosystems. Approximately one-quarter of the carbon dioxide released by human activities annually is absorbed by the oceans. This additional carbon dioxide reacts with seawater, leading to a slight increase in ocean acidity. This change adversely affects the growth of corals and other organisms that build their skeletons from carbonate minerals, which are essential for maintaining the balance of tropical reef ecosystems. Data indicate that ocean acidification has been

Figure 5. Global Sea Level Rise (Relative to 2000, meters, m)



Source: IMF Staff based on SLR projections from Diaz (2016) and data from Kopp et al. (2014). Notes: Local Sea-Level Rise (SLR) probabilistic projections until 2100 under three emission scenarios (Paris – RCP 2.6; Moderate – RCP 4.5; Extreme – RCP 8.5). Solid lines depict median SLR and dotted lines depict the 5th and 95th percentiles for each scenario.

Figure 6. Projected Sea Level Rise in PNG



Source: IMF Staff based on [Climate Central](#). Note: These figures show land areas (in red) that would be below projected tidelines under a moderate 3 degree Celsius warming scenario by 2100. Water levels above the high tide line could be reached through combinations of sea level rise, tides, and storm surge.

⁹ [Current and future Climate of PNG: Pacific-Australia Climate Change Science and Adaptation Planning Program](#)

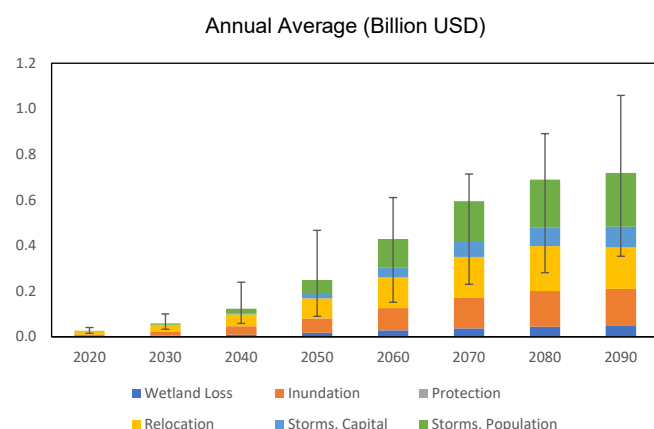
gradually rising in the waters of PNG since the 18th century.¹⁰ Rising temperature and recurring natural hazards compounds long-term economic development challenges. The health of reef ecosystems, already threatened by increased acidification, could be further compromised by additional stressors including coral bleaching, storm damage, and fishing pressure.

Table 1. Potential Inundation Coverage for Five Provinces by 2100

Province	Inundation area (square km)	Population	Households	Roads (km)	Aid Posts	Marine Locations	Bridges	Health Centres	Schools
East Sepik	102	2703	436	6.4	2	2	2	2	0
Madang	27	3073	477	15.72	2	0	3	2	2
Morobe	52	4390	678	2.22	5	2	0	1	3
Oro	29	193	32	0.75	1	0	0	1	0
New Ireland	38	643	121	23.97	0	0	0	0	0

Source: CCDA's Climate Flooding Hazard Maps.

Figure 7. Estimated Economic Cost of Sea Level Rise – No Adaptation



Source: IMF Staff using the Coastal Impact and Adaptation model (Diaz 2016).

Note: Figure is based on RCP 4.5 scenario.

7. PNG’s rising temperatures and recurring natural hazards compound its long-term economic development challenges. In 2022, 40 percent of the population lived below the extreme poverty level and only 13-21 percent of the population had access to electricity (Table 3). The population is dispersed with over 86 percent living rurally while the informal sector is predominantly made up of subsistence farming.¹¹ With one of the lowest electrification rates in Asia and the Pacific, PNG faces rapidly increasing energy demand. Simultaneously, urban development and agricultural expansion exert significant pressure on natural resources, including land, forests, and water. Inadequate infrastructure, corruption, safety and security issues, the absence of social security systems, among other factors, exacerbate the vulnerability of the population. Over two-thirds of its exports consist of liquefied natural gas (LNG), gold, and copper. However, since 2014, the country has faced several challenges: low commodity prices, severe drought in 2015-16, and major earthquake in 2018. These factors weakened

¹⁰ [Current and future Climate of PNG: Pacific-Australia Climate Change Science and Adaptation Planning Program](#)

¹¹ [UNFCCC Second Biennial Update Report](#)

economic growth, caused foreign exchange shortages, and led to a significant increase in public debt ([Article IV](#)). Under a high emissions scenario, the economy-wide impact of climate change could reach to 4 percent of GDP by 2050 and 15 percent by 2100.¹²

Table 2. Selected Climate and Development Indicators of PNG

Indicators	Most Recent Data Year
Geography	
Forest area (% of land area)*	79.1
Arable land (% of land area)*	0.7
Agricultural land (% of land area)*	3.2
Land area (sq. km)*	452,860
Demographics	
Population growth (annual %)	1.9
Population, total*	10,142,619
Rural population (% of total population)	86.4
Economic	
Employment in agriculture (% of total employment) (modeled ILO estimate)	18.5
GDP (current US\$ billion)*	31.7
GDP growth (annual %)	5.2
GNI per capita, PPP (current international \$)	4,180
Inflation, GDP deflator (annual %)*	15.4
Percent of Population Below the Extreme Poverty Line	40.0
Energy & Environment	
Access to clean fuels and technologies for cooking (% of population)*	9.7
Access to electricity (% of population)*	13-21
Annual freshwater withdrawals, agriculture (% of total freshwater withdrawal)	0.3
Electricity production from fossil fuels (% of total)	75
Electricity production from renewable sources (% of total)	25
Energy imports (% of primary energy supply)	50
Energy imports (% of total final consumption)	75
Total greenhouse gas emissions (% of global emissions)	0.08

Source: IMF Staff calculations based on data from the [World Bank](#).

Notes: Indicators are from 2022, with the exception of indicators with an asterisk (*) that are from 2021.

8. Notwithstanding these challenges, the Government of PNG is proactively incorporating climate change considerations into its development objectives and planning. PNG has implemented various climate laws and policies to address the challenges posed by climate change. With the Climate Change Management Act (CCMA) and the United Nations Paris Agreement Act acting as the main legislation, key climate-related policies include the Vision 2050, a Development Strategic Plan 2010-2030, a National Strategy for Responsible Sustainable Development (StaRS), the National Climate Compatible Development Management Policy and a National Adaptation Plan (NAP). More recently, the government has implemented a Sustainable Development Goal 13 Roadmap (30 actions by 2030), an enhanced Nationally Determined Contribution (NDC), and the Climate Change Management (NDC) Regulation. Climate components are also included in the country’s Medium Term Development Plan (MTDP) IV (2023-2027). Chapter II and III of the MTDP explore additional measures to advance PNG’s adaptation and mitigation agenda. Chapter IV offers an in-depth review of existing policies and

¹² Asian Development Bank’s [The Economics of Climate Change in the Pacific](#)

legislation, pinpointing gaps and outlining steps to support the effective implementation of the adaptation and mitigation actions.

II. Climate Adaptation Policy

A. National Adaptation Policy Landscape

9. PNG has made substantial progress in building legal, institutional and policy foundations for country’s adaptation priorities. PNG established its legal mandate for adaptation in the CCMA. A series of policy documents further outlines adaptation priorities, namely National Climate Compatible Development Management Policy 2014, PNG Enhanced NDC 2020, and the NAP 2023. The NAP identifies the country’s quantitative adaptation targets to be achieved by 2030 including: (i) 10 percent of population having increased resilience with respect to food, water security, health and wellbeing; (ii) 100 percent of population benefiting from improved health measures to respond to malaria and other climate-sensitive diseases; (iii) US\$1.2 billion of transport infrastructure built/rehabilitated to climate-resilient codes and standards; (iv) 6 million people benefiting from improved early warning systems; and (v) US\$127 million of building and utility infrastructure assets built and rehabilitated to climate-resilient codes and standards. In addition, the NAP identifies additional cross-cutting policy priorities including but not limited to climate and adaptation governance, information, capacity building and awareness building, and climate-resilient terrestrial, coastal and marine ecosystems. This section analyzes the state-of-play regarding key adaptation sectors in PNG– water, disaster risk management and financing, and agriculture – and identifies policy priorities to build climate resilience in the short, medium and longer-term. Box 1 outlines key principles for government intervention in adaptation actions.

Box 1. Rationale for Government Intervention in Climate Adaptation

Individuals and private firms have incentives to adapt to climate change because many adaptation benefits tend to be local and private. However, there is a clear role for the government when adaptation has large externalities: (i) **Goods with large positive externalities and public goods** such as information about climate change, emergency preparedness plans, seawalls, basic research in new materials and technologies. (ii) **Network effects**, when resilience depends on networks, such as a system of dikes, a water network, or a transportation network, adaptation in each component of the network has impacts on the rest of the network that may not be captured. (iii) **Other market imperfections** such as a poor business environment and inefficient credit markets, or lack of clarity or documentation of land ownership can prevent investment due to lack of incentives or due to lack of collateral, hampering opportunities for farmers to invest in new capital to grow crops that are more suitable to the new climate.

Compared to other types of capital, infrastructure is more likely to be subject to market failures for three main reasons. First, many infrastructure projects often entail large, capital-intensive investments and, therefore, tend to be “natural monopolies,” which means that it is more cost-effective for services to be provided by a single entity. Second, projects have significant upfront costs, but the returns accrue over long periods of time, often several decades, and may be difficult to assess over such a long horizon. Third, infrastructure investments generate positive externalities, so that the social return of a project for the whole population can exceed the private returns generated for the investor.

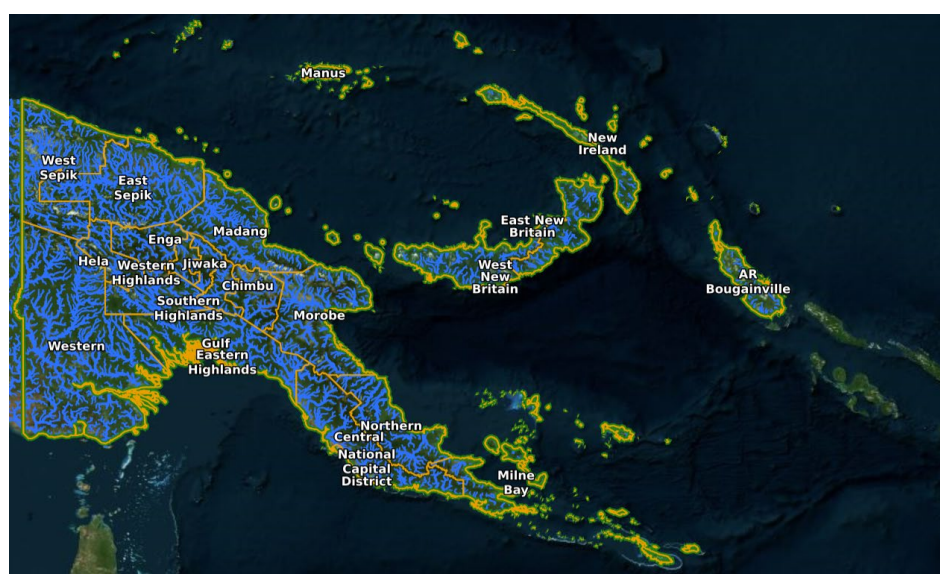
Source: Bellon and Massetti (2022) and Eyraud, et al. 2021, Private Finance for Development 69.

B. Climate Resilience of Water

Current State and Challenges

10. PNG is among the wettest countries in the world, with major constraints on access to clean water and sanitation and high risk of water related disasters (Figure 8). According to the Food and Agriculture Organization's (FAO's) AQUASTAT, PNG's available renewable water in 2020 includes renewable surface water of 801 billion Cubic Meters (BCM) per year along with renewable groundwater of 211.6 BCM/year. On a per capita basis, this translates to the available renewable water per capita of 89,527 cubic meter/inhabitant/year, more than five times the global average of 17,037 cubic meter/inhabitant/year. Currently, the municipal sector accounts for 57 percent of water withdrawal, followed by the industrial sector withdrawing 42.7 percent and the agricultural sector 0.26 percent in 2020. Given the abundance of renewable resources, the country's water stress level remains low¹³ even under climate change until the latter 21st century. However, economic water scarcity – i.e., inability to meet water demand due to lack of water infrastructure – remains high. This, combined with erratic rainfalls, including the increase of extreme precipitation, poses a significant risk to PNG.¹⁴

Figure 8. PNG's Surface Water Streams



Source: PNG [Forest and Land Use Monitoring Geo-Portal](#).

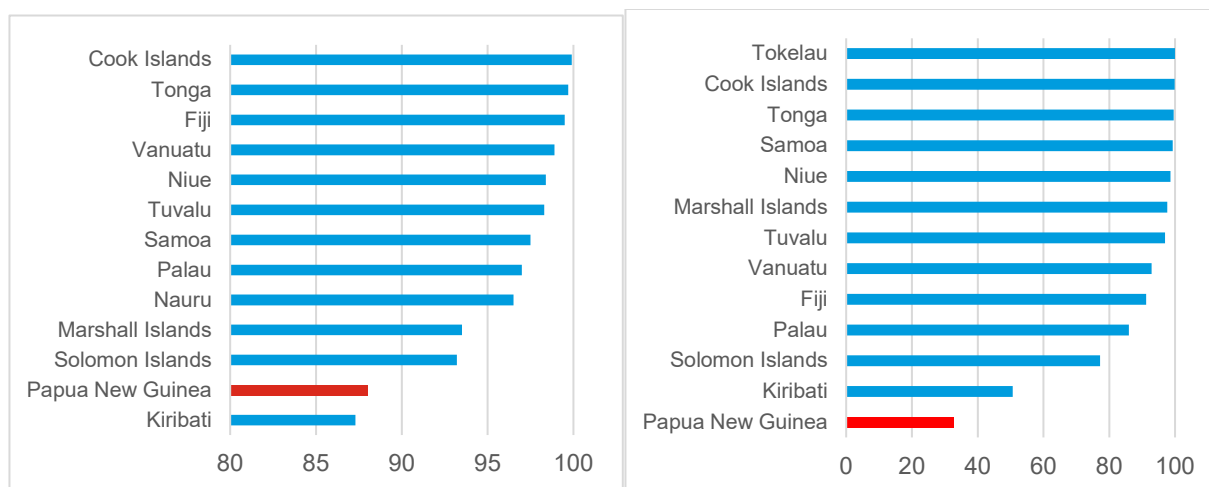
11. PNG's performance on water-related sustainable development goal (SDG) indicators is among the lowest in the Pacific region (Figure 9). Expanding access and climate resilience of water supply is hence among the key priorities of the NAP in PNG. NAP priority actions in the water sector include actions to (a) improve the climate resilience of water and sanitation infrastructure led by the Department of Works and Highways (DoWH) and to (b) implement climate resilient water management and conservation systems such as protection of water resources and water/soil use management, water

¹³ Withdrawal to total renewable water availability >10%

¹⁴ [15871-WB PNG Country Profile-WEB.pdf \(worldbank.org\)](#)

efficient irrigation and rainwater harvesting, and recycling of water led by the Department of Agriculture and Livestock (DAL). MTDP IV have identified, public investment and policy actions needed to improve safe drinking water access to 70 percent and improved sanitation to 60 percent by 2027, with an estimated funding needs of K915 million (about 0.8 percent of GDP) to achieve these goals.

Figure 9. Percent Share of Urban (left) and Rural (right) Population with Access to Safe Drinking Water in the Pacific



Source: IMF Staff Analysis Based on [FAO AQUASTAT](#).

Key Policy Gaps and Opportunities

12. Achievement of climate resilience of water sector as envisioned in the NAP and MTDP IV will require significant coordination across the currently fragmented institutional landscape.

Building solid legal, policy and institutional framework as well as improving coordination at the technical levels are important prerequisites for PNG. The legal foundation for the water sector is codified across several laws including Environmental Act 2000 and its amendments (covering water resources and environmental quality management), Water Supply and Sanitation Act 1996 and its amendment (covering WaSH provision) and the Public Health Act 1973 and its amendments (covering the drinking water quality). The water sector has a number of agencies with varying mandates including the Conservation and Environmental Protection Authority (CEPA) responsible for water resource monitoring and abstraction charges, Water PNG tasked with provision of water supply and sewerage in urban areas, Provincial/Local Governments tasked with water supply and sewerage, Department of Health (DoH), administering drinking water quality regulation along with DAL, Department of Works and Highways (DoWH) covering water aspects relevant to their line ministry mandates. The sector currently does not have a national policy which guides integrated water resources management (IWRM) and WaSH provision is guided by PNG National Water, Sanitation, and Hygiene (WaSH) policy 2015-2030 that is yet to be fully implemented.

13. Addressing capacity gaps in hydrological monitoring, modeling and integrated water resources planning functions will be important to strengthen water sector resilience against climate change. In the area of overall water sector policy and planning, PNG does not have a clear institutional mechanism to implement longer-term integrated water resources assessment and

management, which poses major concern under the anticipated impacts of climate change. CEPA currently collects limited information regarding water quality and quantity in selected locations. PNG does not have a sufficient hydrological observation network and the existing network is non-operational. CEPA’s hydrological unit staffed with only three persons, with no hydrological/hydraulic modeling capacity. Despite its mandate covering the aspects of flood monitoring and assessment, CEPA does not have any past experiences providing flood forecast and the monitoring of flood situations, which have been practiced in the past, has been discontinued due to non-functioning observational network.

14. In the area of urban water supply, insufficient public investment hinders safe drinking provision under climate change. Urban water is supplied by the government-owned Water PNG, which operates across 14 provincial centers along with 10 district towns. Among all Water PNG service areas, 6 are currently profitable, with the remaining 18 are either break-even or loss making.¹⁵ Major water assets owned by PNG are built in the 1960s requiring urgent upgrading, while the demand gap is projected to grow due to lack of sufficient investment.¹⁶ The government/Water PNG are in discussions with development partners including the Asian Development Bank (ADB) to significantly expand urban infrastructure in coming years.

15. Urban water tariff is set according to financial cost recovery plus annual permitting fee, but not reflective of full economic cost. Urban water tariff is regulated by the Independent Consumer Competition Commission (ICCC) as per relevant legislations such as the ICCC Act 2002¹⁷ and Price Regulations Act 1949 and its amendments.¹⁸ Urban water tariff is reviewed every 5 years, with the last round of review completed in 2022. Tariff calculation is based on operational and capital cost requirements including NRW and annual permitting fees charged by the CEPA. The current tariff structure adopts an increasing block rate with 3 bands (Table 4) and does not distinguish between different consumer sub-categories such as industries and households. Although the Environmental Act 2000 and associated Environmental Regulation 2002 further include provisions related to volumetric abstraction and waste discharge fees (Table 5), the mission did not find sufficient technical details to evaluate whether or not full economic value of water was taken into account. Box 2 describes economic cost pricing approaches of water.

Table 3. Tariff for Urban Water Supply and Sewerage Service

Bands	Water Supply		Sewerage Service	
	Volume (kiloliters)	Tariff (Kina per kiloliters)	Volume (kiloliters)	Tariff (kina per kiloliters)
1	0.2 to 30	K1.45	0.1 to 30	K1.00
2	31-100	K2.00	31 to 100	K1.50
3	Above 100	K5.85	Above 100	K3.50

Source: [PNG Water](#).

¹⁵ [KCH-2022-Annual-Review-15112023.pdf](#)

¹⁶ Water PNG’s production capacity is growing from 91,000 ML (2021) to 100,000 ML (2023 target), the demand gap is likewise projected to grow from 1,605 ML (2021) to 12,125 ML (2023 target).

¹⁷ [THE INDEPENDENT CONSUMER AND COMPETITION COMMISSION ACT 2002 \(fao.org\)](#)

¹⁸ [Prices-Regulation-Act-1949.pdf \(iccc.gov.pg\)](#)

Table 4. Components of Volumetric Abstraction Charges

Descriptions	Values
Basic charges	Surface water (K.001/cubic meter/yr) Groundwater (K.005/cubic meter/yr)
Annual charge=volume (m ³ /year) x use factor x basic charge	Use factor: Public water supply 1, Industrial activities with re-use of water 0.8, Sprinkle irrigation 0.3, non-consumptive use 0.1.

Source: Environment Regulation 2002.

16. Non-Revenue Water is estimated high with limited regulatory supervision for its reduction. NRW is currently estimated at approximately 30 percent loss due to physical loss, 20 percent commercial loss, along with additional 20 percent loss due to non-payment by the government sector as the largest consumer¹⁹. In addition to making necessary investments such as replacement of faulty meters as part of the ongoing WB project, Water PNG has been conducting pilot projects to extend water connection in informal settlement and poorly connected peri-urban areas testing concepts such as meter farming²⁰. ICCC along with Water PNG recognized the importance to address NRW. Whereas NRW is part of key business performance indicators of Water PNG corporate plan, this aspect is yet to be formally included as part of service level targets reviewed by the ICCC.²¹ In the area of climate change resilience, PNG Water has not conducted resilience assessments of its assets and inclusion of climate change aspects into key performance indicators (KPIs) is also absent (Table 6).

Box 2. Alternative Approaches to Pricing Water

For effective management of water resources, water economics encourage the recovery of three cost components namely (a) financial costs, (b) resources costs (opportunity costs) and (c) environmental costs. **Financial costs** include the costs borne by the utilities in supplying water services such as operation and maintenance, capital cost of new investments, depreciation and cost of capital.

Resource (or opportunity) costs are reflective of scarcity value, i.e. the cost of depriving the possible users of today or in the future. **Environmental costs** reflect the cost of environmental damages caused by water use, such as acceleration of saline intrusion due to groundwater depletion and biological and chemical pollution due to agricultural and industrial water use.

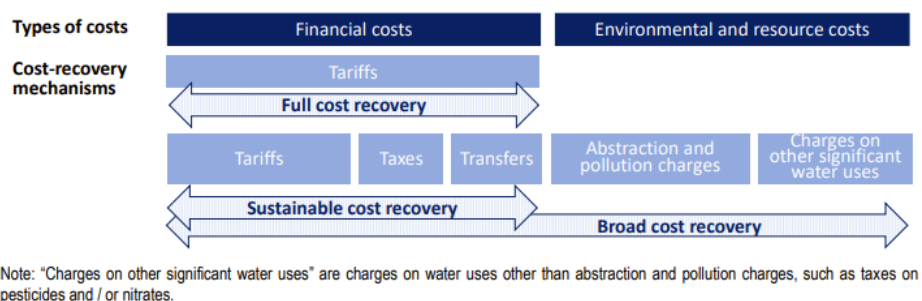
In order to meet alternative water pricing objectives such as financial cost recovery, affordability and environmental sustainability, a government may move from the conventional full cost recovery based on tariff as a single pricing mechanism to a combination of fiscal instruments such as tariff combined with tax to correct for externalities and transfer to ensure affordability of water to the poorest. Finally, the strategy of broad cost recovery aims for recovery of financial cost, together with environmental and resources costs.

¹⁹ The cumulative arrears by the government sector is estimated at K200 million.

²⁰ [Launching of pilot Metre Farming Project in NCD \(waterpng.com.pg\)](http://waterpng.com.pg)

²¹ [KCH-2022-Annual-Review-15112023.pdf](#).

Box 2. Alternative Approaches to Price Water (Continued)



Source: [OECD](#).

Table 5. ICCC Service Level Indicators Reviewed and Selected Business KPIs by Water PNG

ICCC Service Level Indicators	Selected business specific KPIs per Corporate Plan
<ul style="list-style-type: none"> - Reliability Target (>90% of total hrs/month) - Unplanned Interruption per 100 km per month - Number of complaints per 1000/month - Response time to major/minor complains - Turbidity compliance - Chlorine Residual - Time to connect/re-connect new customer (days) - Sewerage overflows per 100 km of main and - Sewerage overviews to customer property per 1000 connection 	<ul style="list-style-type: none"> - Debt to equity ratio - Capital expenditure - # of water/sewerage connections - Plant availability - Non-revenue water - % compliance to all regulatory requirements - Timely completion and submission of audit report - % of technical staff trained by Water PNG - % of business staff trained by Water PNG - Staff turnover rate

Sources: [ICCC 2022](#); [KCH 2022](#).

17. Rural water supply suffers significant under-investment. The main funding mechanism to facilitate rural water supply investment is Provincial and District Service Improvement Programs (PSIP/DSIP) administered by the respective Provincial Government and District Development Authorities (DDA). Despite the high need of rural water supply investment, PNG currently has no clear guidelines as to how PSIP and DSIP should be used to promote WaSH sector investment and climate consideration be mainstreamed. At the same time, PNG is receiving WB support to build ward-level capacity (across 225 wards) to investment in essential services provision (of which approximately 50 percent of financing is used to build rural water supply). This ward-level service planning and investment mechanism is yet to be formalized under the existing organic law. PNG plans to further institutionalize ward-level planning and investment in the next phase of the WB project under discussion, expanding the coverage to approximately 1,000 wards (prioritized among 6000+ wards in PNG) and developing guidance as to how climate change consideration may be mainstreamed. A draft bill is also under development to empower ward-level planning by the Department of Provincial and Local-level government Affairs (DPLGA).

Recommendations

- Strengthen water resources monitoring (surface and groundwater quantity/quality).
- Build further (a) analytical capacities for integrated water resources management (IWRM), (b) an inter-agency coordination mechanism and (c) develop an IWRM plan.
- Operationalize volumetric water resources abstraction and sewerage charges per Environmental Act (Environmental Regulation 2002).
- Review and update charges to appropriately internalize environmental externalities and reflect full economic value of water.
- Incorporate NRW reduction and other climate relevant targets as part of service level indicators to be reviewed by ICCC, making an approval of 2027 tariff increase conditional on the successful achievement of revised service level indicators.
- Update water tariff based on financial cost recovery and abstraction fees reflective of environmental/opportunity cost. Make complementary adjustments (such as through block rates and consumer segmentation) to account for distributional impacts.
- Strengthen coordination and planning of rural WaSH sector, allowing for an effective mobilization of grant/concessional financing.

C. Disaster Risk Management and Disaster Risk Financing

Current State and Challenges

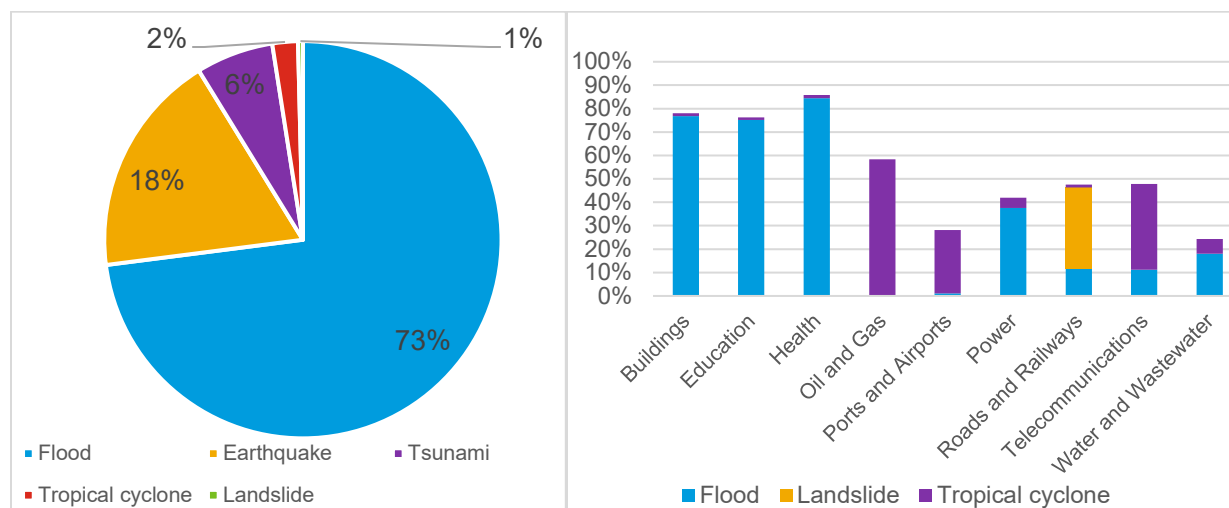
18. PNG is highly exposed to multiple climate related hazards such as floods, landslides, droughts and tropical cyclones, which are expected to worsen under climate change. According to the INFORM Risk index, PNG ranks 16th most at-risk countries globally in terms of hazard, exposure and vulnerability related to natural and man-made disasters.²² Based on the Global Infrastructure Resilience (GIRI) Index, the annual average losses (AAL) related to all disasters are estimated at US\$ 290 million of which 76 percent is climate related hazards including floods, landslides, tropical cyclones (Figure 10, left). With frequency and intensity of extreme rainfalls projected to increase under climate change,²³ PNG faces rising risk of disasters such as floods and landslides. The AAL subsequently is expected to increase from the present US\$290 million to US\$322 million (lower bound) and US\$ 389 million (upper bound) with the impact of climate change alone.²⁴ According to the global modeling estimate, flood is the costliest hazard in the PNG, leading to significant loss of building and infrastructure assets including housing, education/health facilities and power infrastructure (Figure 10, right). PNG currently lacks robust estimates related to the economic cost of drought risk at the national level and disaster risk estimates are likewise limited for landslides.

²² EU [INFORM Risk country profile for PNG](#)

²³ [15871-WB PNG Country Profile-WEB.pdf \(worldbank.org\)](#)

²⁴ [GIRI & key figures | GIRI \(unepgrid.ch\)](#) The future scenario runs towards the end 21 century.

Figure 10. Breakdown of AAL per Hazard (left), Percent of AAL Due to Climatic Disasters per Asset Category (right)



Source: [GIRI Index 2023](#).

Key Policy Gaps and Opportunities

Disaster Risk Management

19. PNG has established legal, policy institutional bases for DRM, but update and alignment are long overdue. The mandates of PNG's DRM institution are codified in Disaster Management Act (DMA) 1984, which established the National and Provincial Disaster Committees as the main executive bodies, along with National Disaster Center for operational coordination.²⁵ The main policy making body of the DRM sector is the National Executive Council (NEC). Additional laws such as the Essential Services Act of 2002, further specify authorities over essential public services in case of emergencies.²⁶ The limitations of DMA 1984 are well recognized in PNG, including the lack of (a) clarities regarding the roles and responsibilities of actors, (b) provisions related to predictability of financing, (c) DRM structure at the local levels below provincial levels, (d) emphasis on ex-ante DRM actions and (e) limited engagement of civil society and private sector organizations among others. The review and updating of DMA 1984 have hence been ongoing since 2013. PNG has developed sector planning documents including National Disaster Mitigation Policy 2004, Emergency Operating Centers (EOCs) Standard Operating Procedure (SOP) Plan 2009, National Disaster Risk Management Plan 2012 and Drought Preparedness and Response Plan 2015 and Draft Response and Recovery Plan 2023 and the National Disaster Risk Reduction (DRR) Framework 2017-2030, many of which are due for update (Table 7).

²⁵ While not explicitly codified in DMA 1984, PNG has also set up provincial disaster centers.

²⁶ [PNG Essential-Services-Act-esa2002208.rtf \(fao.org\)](#)

Table 6. Selected DRM Legal Policy and Planning Documents and Key Gaps

Documents	Main contents and key gaps
Disaster Management Act 1984	Sets up national and provincial disaster committees, along with national disaster center in charge of emergency response and recovery. Update is needed to align with decentralization trends to strengthen ex-ante actions.
National Disaster Mitigation Policy 2004	Identify major planning tools and programs to guide PNG's pre- and post-disaster risk management. NDMP 2004 does not clarify roles and responsibilities of implementing agencies related to the tools and programs identified.
National Disaster Risk Reduction Framework 2017-2030	Identify major disaster risk reduction priority actions along the Sendai Framework of Action. An implementation plan with clear roles and responsibilities, funding needs and milestones is pending.
National Disaster Risk Management Plan 2012	Defines roles and responsibilities of national and sub-national DRM institutions (incl. district and local levels). Also specified are criteria for the declaration of state of emergency, lead and supporting agencies for risk reduction response and recovery for 15 different hazards. NDRMP includes sub-plans to operationalize national end-to-end early warning systems, which have not been developed.
Emergency Operating Centres Standard Operating Procedure (SOP) Plan 2009	Defines activation and deactivation rules and procedures of emergency operating centers. Defines lead and supporting agencies of 22 man-made and natural hazards. Provides templates for situational report, damage assessment, and logistical arrangements of relief goods and services. Update and alignment are needed.
PNG Drought Response and Recovery Plan	Defines roles and responsibilities of 16 agencies to respond and recovery in case of drought events. The plan focuses primarily on ex-post actions including activation of EOC, damage assessment and reference to anticipatory actions is limited.

Source: IMF Staff Analysis.

20. Building of an effective early warning system is among the top of the NAP agendas, and the coming years will require effective planning, coordination and learning-by-doing of all relevant stakeholders. The overall institutional architecture for PNG's national end-to-end early warning system is clarified in existing sectoral plans including the National Disaster Risk Management Plan 2012 which identified key agencies, roles and responsibilities and sub-plans to standardized inter-agency operation including: (a) emergency warning plan – which standardize warning messages to sub-national and private sectors, (b) communication plan, to be used by the EOC, (c) relief plan which defines damage assessment and humanitarian-government coordination and (d) early recovery plan, which defines steps link emergency response and long-term recovery. However, these sub-plans as envisioned in the NDRMP 2012 have not been developed and operationalized.

21. At the same time, legal and institutional frameworks governing end-to-end early warning system, along with technical capacities are yet to be established. CEPA, for example, has the mandate to cover hydrological observations and flood, yet flood monitoring has been discontinued due to the lack of financing/staffing and CEPA has no prior experience in producing flood forecasting. Technical capacity is likewise limited for major hazards such as landslides and droughts and PNG is currently

receiving development partner support to strengthen these aspects²⁷. In addition, communication channels linking early warning and emergency preparedness action are under-developed; primary means to deliver information is radio broadcasting. Going forward, strengthening of early warning in PNG should be built on international good practice, with an emphasis given to developing an effective end-user and last-mile delivery first, with the use of appropriate and low-cost technology options and involvement of wider civil society and private sector engagement (Box 3). PNG should build on existing mechanisms such as national volunteer service and youth engagement to strengthen response capacity while developing effective inter-agency coordination mechanisms.

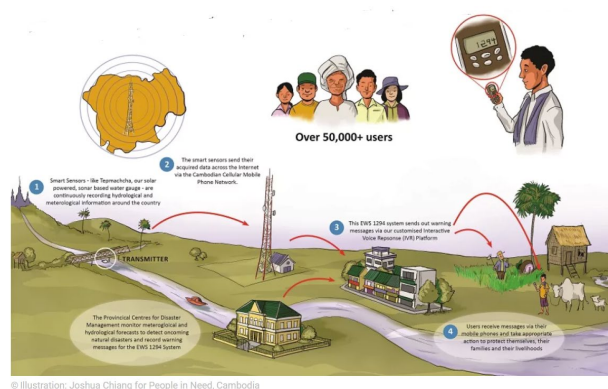
Box 3. Strengthening End-to-End Early Warning Systems Based on People-Centered Approach

The concept of 'End-to-end' early warning emphasizes the importance to link hazard monitoring and forecast with end-users capacity to take appropriate actions based on warning information. A number of countries have taken innovative approaches to foster early warning systems. In Cambodia, the National Committee for Disaster Management, signed a Memorandum of Understanding (MoU) with an international Non-Governmental Organization (NGO), People-in-Need, and established a mobile-phone based early warning system known as 'EWS 1294.' In this system, flood risk is monitored real-time through solar-powered low cost/locally produced sensors installed throughout the country in key locations such as under bridges. Dissemination channels along with recommended prepared actions are designed based on a people-centered approach. The Provincial Center for Disaster Management is equipped with a clear mandate along with Standard Operating Procedures with pre-defined triggers to disseminate official early warning messages. The Provincial, District Disaster Management Committees, along with Village Disaster Management Groups are also trained in emergency preparedness planning. Communities through participatory sessions identify options such as pre-disaster actions to take and safe locations to evacuate.

The end-users registering using the national mobile number '1294' will receive voice-based actionable early warning information in case a flood is projected. Mobile-based dissemination channels are further supported by other means such as community loudspeakers and radio broadcasting. First implemented as a pilot project across 3 villages in Pursat Province, Cambodia in 2013, EWS 1294 is now scaled as the official national early warning system serving all provinces throughout the country.

²⁷ [Anticipatory Action Protocol ; PNG National Weather Service launches 5-year strategy \(highcommission.gov.au\)](#)

Box 3. Strengthening End-to-End Early Warning Systems Based on People-Centered Approach (Continued)



Source: [People in Need](#).

22. The urgent need for climate resilience of critical infrastructure and other ex-ante disaster risk reduction efforts are well-recognized in PNG. However, this has yet to be translated into substantial actions by all relevant stakeholders. PNG is currently conducting a variety of activities to strengthen disaster preparedness and resilience of critical infrastructure (Table 8). Development of contingency plans is practiced by a number of stakeholders consulted, including National Disaster Centre, PNG Forest Authority (PNGNFA) and State-Owned Enterprises (SOEs) while climate risk assessment is generally nascent. Given the substantial overlap of risk assessment needs across DRM and climate change adaptation sectors, close coordination between National Disaster Centre and CCDA will be crucial to avoid any duplication of efforts and to improve the efficiency of policy implementation related to risk assessment, disaster preparedness and critical infrastructure resilience building. At the same time, as national census is ongoing, the availability of accurate demographic information will help facilitate climate risk assessment, impact-based forecasting, post-disaster assessment and prioritization of funding.

Table 7. Current Ex-Ante DRM Activities Taken by Selected Government Entities and SOEs

Entities	Current DRM Activities and Gaps
CCDA	Climate change and vulnerability assessments are conducted in selected provinces. ²⁸
National Disaster Centre	National and provincial contingency plans are available. NDC/PDC staff are trained but wider training/engagement of communities is limited due to insufficient funding.
PNGNFA	A forest fire response plan is available within PNGNFA jurisdiction but not across all forested areas of PNG. PNGNFA has the capacity to translate National Weather Service weather forecast into fire risk indicators but has no means to disseminate them to wider communities.
PNG Power	No systematic climate risk assessments (incl dam safety assessments) have been conducted. A contingency plan is available at the operational level.
Water PNG	No systematic climate risk assessments have been conducted. A contingency plan is available at the operational level.

Source: IMF Staff.

²⁸ [Building resilience to climate change in PNG](#)

Disaster Risk Financing

23. In the area of disaster risk financing, the lack of predictable budgetary provision and operational delays significantly impede DRM implementation. The DMA 1984 contains limited provisions regarding public financing for disaster relief, including the procedure for financial assistance requests by Provincial Disaster Committees and cost-sharing arrangement between provincial and national governments. PNG's annual budget allocates approximately K2 million for National Disaster Center, of which three-quarters is used to fund 10 full time staff. The remaining operational cost (K0.5 million) can be used for emergency response purposes. PNG also has a national budget line of unforeseen payments related to natural disasters (2023 appropriation of K3 million) which is significantly below annual response needs (Annex I). At the provincial level, budget allocation is similarly limited, with Provincial Disaster Centers hiring on average 1 full-time (highlands provinces) and 2-3 staff (lowland provinces). In case disaster response needs is above the available annual operating cost, National Disaster Center requests Department of Treasury (DoT) for additional funding allocation, which may require approximately 1 week before the actual funds are made available or disbursed.

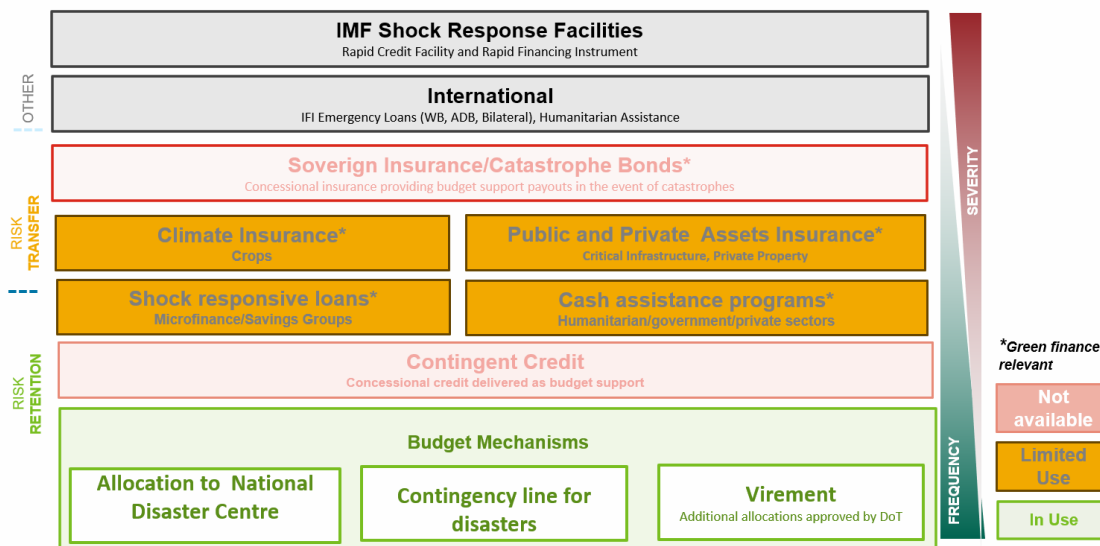
24. PNG has legal/regulatory frameworks that define public resources allocation and budget execution related to disasters including the Appropriation Act which defines the procedure and threshold for virement and the Public Finance Management Act 1995 which grants the Finance Minister, discretion to waive public tendering requirements in case of a disaster for an individual transaction below K500,000. Despite the availability of public tender waiving option, National and Provincial Disaster Centers do not typically rely on this procedure, instead the use of regular tendering involving at least 3 service providers is common, delaying further the procurement of emergency response goods and services by approximately 1 week.

25. PNG currently lacks a strategic understanding regarding alternative ex-ante and ex-post options to strengthen financial resilience against disaster risk. Beyond the existing National and Provincial Disaster Centre allocations, contingency budget line and virement options, the only ex-ante disaster risk financing option that PNG has taken is a parametric earthquake insurance against submarine communication cables offered by the Pacific Catastrophe Risk Insurance Company²⁹. PNG has not made any other arrangements, including contingent line of credit (Figure 11). Discussions are ongoing to identify options to mobilize additional domestic revenue and to foster financial sector instruments such as the use of micro-finance and climate insurance, especially in the context of the green finance policy. However, an awareness regarding alternative ex-ante disaster risk financing options is limited among government stakeholders, so are standard practice to facilitate post-disaster budget execution such as pre-arranged procurement. The government has several channels to mainstream disaster risk reduction (DRR) such as PSIP/DSIPs but there is no clarity as to how much is currently spent on DRR nor clear technical guidance on how DRR mainstreaming can be done effectively.

²⁹ [PCRIC-AR-2023_EXPORT-Web1.pdf](#)

26. The PNG government, working with development partners, is beginning to evaluate mechanisms such as post-disaster cash transfer³⁰ and anticipatory actions,³¹ yet the government lacks an overarching strategic view as to how these alternative public, private and civil society-led channels may be fostered to strengthen the country’s financial resilience. Given the need for such strategic planning, PNG would benefit from an in-depth technical diagnostic followed by the development of a Disaster Risk Financing Strategy (DRFS), as have been followed by a number of countries (Box 4).

Figure 11. Disaster Risk Financing Instruments in PNG



Source: IMF Staff Analysis.

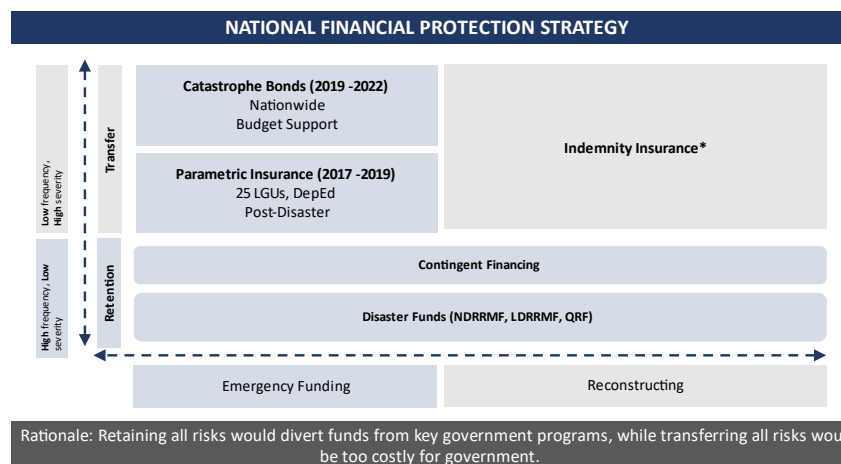
Box 4. National Disaster Risk Financing Strategy to Foster Financial Resilience Against Disasters

Located within the Pacific Ring of Fire the Philippines is highly prone to devastating natural hazards. It is estimated that on average the country is hit by 20 typhoons each year, and earthquakes are common as well. The annual average loss of public and private assets due to typhoons and earthquakes is approximately US\$3 billion. The financial impact of these disasters hurts efforts to reduce poverty and promote sustainable economic growth in the country. These disasters not only cause immediate destruction but also have long-term economic impacts reducing growth and capital stock. In response to these challenges, the Philippines has implemented a comprehensive disaster risk financing strategy. Risk layering is a key part of the Philippines' risk financing strategy. Through developing an appropriate mix of risk retention and risk transfer instruments, the government has significantly expanded its fiscal buffers with cost effective coverage for disaster response with fiscal risk from shocks distributed across different markets and instruments.

³⁰ PNG Cash Working Group | ReliefWeb Response

³¹ Anticipatory action and cash transfers for slow-onset hazards: Practitioners' note for field testing - World

Box 4. National Disaster Risk Financing Strategy to Foster Financial Resilience Against Disasters (Continued)



Source: Government of the Philippines.

Recommendations

- Finalize the revision of Disaster Management Act 1984 clarifying roles and responsibilities across all phases of disaster risk management (prevention, preparedness, response, and recovery), establishing formal mechanisms for DRM coordination below district levels.
- Operationalize the national end-to-end early warning system as outlined in the National Disaster Risk Management Plan 2012 with appropriate updates, establishing a clear mechanism to link early warning information with preparedness actions.
- Integrate ongoing census information into DRM activities and decision making such as climate vulnerability/risk assessment, impact-based forecasting, post-disaster damage assessment and funding prioritization.
- Develop a disaster risk financing strategy, strengthening ex-ante budgetary planning and use of alternative risk financing instruments by public and private entities, building on green finance initiative.

D. Climate Resilience of Agriculture

Current State and Challenges

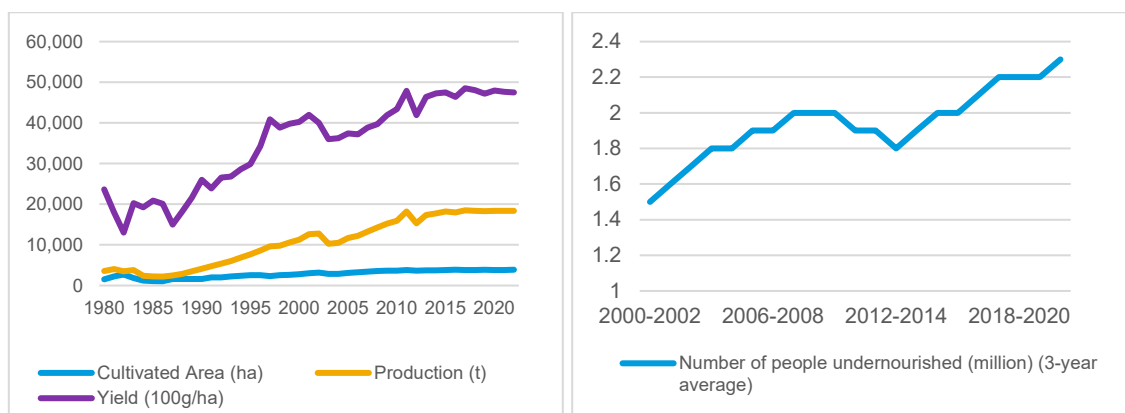
27. Climate resilience of agriculture underpins PNG's development priorities. Agriculture is a mainstay of PNG's economy, accounting for 14 percent of GDP, offering livelihoods for an estimated 85 percent of the country's population. PNG's agriculture is dominated by small-holder farming systems producing all of rain-fed subsistence food crops, along with the majority of cash crops, including approximately 25 percent of oil palm, 80 percent of coconuts, 75 percent of coffee, 70 percent of cocoa along with nearly all of spices³². As part of the MTDP IV, the country aims to boost agricultural sector,

³² According to PNG Agriculture Medium Term Development Plan 2020-2022.

aiming for a transition away from subsistence to agri-business production, enhancing export values by 58 percent and sector contribution to GDP to reach 31.7 percent by 2027.

28. Climate change is projected to pose significant risks to PNG’s agriculture. Agriculture including fishery activities in PNG are affected by sea level rise, ocean acidification, droughts, floods, including the impacts of El Niño–Southern Oscillation and biological hazards such as pests and plant diseases. The vulnerability of the sector stems from a variety of factors including high reliance on rainfed agriculture, limited access to public and private services such as all-season resilient roads, weather information, extension and financial services.³³ PNG’s agricultural sector has made mixed progress in the recent years. While substantial gains have been made in yield and overall production of major cereals since 1980, the gain has stalled over the last decades (Figure 12, left). The progress to alleviate undernourishment has also stalled, leading to the increase in absolute number of undernourished (Figure 12, right). These underlining vulnerabilities are causes of major concern as climate change is projected to hamper yields of major crops in the country, (Table 9) and subsistence crop production. In addition, cash crops (primarily oil palm) are a major drivers of deforestation in PNG (please see the Forestry section for further discussions).

Figure 12. Area, Production and Yield of Major Cereals (left) and Number of Undernourished (right)



Source: IMF Staff Analysis based on [FAOSTAT](#).

Table 8. Projected Climate Change Impacts on Yields of Key Crops Relative to Present

	RCP 8.5 optimistic 2050	RCP 8.5 median 2050
Cassava	-9.3%	-11.5%
Maize	-3.9%	-8.2%
Rubber*	-	-3.4%
Coffee*	-	-5.8%
Cocoa*	-	-4.5%

Note: *projected changes based on proxy values according to Global Agro-Ecological Zoning (GAEZ) for Indonesia. RCP 8.5 scenario is considered a very high emission scenario.

Source: [International Fund for Agricultural Development \(IFAD\) Climate Adaptation in Rural Development \(CARD\)](#) and [FAO GAEZ](#).

³³[Spotlight_Vol16_Iss16_The need to adopt Climate Smart Agriculture practices to promote food security in Papua New Guinea .pdf](#)

Key Policy Gaps and Opportunities

29. PNG's agricultural sector is characterized by legal, policy and institutional fragmentation.

The legal bases for agricultural sector are codified in a set of laws such as National Agricultural Research Institute Act 1996, National Development Bank Act 2007, and acts related to individual commodity boards. The sector currently lacks a comprehensive law detailing the roles and responsibilities of agricultural sector administration. Key institutions covering agricultural sector includes but are not limited to: the DAL which regulates the agricultural sector, the National Fisheries Authority (NFA), which regulates the fisheries sector, as well as agencies for other crops including cocoa, coffee, rubber, coconut, vanilla, and fresh food produce.³⁴ Agricultural research and development (R&D), along with extension services, are segmented into food and cash crops, including the National Agricultural Research Institute (covering subsistence crops), Oil Palm Research Association, Cocoa Coconut Institute, Coffee Research Institute, Highlands Agricultural Technical Institute, and Fisheries College.³⁵ The National Development Bank (NDB), along with other commercial banks, extends financial services, primarily targeted at micro, small and medium sized enterprises in the agricultural sector.³⁶ The key planning document guiding the sector is the Mid-Term Development Plan for the Agricultural Sector 2023-2027.

30. Climate resilience of agriculture is among the top adaptation priorities for PNG under the NAP.

PNG's NAP calls for a series of policy actions to facilitate climate smart agriculture and climate resilient infrastructure access for agricultural sector. In the area of climate smart agriculture, NAP prioritizes activities such as R&D on resilient crop varieties, promotion of indigenous coping mechanisms, seed banks, livelihood diversification. PNG is currently receiving development partner support in areas such as design of farm climate advisory services,³⁷ and promotion of climate adapted practices in cocoa, vanilla, and aquaculture.³⁸ To foster farmers' access to markets, PNG government currently provides subsidies to cover for high transportation cost of agricultural production, however, the mission did not find any other fiscal incentives related to the adoption of climate smart agricultural practices. Development of climate smart agricultural policy is currently ongoing.

31. PNG also prioritizes agricultural financial inclusion and risk management as part of climate adaptation.

The PNG financial sector consists of (a) regulators including Central Bank of PNG (overseeing the Banking, non-bank financial intuitions, finance companies and Life Insurance). Insurance Commission (regulating the Motor Vehicle and General Insurance) and Exchange Commission regulating Securities Markets and (b) financial institutions including one national development bank, four commercial banks, 12 non-bank licensed financial institutions (including micro banks which operates on for-profit-basis) and 16 saving and loan societies. The actual size of agricultural lending across the value chain is noted as 'unclear' in the Inclusive Green Finance Strategy 2023, while 100 percent of farmers and agri-business owners surveyed in the Market for Village Farmers (MVF) Project indicated they are in need of credit. In general, an estimated 80 percent of PNG's population remains unbanked, whereas 100 percent of farmers surveyed in the MVF lacked non-cash collaterals. PNG's NAP priority hence includes

³⁴ [PNG Commodities – PNG Commodities \(nto.gov.pg\)](https://www.nto.gov.pg)

³⁵ [National Agricultural Research Institute Act 1996, | FAOLEX: GF-IGFP-Booklet.pdf \(thecefi.org\)](#)

³⁶ [National Development Bank - About \(ndb.com.pg\) National Development Bank Act 2007 \(No. 5 of 2007\).](https://www.ndb.com.pg)

³⁷ [Accessible weather forecasts, advisories key to PNG farm resilience | ACIAR](#)

³⁸ [EU-STREIT PNG > Home \(google.com\)](#)

priority actions to strengthen financial sector inclusion including: (a) establishment of farmer cooperatives and microcredit facilities (b) inclusion of agricultural risk insurance in all production supply and value added, transport/marketing systems. Efforts are ongoing by the Green Finance Center, to conduct a technical needs assessment for expansion of green finance in the agricultural sector. DAL is also working on a technical feasibility study to evaluate index-based insurance options for the agricultural sector (Box 5 provides an example from Kenya). Related initiatives are also ongoing to strengthen financial inclusion through mechanisms such as provision of credit guarantees³⁹.

Box 5. Bundling of Risk Management, Credit and Agronomical Knowledge/Inputs to Foster Climate Resilience

Small scale, rainfed agriculture is especially prone to adverse impacts of climate change. Small scale farmers often lack means necessary to invest in appropriate technology such as credits, inputs, knowledge that may reap high productivity enhancing investment. In order to address these common challenges, many countries are working with private and civil society organizations on effective bundling of risk management, credit and other necessary information and inputs including agronomic services, fertilizers and improved seed varieties.

A Kenya-based agricultural insurance service provider Pula for example, helps design area-yield index (covering multiple perils of weather and non-weather risks) and weather-index based insurance products bundled with agricultural inputs (e.g. seeds and fertilizers). It also offers agronomic advisory. Pula operates on a unique business model in which insurance premium is paid by private input producers who are willing to pay extra in order to achieve product differentiation. Insurance products are then under-written by third party insurers. Index-based insurance along bundled with inputs are used by agencies such as the Central Bank of Nigeria to insure 543,000 farmers in 2020, 10,000 farmers have been insured with the World Food Programme's support in Kitu, Kenya. Bundled insurance-input products by Pula are available for 14 food and cash crops along with livestock and the company aims for a customer-base of 8 million farmers by 2025.

Source: [CGAP](#); [Mercy Corp.](#)

Recommendations

- Finalize the adoption of climate smart agriculture policy with a clear M&E framework to strengthening sector coordination.
- Evaluate alternative options to strengthen agricultural financial inclusion and risk management (shock-responsive lending/savings activities, index insurance, etc.) as part of green finance initiative/disaster risk financing strategy.

³⁹ [Market for Village Farmers – Maket Bilong Vilis Fama \(MVF\) \(ifad.org\)](#) ; [GF-IGFP-Booklet.pdf \(thecefi.org\)](#); [USAID and DFC Support Businesswomen in PNG with \\$5 Million Guarantee to Nationwide Microbank](#)

III. Climate Mitigation Policy

A. GHG Emissions and Mitigation Targets in PNG

32. This section evaluates PNG’s historical and projected greenhouse gases (GHG) emissions against its NDC, provides an overview of current policies, and recommends additional mitigation policies to achieve the country’s climate goals. The analysis starts with a discussion of the main GHG sources in the country, focusing on energy-related sectors: power, industry (including mining), transport, and non-energy related sectors: land use, land use change, and forestry (LULUCF), agriculture, and waste. The section then compares projected emissions against the updated NDC, and reviews existing climate mitigation policies. Finally, it identifies public policy gaps and proposes reforms, evaluating fiscal, macroeconomic, price, and emissions impacts of reforms.

33. Estimates of PNG emissions vary significantly across different sources and over time. According to latest available official estimates in the [Second Biennial update report \(BUR, 2022\)](#), PNG went from a ‘net sink’ to a ‘net source’ in 2016 (around 7 MtCO₂e) and returned to being a carbon sink again in 2017 (around -2 MtCO₂e), with the changes over time are driven by LULUCF sector. According to FAO datasets⁴⁰, total GHG emissions in PNG reached 50 MtCO₂e in 2021, with agriculture, forestry, and other land use (AFOLU) sector accounting for approximately 72 percent. IMF estimates of PNG’s emissions, used in this report unless otherwise noted, were around 45 MtCO₂e in 2022. Global Forest Watch⁴¹ assesses that in 2023 forest loss led to emissions at 66 MtCO₂e.

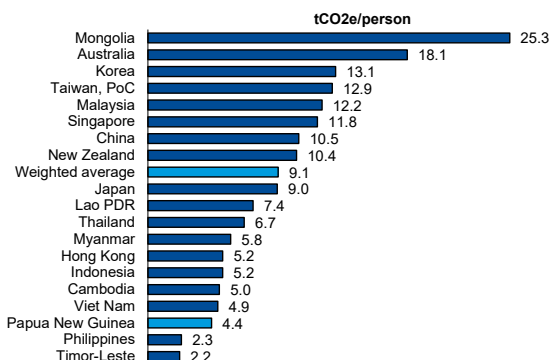
34. While total and per capita emissions in PNG are relatively low, its emission intensity of GDP is high. PNG accounts for approximately 0.08 percent of global emissions. With 4.4 tCO₂e emissions per capita, PNG is below the regional average of 9.1 tCO₂e per capita (Figure 13, panel A) and below the global average of 6.8 tCO₂e per capita. However, emission intensity of GDP of PNG is almost twice the regional weighted average with 1.42 tCO₂e per 1000 USD GDP (Figure 13, panel B), and more than twice the global average of 0.54 tCO₂e per 1000 USD GDP.

⁴⁰ <https://www.fao.org/faostat/en/#data/GT>

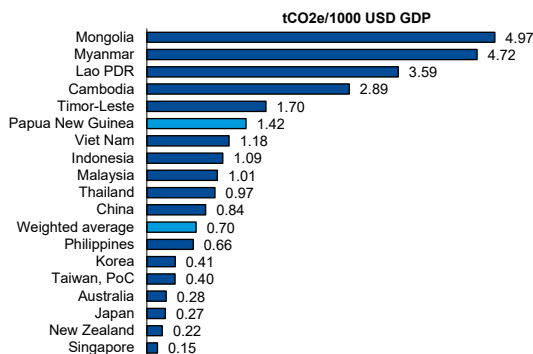
⁴¹ <https://www.globalforestwatch.org/dashboards/country/PNG/?category=forest-change&location=WyJib3VudHJ5liwiUE5HII0%3D>

Figure 13. GHG Emissions per Capita and GHG Intensity of GDP, 2022

A. GHG Emissions per Capita, 2022



B. Emissions Intensity of GDP, 2022

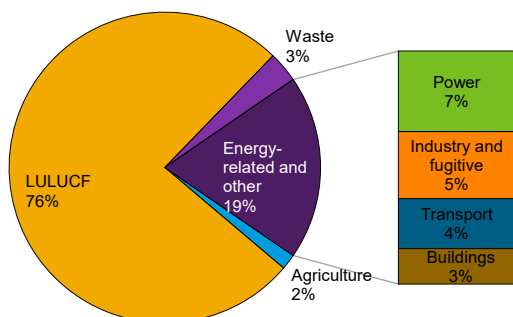


Source: IMF staff calculations.

35. Most emissions in PNG come LULUCF and energy. Of the 45 MtCO₂e emitted in PNG in 2022, three-quarters came from LULUCF, and around 20 percent from energy-related and industrial emissions, including 7 percent from power and 5 percent from industry and fugitive emissions (Figure 14, panel A). Transport and buildings sectors account for another 7 percent of emissions.

Figure 14. GHG Emissions and Primary Energy Consumption

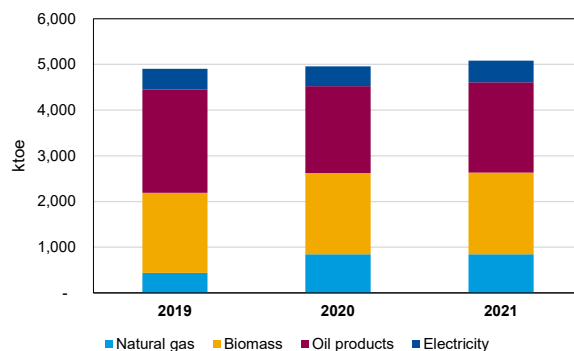
A. GHG Emissions by Sector in 2022



Source: IMF staff calculations

Note: Industry and fugitive emissions category includes also industrial processes and product use (IPPU) emissions. Buildings category includes negligible unclassified emissions (81 ktCO₂e).

B. Primary Energy Consumption, 2019-2021



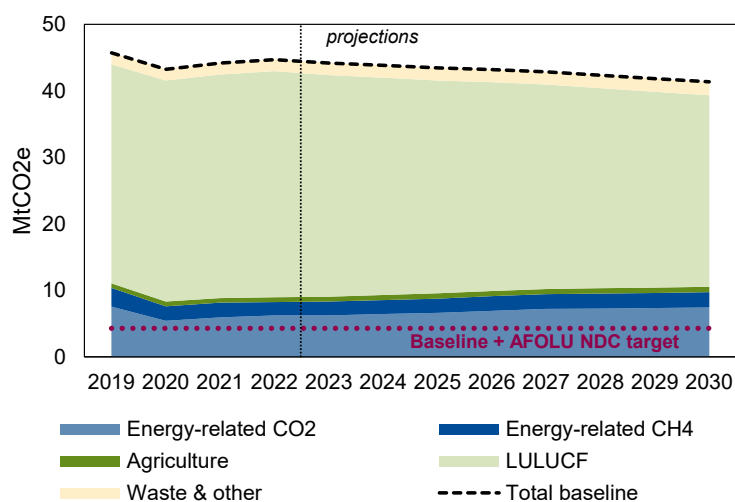
Source: Enerdata.

36. Biomass and fossil fuels dominate primary energy consumption in PNG, which has adverse impacts on health and workers' productivity. Biomass (35 percent) and oil products (40 percent) together account for three-quarters of primary energy consumption in 2022 (Figure 14, panel B). Access to clean fuels and technology for cooking in PNG is limited, at 10 to 15 percent of population (see paragraph 52 for ranges of estimates). Burning solid biomass in open fires or inefficient stoves emits high concentrations of short-lived pollutants, such as black carbon, nitrous oxide, and methane, that have significant climate consequences at regional and global levels. It is estimated that household

air pollution⁴² resulted in more than 10 thousand premature deaths in 2019⁴³. Expanding access to electricity to 70 percent in 2030 and 100 percent in 2050 is current goal of the GoPNG for the sector.

37. PNG is committed to mitigation action, including setting emission targets in the NDC. In 2020, PNG submitted its enhanced NDC to the United Nations Framework Convention on Climate Change (UNFCCC) and sets several mitigation targets. In the energy sector, high-level targets include reducing energy demand, increasing share of renewables in installed capacity to 78 percent, establishing a framework for fossil fuel emissions offsetting, and enhancing data collection. In LULUCF, PNG aims to reduce GHG emissions by 10 MtCO₂e against 2015 levels, including 25 percent reduction of annual deforestation, and 25 percent reduction of forest degradation. According to IMF staff projections (Figure 15) using Climate Policy Assessment Tool (CPAT)⁴⁴, PNG’s total GHG emissions in 2030 would reach 41 MtCO₂e in the baseline scenario.⁴⁵

Figure 15. IMF Estimates of Historical and Projected GHG Emissions, 2019-2030



Source: IMF staff using CPAT.

B. Agriculture, Forestry, and Other Land Use (AFOLU)

Current State and Challenges

38. LULUCF, the biggest sector in terms of emissions, affects the country’s status as a net sink or a net source. PNG represents one of the largest undisturbed tropical forests in the world.

⁴² Household air pollution is generated by the use of inefficient and polluting fuels in and around the home that contains a range of health-damaging pollutants. [WHO, 2023](#).

⁴³ Global Burden of Disease Study 2019

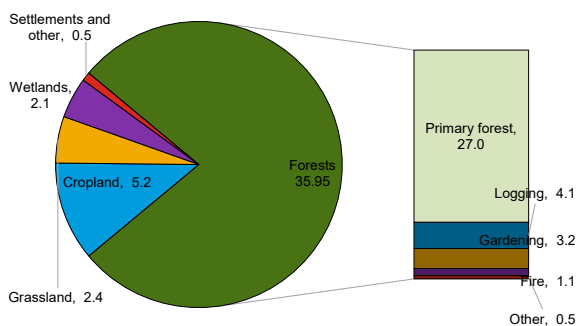
⁴⁴ See “The IMF-World Bank Climate Policy Assessment Tool (CPAT): A Model to Help Countries Mitigate Climate Change” [working paper](#)

⁴⁵ For this report, baseline scenario assumptions are no changes in existing taxes and tariffs and no adding new taxes and levies in the energy sector, implementing planned and proposed renewable energy projects in accordance with the NDC. For the forestry sector, baseline emissions from the NDC were used.

Forests account for 77.9 percent of land in PNG (Figure 16, panel A), and three-quarters of them are undisturbed. The LULUCF sector in PNG acted as a net, yet decreasing, sink for years, temporarily became a net source in 2011, 2013 and 2014-2015, and in 2017 became a net sink again. Depending on the LULUCF sector’s emissions and removals, the whole country changes its status between a net sink and a net source, based on the disaggregation from official PNG data (Figure 16, panel B). Compared to LULUCF emissions, direct emissions from agriculture historically are almost negligible. However, as discussed later in the report, agriculture is the main driver of deforestation (deforestation historically accounted for approximately 17 percent of LULUCF emissions).

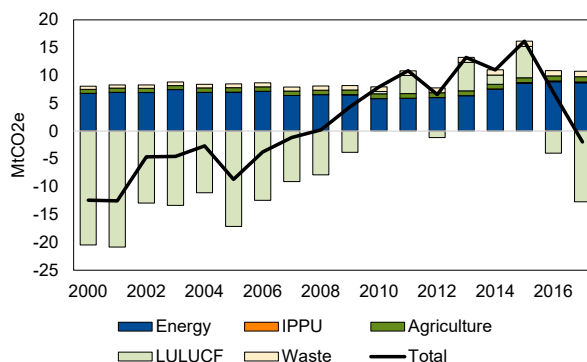
Figure 16. Land Use (left) and Historical GHG Emissions (right)

A. Land Use at National Level, 2019



Source: Forest Reference Level, 2nd submission, 2023.

B. PNG GHG Emissions, 2000-2017

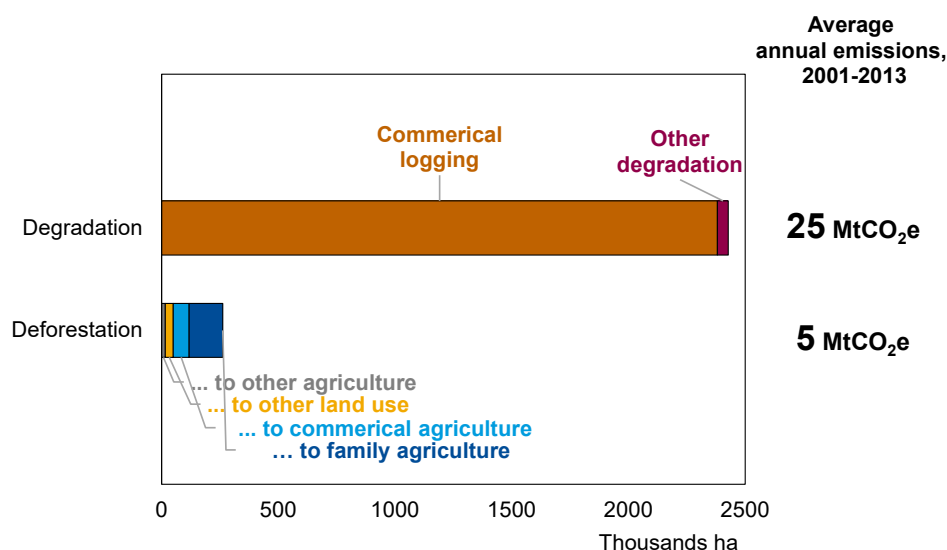


Source: Biannual Update Report, 2nd submission, 2022.

39. Commercial logging drives forest degradation, accounting for more than 80 percent of emissions in LULUCF. In 2000-2018, 8.88 million hectares (ha) was disturbed by human activities (almost 8 percent of total forest area), averaging 150 thousand ha a year. The peak of disturbance, to the latest available data, happened in 2010 and 2011, at 200 thousand ha each. Commercial logging was responsible for 46 percent of forest degradation and disturbance, mostly happening at low-altitude forests.

40. Deforestation is smaller in scale than forest degradation (Figure 17). In 2000-2018, more than 340 thousand ha of forest was deforested at an average annual rate of 0.05 percent. The pace of deforestation is accelerating as well: about 100 thousand ha was deforested in total in ten years (2000-2010), 150 thousand ha – in five years (2010-2015), and another 100 thousand ha in three years, between 2015-2018. The main drivers of deforestation are shifting cultivation (63 percent) and oil palm development (29 percent). In terms of emissions, however, the impact of forest degradation (partial loss of tree cover) is almost five times higher than deforestation (complete removal of forest), and direct emissions from agriculture are negligible in comparison.

Figure 16. Drivers of Forest Degradation and Deforestation in 2001-2015



Source: PNG Forest Reference Level, submission in 2017.

41. While some progress was made in recent years, the risk of further forest degradation and deforestation is high. Forest resources are being depleted faster than restored, as resources of PNG Forest Authority (PNGFA) are limited to track reforestation efforts by logging companies, and an alternative – the reforestation levy from the timber industry – most of the time does not cover the costs of reforestation. At the same time, 8.4 million ha of forest land (or almost one quarter of forest land) is under current timber concessions, including 4 million ha under Special Agricultural Business Leases (SABL) which allow logs to be harvested and exported under Forest Clearance Authorities (FCA).

Key Policy Gaps and Opportunities

42. PNG has multiple quantitative and qualitative targets in the AFOLU sector set in the NDC. The main target in NDC for the AFOLU sector is to achieve net GHG sink of 8.284 MtCO₂e in 2030, or 10 MtCO₂e reduction in emissions from 2015 levels. Non-GHG quantitative targets in the AFOLU sector include reduction by 25 percent each of areas of annual deforestation and forest degradation relative to 2015 levels, or reduction of 8,300 ha and 43,300 ha, respectively, and an increase of area of planted forest and forest restoration (further set at 220,000 ha by 2030 planted forests in the NDC Implementation Plan). NDC also contains multiple action-based targets for the sector, such as: enhanced land use planning, promoting climate-friendly agriculture, enhancing value chain of climate-friendly agriculture products, strengthening monitoring of FCA permits, enhancement of timber legality, promoting the Reducing emissions from deforestation and forest degradation in developing countries framework (REDD+), and promoting downstream processing.

43. Supporting documents further disaggregate targets and actions needed to achieve them. The NDC Implementation Plan (2021-2030) sets up additional actions and activities related to implementation of NDC goals, targets for 2025 and 2030, as well as allocated budget, potential/existing funding sources, and implementing agencies. The AFOLU mitigation plan (2022-2025) clarifies means of

implementation (funding, capacity building, technology, and R&D) and the time frame for each activity and action in the NDC Implementation Plan.

44. Internalizing environmental costs is required to slow down forest degradation and deforestation. PNGNFA is currently reviewing the Forestry Act (1991), which provides an opportunity to impose carbon levy on forest degradation and deforestation. At initial stages, carbon levy can be imposed on activity of logging companies and commercial plantation agriculture using emission factors for deforestation of primary forest, deforestation of degraded forest and forest degradation from 2nd FRL (Table 10). Later PNG can utilize its National Forestry Monitoring System (NFMS). The capacity on forest monitoring using remote sensing technology has significantly improved, with technical support and funding from development partners (FAO under REDD+, National Forest Inventory project, funded by the EU, and Japan International Cooperation Agency).

45. Additional design features to carbon levy might be considered. Regulations under the Forestry Act currently have 19 different levies payable by logging companies, the level and applicability of the levies vary across concessions. Adding carbon levy should be considered in terms of administrative capacity of PNGFA and/or CCDA to collect the levy, as well as ability of timber companies to pay it, given high levels of tax burden imposed on timber exports⁴⁶. As a measure to support reforestation, an increase in forest cover, based on data from NFMS, can be credited against carbon levy payments. A review of existing royalties, taxes, and levies in the logging sector would be beneficial and help identify appropriate tax policy measures and necessary recalibration of existing taxes, to ensure a balance between climate mitigation objectives and the socio-economic goals.

Table 9. Forestry Emission Factors

Land use subdivision	Emission factors (tCO ₂ e/ha/yr)		
	Deforestation (primary forest)	Deforestation (degraded forest)	Forest degradation
Low-altitude forest on plains and fans	526.50	344.70	181.79
Low-altitude forest on uplands	526.50	344.70	181.79
Low montane forest	306.41	200.61	105.80
Montane forest	306.41	200.61	105.80
Montane coniferous forest	306.41	200.61	105.80
Dry seasonal forest	286.76	187.75	99.02
Littoral forest	526.50	344.70	181.79
Seral forest	526.50	344.70	181.79
Swamp forest	526.50	344.70	181.79
Savannah	286.76	187.75	99.02
Woodland	286.76	187.75	99.02
Shrub	168.89	110.57	58.32
Mangrove	493.01	322.78	170.23
Plantation forest	354.15	231.86	122.28

Source: Forest Reference Level, 2nd submission, 2023.

⁴⁶ Including 50 percent log export tax in 2024 (returned to previous value from [70 percent in 2023](#)).

46. Payment for Environmental Services (PES) scheme may be used to incentivize forest conservation and restoration programs. Under the scheme, landowners would receive payments for environmental services the standing forests provide (such as sustaining biodiversity, carbon sequestration, soil conservation, preventing floods and land degradation, and others). Payments in PES schemes are calculated based on the ecosystem value (economic value of services provided by the forests) or the opportunity cost (roughly the opportunity costs of switching to different economic activities for households, whose livelihoods depend on the forest).

47. Introduction of PES scheme would slow down deforestation and forest degradation. A study on effectiveness of PES system in Uganda⁴⁷ using randomized controlled trials showed similar results: the reduction in deforestation rates in treatment villages decreased to 2-5 percent, compared to 7-10 percent in the non-participating villages. Countries like Bolivia⁴⁸, Brazil⁴⁹, Colombia⁵⁰, Costa Rica⁵¹, Guyana, and Peru⁵² to some extent have PES schemes in place. Recent study⁵³ of 40 REDD+ projects in nine countries showed that payment schemes in the forests can reduce deforestation by 47 percent in the first five years, although the effect becomes somewhat smaller for projects operating for 8 to 10 years.

48. PES system will need careful designing. On institutional side, land rights (97 percent of land is customarily owned) and leasing possibilities, and land use planning are a prerequisite to start the PES projects. Implementation of land use plans would also be important for containing leakage (for example, forest degradation in neighboring areas not covered by PES). On financial side, the system will require attracting donors, be supported from the general budget (the fiscal cost of the PES system in Costa Rica is 0.2 percent of GDP) or funded by levies applied in the forest sector (earmarking). The NFMS will need to be used for monitoring of forest cover.

49. The implementation of the Carbon Transaction Law should be approached cautiously due to international challenges and criticisms related to additionality, permanence, reporting, and the credibility of measurement and verification. The CCMA positioned PNG favorably to protect its forests and engage in carbon trading. Rigorous governance mechanisms for the carbon offset market remains absent, risking natural resources are not sustainably managed and causing delay in climate action. The country has already had an adverse experience with voluntary schemes and had to impose a moratorium to give the government time to create a regulatory framework for future and existing deals. International concerns focus on ensuring that the policy only rewards efforts beyond what would have occurred otherwise, maintaining the permanence of forest stands over time (considering risks such as

⁴⁷ https://www.nber.org/system/files/working_papers/w22378/w22378.pdf

⁴⁸ <https://www.naturabolivia.org/wp-content/uploads/2021/05/Grillos-2016-1.pdf>

⁴⁹ <https://www.sciencedirect.com/science/article/pii/S2095633923000011>

⁵⁰ https://climate-laws.org/document/law-2169-2021-promoting-low-carbon-development_add6?q=forest+fiscal+&l=colombia

⁵¹ <https://unfccc.int/climate-action/momentum-for-change/financing-for-climate-friendly-investment/payments-for-environmental-services-program>

⁵² <https://www.sciencedirect.com/science/article/pii/S0264837721002374>

⁵³ <https://conbio.onlinelibrary.wiley.com/doi/pdf/10.1111/cobi.13970>

forest fires and disease), developing meaningful baselines and reliable measurement tools for reporting and tracking, and avoiding potential social and environmental harms.

Recommendations

- Impose carbon levy on forest degradation and deforestation starting with commercial logging and commercial plantation agriculture, while considering exemptions/deductions for companies that meet certain sustainability standards/criteria.
- Consider introducing payment for environmental services (PES) schemes on a pilot basis to support conservation efforts.

C. Energy Sector

Current State and Challenges

50. Industry, transport, and buildings account for most of energy-related emissions and most energy consumption. In 2022, these three sectors combined, including fugitive emissions, accounted for around 5.4 MtCO₂e, or 65 percent of energy-related emissions (12 percent of total GHG emissions) – the remaining 35 percent is due to fuel combustion in the power sector. Together, industry, transport, and buildings consumed about 70 percent of total energy in PNG in 2019.

51. Despite being an oil and gas producer, most petroleum products in PNG are imported. In 2022, PNG produced 382.7 billion cubic feet (bcf) of natural gas and 34.4 million barrel per day (Mb/d) of crude oil and liquids⁵⁴. However, mid- and downstream petroleum industry is not developed, so more than 90 percent of natural gas and crude oil is exported. PNG imports about 85 percent of its final consumption of oil and oil products (according to Enerdata, import of petroleum products was about 1.08 Mtoe in 2021). Domestic market obligations (under the Oil and Gas Act) are negotiated between GoPNG and developers, and so far, are being not operationalized fully. For example, 58 MW Port Moresby Power Station is the first grid-connected station operated by NiuPower (independent power producer (IPP)), that uses domestic gas, and started operation in 2020.

52. Most of the population in PNG lacks access to electricity. Various agencies provide conflicting data on electricity access in PNG, although all of them are below 20 percent. The ADB estimates access to be at 13 percent⁵⁵, the World Bank (WB) – at 19 percent⁵⁶ (14 percent for rural population), United States Agency for International Development (USAID) – at 15 percent⁵⁷. The government has set the objective of achieving 70 percent electricity access by 2030 and universal access by 2050. PNG population is highly dispersed and isolated, the terrain of the country is rugged, which makes buildings transmission lines to remote areas very costly. Development partners⁵⁸ in the

⁵⁴ EIA datasets: <https://www.eia.gov/international/overview/country/PNG>

⁵⁵ <https://www.adb.org/sites/default/files/linked-documents/47356-002-ssa.pdf>

⁵⁶ <https://data.worldbank.org/indicator/EG.ELC.ACCS.ZS?locations=PG>

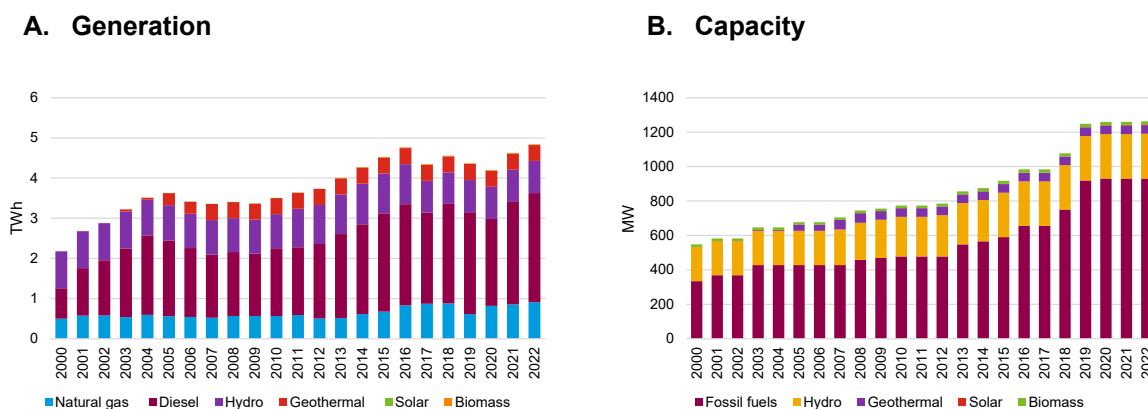
⁵⁷ https://pdf.usaid.gov/pdf_docs/PA00ZZMD.pdf

⁵⁸ ADB, Australia's DFAT, JICA, New Zealand's MFAT, UNDP, USAID, World Bank, others

country are currently focusing on off-grid expansion, through solar home kits and mini-grids. PNG Power Limited (PPL), the state-owned utility, is responsible for generation, transmission, and distribution of electricity throughout PNG. PPL acts as a single buyer to independent power producers (IPPs) and has a monopoly on transmission and distribution. In the medium- and long-term, PPL is planning to expand on-grid electricity capacity, mostly through large-scale hydro.

53. Hydro and diesel dominate electricity generation in PNG. Over time, different agencies reported different values for PNG’s installed electricity capacity: the National Energy Policy 2017-2027 cites 797 mega-watts (MW) for 2016 and 580 MW for 2013⁵⁹, updated NDC uses 580 MW (without specifying the year), while the United States Energy Information Administration (EIA) estimates capacity at 1,263 MW in 2022 (Figure 18, panel A). However, based on available data (Figure 18, panel B) from EIA, hydro (between 40 and 54 percent) and diesel (27-37 percent) are the largest in the capacity mix, followed by natural gas (11-14 percent) and geothermal (7-9 percent). The official data on electricity generation is lacking as well⁶⁰.

Figure 17. Electricity Generation and Capacity by Fuel Source, 2000-2022



Source: EIA.

54. Electricity tariffs setting needs a clear and transparent framework. Until recently, Independent Consumer and Competition Commission (ICCC) was responsible for economic regulation of the electricity sector. The National Energy Authority (NEA), established under the National Energy Authority Act 2021, now has taken over economic and technical regulation and licensing of the electricity sector. In August 2023, PPL and NEA announced adjustments of electricity tariffs, that has been frozen since 2013 by GoPNG. However, ICCC stated that the tariff increase was inappropriate and lacked transparency, and that NEA did not follow proper legislative process. The tariff rate adjustments are supposed to be administered through regulatory instrument such as five-year regulatory contract.

55. PPL’s financial situation is worsening due to electricity tariffs below cost recovery, high generation costs, and technical and non-technical losses. Frozen electricity tariffs for over 10 years

⁵⁹ On pages 7 and 63 of the document, respectively.

⁶⁰ For this report, we have used the most recent estimates from EIA on installed capacities and generation, cross-checked with Enerdata’s energy consumption and production datasets.

(Table 11) led to PPL’s inability to cover all operational and capital costs and limit its ability to invest in new projects and maintain existing infrastructure. Using expensive imported diesel for power generation increases operational costs of electricity generation. PNG also suffers from frequent power outages, due to PPL’s inadequate generation capacity and shortage of fuels. According to PPL, its technical losses are around 8-10 percent, while non-technical/commercial losses are estimated at 20 percent. In addition, PPL is responsible for paying a significant amount of capacity charges to existing IPPs.

Table 10. Electricity Tariffs

Customer	Tariff	Share in on-grid demand
Industrial	63.31 toea/kWh	~50 percent
Commercial	96.27 toea/kWh	~30 percent
Residential	69.68 toea/kWh	20 percent

Source: based on USAID and ICCC.

Key Policy Gaps and Opportunities: Power sector

56. PNG has multiple targets to achieve its mitigation goal in its updated NDC for the energy sector. The enhanced NDC in 2020 set the overall goal of achieving 50 percent carbon neutrality by 2030, and 100 percent by 2050. Specifically for the energy sector, the headline target is reaching carbon neutrality within the energy sector by 2050. The quantitative non-GHG target is to achieve a share of 78 percent of renewables in the on-grid generation capacity by 2030, from 30 percent in 2015 (around 26 percent in 2022). Non-GHG action-based targets include reducing energy demand through adoption of minimum energy performance standards and labeling (MEPSL), establishing a framework for fossil fuel emissions offsetting, and enhancing data collection capacities. Potential measures for transport in the NDC, among others, include reducing vehicle-miles, encouraging efficiency in the transport sector, and encouraging the introduction of hybrid and electric vehicles (EVs).

57. Additional documents further disaggregate implementation measures needed in the energy sector. As with forestry, NDC Implementation Plan outlines actions and projects in the energy sector to achieve the main targets, as well as additional activities supporting areas such as renewable energy and transport. Energy Mitigation Plan (2022-2025) sets out means of implementation for activities and actions from the NDC Implementation Plan, and it is complemented by the Implementation Roadmap for the electricity sector. Both documents list 37 planned and proposed projects, with total capacity of more than 470 MW, summarized in Table 12 below.

Table 11. Planned and Proposed Projects (MW)

Stage	Technology	Short-term	Medium-term	Long-term	Total
Planned	Hydro	159	31	190	380
	Solar	17			17

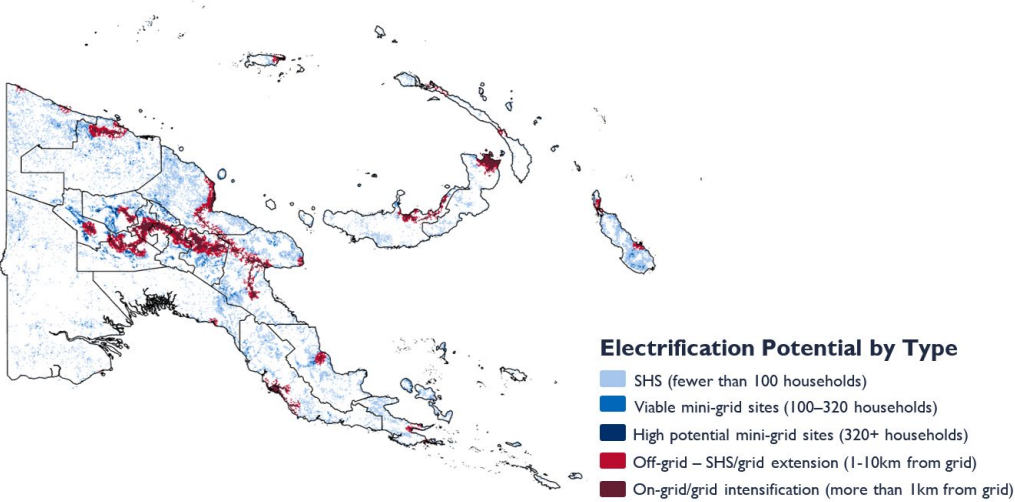
Proposed	Hydro		2	21	24
	Solar	15	4		20
	Biomass			2	2
Total		191	38	213	472

Source: based on Electricity Sector Implementation Roadmap.

58. Renewable energy deployment in PNG will have multiple benefits. Adding at least 470 MW of renewable electricity projects to the grid will over time lower generation costs. However, given the frozen electricity tariff, PPL would not still recover its total costs. Currently, NEA is working on regulation to establish a cost-recovery tariff mechanism. However, removal of the tariff freeze will increase electricity bills for households, so additional measures or exemptions should be taken to protect low-income households. The analysis later in the report evaluates the impact of gradual removal of electricity tariff freeze.

59. Off-grid expansion is essential for reaching electrification goals. National Electrification Roll-Out Plan estimates that to reach 70 percent electricity access target by 2030, over 630 thousand households, or 27 percent of population, will need to be served by the off-grid generation. According to USAID-PEP estimates⁶¹, total accessible market for mini-grids and solar home systems in PNG is around \$71 million per year, potentially serving more than 850 thousand households (Figure 19).

Figure 19. PNG Electrification Potential



Source: USAID-PEP.

60. Off-grid expansion currently is limited mainly due to the lack of regulatory framework, high transportation costs, and low available skills. Currently PNG does not have a regulatory framework for off-grid projects, which puts potential investors into an uncertain environment and hinders

⁶¹ The United States Agency for International Development (USAID) PNG Electrification Partnership (PEP): Off-grid PNG Market Assessment

project development. The NEA is in the process of developing regulatory frameworks for renewable energy such as hydro, solar, and wind. The regulations will address licensing, tariffs, and land rights issues, among others. Across the value chain, distribution and transportation costs to get equipment to remote areas, adds 20 percent to overall costs. Remoteness of locations also complicates maintenance of mini-grids and payment collection, requiring having trained local employees in electrical systems and financial accounting. Current process of drafting regulations for off-grid generation provides NEA with an opportunity to include incentives, such as feed-in tariffs, renewable subsidies, as well as requirements to include training programs in locations of mini-grids.

Key Policy Gaps and Opportunities: Petroleum Fuels

61. PNG is planning to impose carbon levy to address the externalities of fossil fuel consumption. The 2023 amendment of the CCMA introduces carbon levies on imported and locally produced fuels, regardless consumption sector (Table 13), as well as nitrogen levy on imports of synthetic fertilizers. While implementation of the carbon levy is currently suspended due to its inconsistency to section 209 of PNG’s Constitution, which requires Parliamentary endorsement (see Chapter IV), and the level of the levy is relatively low, it will incentivize more efficient fuel use. Once introduced, the carbon levy rates could be raised gradually over the long-term.

62. Effective tax rates on fuels in PNG are declining. Excise tax rates on fuel products have been infrequently adjusted, eroding their real value, which negatively impacts revenue collections and reduces externality-correcting benefits of the excises. According to CPAT estimates, revenues from gasoline and diesel will decline by almost 20 percent in 2030 relative to 2020 in the baseline, despite 18 percent increase in consumption.

Table 12. Proposed Carbon Levy

Fuel	Carbon levy rate	Fuel levy rate
Motor spirit (gasoline) including aviation spirit	5 toea per kg of carbon	1 toea per liter
Jet A1	5 toea per kg of carbon	1 toea per liter
Kerosene	5 toea per kg of carbon	1 toea per liter
Diesel	5 toea per kg of carbon	1 toea per liter
Heavy fuel, oils	23 toea per kg of carbon	5 toea per liter

Source: CCMA.

Recommendations

- Implement carbon levy on liquid fuels according to the 2023 amendment to the CCMA.
- Restore real value of fuel excises (adjust fossil fuel excises to inflation).
- Establish a clear and transparent multi-year regulatory framework for tariff setting and review.

- Adjust end-use electricity tariff, to reach cost-recovery in PPL and promote electricity use efficiency, with measures protecting low-income households.
- Adopt a regulatory framework for off-grid renewable electricity generation projects that include incentives such as feed-in-tariffs and capacity building.

D. Methane

Current State and Challenges

63. Most of methane emissions in PNG come from oil and gas extraction and waste. Methane emissions accounted for about 3.8 MtCO₂e in 2022, with 45 percent of which are emissions from oil and gas extraction and 35 percent from the waste sector.

64. Currently there is no regulatory framework concerning methane emissions from waste and oil and gas sectors. Venting and flaring methane in oil and gas extraction, for example, are only required to be reported by producers to DEP, and there are no technical requirement nor standards for these processes. There are also no policies, laws, or regulations for integrated waste management (Environment Act manages industrial waste, Public Health Act manages medical waste, Trade Waste Policy only restricts a discharge of wastewater, harmful to the sewerage system). The Organic Law on Provincial and Local-Level Governments (1995) and the Local-Level Governments Administration Act (1997) allow all urban local level governments to formulate their own waste management policies, legislation, and bylaws. However, as of 2022, only two urban local level governments (the National Capital District Commission and Kokopo-Vunamami) have their solid waste management plans.

Key Policy Gaps and Opportunities

65. There are various options for mitigating methane emissions through reductions in the emission intensity of production. Reductions in emission intensity can be achieved through technological means, including flaring or capturing methane (for own use in power generation or for sale to the natural gas grid or mobile processing units) at extraction, electrifying extraction processes and replacing natural gas pumps, improving leak detection and repair systems, and upgrading distribution infrastructure.

66. Methane fees can be integrated into existing fiscal regimes on oil and natural gas extraction. Fees can limit administrative burdens by building on existing business tax regimes. However, the fee needs to be modified when firm-level emissions are not directly observed. A fee can be imposed indirectly on production, scaled by default emission factors and allowing low emission-rate firms to apply for rebates. A methane fee can be integrated into existing fiscal regimes, considering existing contracts such as fiscal stability clause in oil and gas production. To implement such fees effectively, the government also needs to improve the monitoring system. Alternative mitigation instruments are emission rate regulations and technology requirements.

67. Given institutional and capacity constraints, fiscal instruments⁶² in the upstream of waste lifecycle might address negative externalities associated with waste generation. Fiscal instruments could internalize the negative externalities of waste generation and improper disposal (such as adverse health effects, including from open fire burning in landfills, ground water contamination, foul odors, harm to biodiversity, and GHG emissions), while helping to finance waste management.

- For imported consumer durables and other highly polluting products, such as batteries, tires, plastic packaging, and vehicles, fees like advance disposal fees (ADFs) and advance recycling fees (ARFs) can be imposed at the customs to cover the future fees of disposal and recycling. However, these fees may not sufficiently incentivize disposal and recycling (proper waste collection and separation will be required), may be passed on directly to consumers, leading to potentially regressive impacts, and might not be effective on reducing waste generation itself.
- At the retail, for single-use containers made of recyclable materials, such as plastic, glass and aluminum, a deposit-refund system (DRS), which imposes a surcharge on a product at purchase and provides a rebate when it is returned. DRS would incentivize recycling as it raises prices only for consumers who do not recycle, thus potentially reducing regressive distributional impact of the fees. To minimize administrative and compliance costs, the deposit could be collected at the import stage, while consumers receive the refund at designated collection locations.
- At the disposal, tipping fees (charges by landfill owners per volume/mass of deposited waste) and landfill taxes can be applied, although these fees might not be effective at reducing waste generation (since ultimate payers are users of landfills) and their administration requires monitoring and inspections of landfill areas. Since all waste disposal sites in PNG, except the Baruni Landfill serving POM, are open dump sites, with no day-to-day management and no monitoring of incoming vehicles, implementation of fiscal instruments downstream (at the disposal) is limited.

Recommendations

- Consider introducing technical standard and/or fees on fugitive emissions from oil and gas production.
- Adopt regulatory framework to promote waste management and consider introducing fees to internalize waste externalities.

E. Evaluating the Impact of Mitigation Policies

68. This section models the impact of proposed pricing measures in the energy sector. Policy packages are discussed in terms of their impact on fiscal revenues, economic growth, energy prices, and emissions. The evaluation was performed using the CPAT (see Annex II). Three illustrative policy packages include:

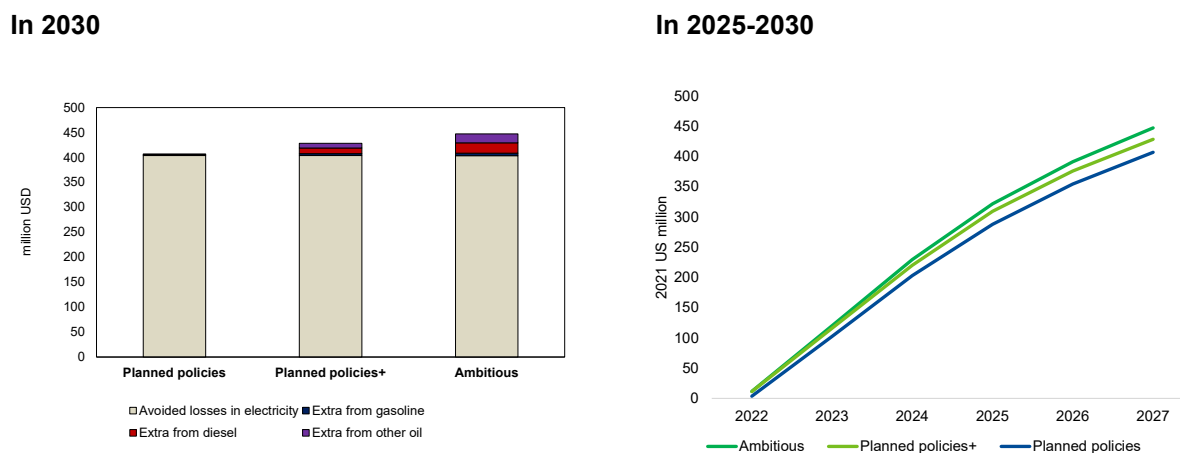
- **Planned policies package** includes a gradual adjustment of the electricity tariffs to be reflective of costs as envisioned by NEA over the 2025-2030 period, and introduction of the carbon levy proposed in the CCMA starting from 2025.

⁶² See details in [Matheson 2019](#)

- **Planned policies + package** includes adjustment of fuel excises to inflation starting from 2025, on top of the planned policies package.
- **Ambitious package** includes gradual adjustment of carbon levy from approximately \$1/tCO₂ in 2025 to \$5/tCO₂ in 2030⁶³, on top of the planned policies+ package.

69. These climate mitigation policies would increase fiscal revenues and reduce financial losses in the electricity sector. Baseline revenues from petroleum products in 2030 are estimated to about US\$97 million (down from estimated US\$125 million in 2020), which is more than offset by losses in the electricity sector (around US\$ 370 million). The planned policies package is estimated to generate US\$407 million in additional revenues and avoided losses, while US\$428 million is expected for the planned policies + package, and US\$ 447 million for the ambitious package in 2030 (equivalent to about 1.1, 1.2 and 1.3 percent of GDP, respectively) – see Figure 20. The higher tax revenues collected from the carbon tax can then be used to mitigate negative impacts on households and economic growth and finance climate-friendly initiatives such as renewable energy and energy-efficient projects and the REDD+ schemes proposed in the forestry section. (See also Annex III on recycling carbon tax revenues).

Figure 18. Additional Revenues and Avoided Losses, Compared to Baseline



Source: IMF staff based on CPAT.

70. Pricing policies are likely to put upward pressure on energy prices. Considering that international fuel prices are projected to decrease, prices in 2030 are expected to be lower than current prices despite the implementation of the reforms. Specifically, although energy prices would increase in the short term, the prices of gasoline, diesel, and kerosene in 2030 would be below the 2023 levels even under the introduction of policy packages. The electricity price, however, will increase from its current level, due to the need to achieve cost recovery, by 0.02 US\$/kWh for industrial consumers, and by

⁶³ Assuming exchange rates of 4 kina/US\$ in 2025, increasing to 4.4 kina/US\$ in 2030 (IMF World Economic Outlook database).

US\$0.01 for commercial and residential consumers. Additional measures will be required to address distributional impacts⁶⁴ of the reforms (Table 14).

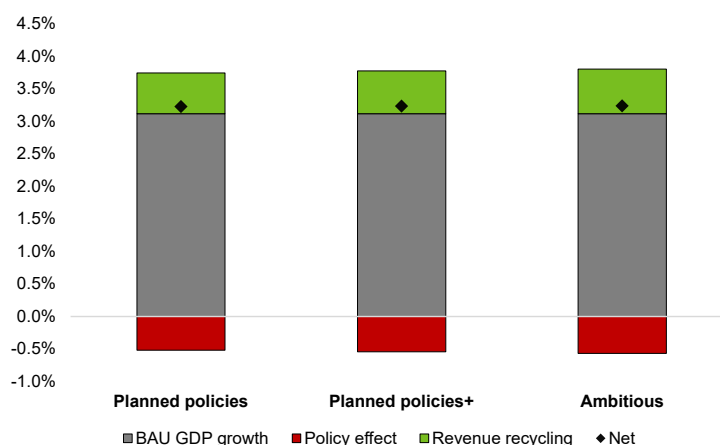
Table 13. Impact on Energy Prices

Fuel	Unit	2023	Baseline, 2030	Planned policies, 2030	Planned policies+, 2030	Ambitious, 2030
Electricity, industry	\$/kWh	0.16	0.12	0.18	0.18	0.19
Electricity, commercial	\$/kWh	0.22	0.16	0.23	0.23	0.24
Gasoline	\$/liter	1.02	0.87	0.87	0.90	0.91
Diesel	\$/liter	0.93	0.80	0.80	0.82	0.83
Kerosene	\$/liter	0.74	0.64	0.65	0.65	0.66

Source: IMF staff based on CPAT.

71. In the absence of revenue recycling, increases in energy prices due to policy packages would have negative effects on economic growth. However, appropriate use of additional tax revenues can mitigate the negative impact on the economy. The impact on economic growth of the policies in 2025 is between 0.5-0.6 percentage points and could be offset by productive public investment and increase in current spending (general government expenditures), bringing the net impact to positive 0.11-0.12 percentage points compared to the baseline (Figure 21). The estimates are subject to caveats, including, among others: (1) fiscal multipliers used are aggregated at income level, (2) economic effects do not account for interactions between climate mitigation policies and distortions in the economy created by the broader fiscal system, (3) GDP impacts from changes in informality, induced technical change, or local air pollution (for example on productivity) are not included, (4) impact of mitigation policies on industrial competitiveness is not modeled directly.

Figure 19. GDP Growth Impact Decomposition in 2030



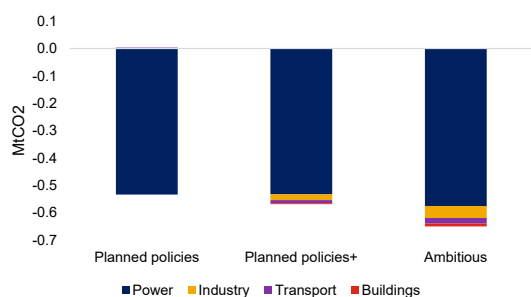
Source: IMF staff based on CPAT; Note: BAU stands for business-as-usual.

⁶⁴ See chapter 4 and Annex II of the [IMF working paper](#) for a short discussion of distributional impact of climate mitigation policies, potential policies to address them (new or existing targeted cash transfers, transfers towards public investment in infrastructure, scaling up an existing social protection scheme, and/or reducing effective PIT liabilities) data requirements for distributional analysis

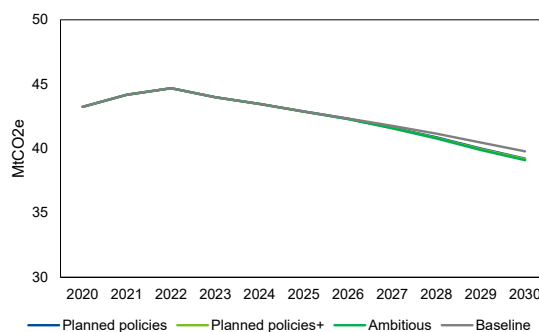
72. Given that most emissions in PNG originate from non-energy sectors, total GHG emissions are not highly responsive to policy packages. Figure 22 below show that the impact on emissions of policy packages is minimal, and mainly comes from the power sector. Compared to the baseline, modeled policy packages bring between 7 to 9 percent of emissions reduction in 2030, or up to 2 MtCO₂ cumulatively over five years. Table 15 provides a summary of findings on key indicators across the three scenarios.

Figure 20. Impact on Emissions

A. Reduction in Energy-Related CO₂ Emissions in 2030



B. GHG Emissions, Including LULUCF, by Scenario, 2020-2030



Source: IMF staff based on CPAT.

Table 14. Summary Table

Scenario	Planned policies	Planned policies+	Ambitious
Energy-related CO ₂ emissions reduction in 2030, % to a baseline	7.3	7.8	8.9
Cumulative CO ₂ emissions reductions in 2024-2030, MtCO ₂	1.4	1.6	1.8
Fiscal revenues raised in 2030 to baseline, % of GDP	1.1	1.2	1.3
Cumulative fiscal revenues in 2024-2030, difference to baseline, bn USD	1.36	1.46	1.52
Impact on GDP growth in 2030, percentage points deviation from the BAU growth	0.1	0.1	0.1
Weighted average electricity prices in 2030, \$/kWh	0.2	0.2	0.2

IV. Enabling Institutions

73. Strong climate governance helps to build the country's resilience to the challenges of climate change and reduce its costs. Good climate governance implies that institutions play a key role in the regulation, policy development, coordination, resource mobilization and implementation of climate actions. It involves integrating climate considerations into existing systems and processes of the public administration, enhancing them without compromising their efficiency. Ultimately, climate governance ensures that future development gains such as economic growth and stability, peace and social cohesion are not compromised by the impact of climate change while also capitalizing on green growth opportunities deriving from a transition to a low carbon economy. To ensure effective delivery of PNG's Enhanced NDC 2021 targets and actions and supporting sector roadmaps and the NAP, it is essential that an effective climate governance framework is put in place. This chapter examines PNG's climate governance with a focus on regulations, policies, institutions, and climate finance. By examining current gaps and proposing solutions, the chapter aims to provide a roadmap for enhancing institutional capacity and ensuring coordinated efforts.

A. Legislative Framework

74. PNG was an early adopter of international climate change commitments and has established a robust legal foundation to address climate change. PNG ratified key international conventions and agreements on climate change (UNFCCC, 1992; Paris Agreement, 2016), forming the basis for its climate governance framework.⁶⁵ In 2015, the CCMA was adopted by Parliament. It sets out the regulatory framework for PNG to (a) promote and manage climate-compatible development through climate change mitigation and adaptation activities; (b) establish the CCDA and the National Climate Change Board (NCCB) to coordinate climate change related policies and actions, and (c) set up administrative procedures related to funding arrangements, Measurement Reporting, and Verification (MRV) and benefit sharing. The CCMA was recently amended (2021 and 2023) to strengthen revenue mobilization through the introduction of carbon levy and enhance the mandate of the CCDA to ensure transparency and accountability for the Authority.⁶⁶ The amendments also strengthened the legislation that drives adaptation planning: all regulated sectors (identified in Section 53 of CCMA 2015) are required to develop sectoral adaptation plans. To support the 2021 NDC implementation, a regulation was also issued in 2022 including the creation of a Technical Advisory Committee and Sub-Technical Working Committees, the formal recognition of NDC targets, the development of an implementation plan, implementation measures, and MRV protocols.

⁶⁵ PNG is also a member of the Small Island Developing States (SIDS) and aligns itself with the Alliance of the Small Island Developing States (AOSIS) in the context of the UNFCCC. PNG is the current Chair of the Coalition for Rainforest Nations (CfRN), engaging in negotiations under the UNFCCC for its 52 member countries, especially on Article 6 of the Paris Agreement.

⁶⁶ The CCMA's regulated sectors are the areas of agriculture and livestock; the energy sector, the transport sector; works & infrastructure sector; the forestry and land use sector (LULUCF); the mining sector; the fisheries and marine resources sector, and the waste management sector.

75. Legislation has been issued for several sectors to strengthen the regulatory basis for climate action. Legal and regulatory provisions for energy, water, environmental management, land use planning sectors, which provide an initial basis for regulating how the various actors address climate change have been in place for several years (Figure 23, col. 2). Yet, other complementary legislation are pending or absent. The resource mobilization and financial management of the climate regulations are governed by the PFM and revenue legislation (for example, the Public Financial Management Act (1995), the Audit Act (1989), the National Procurement Act (2018) and the Non-Tax Revenue Administration (NTRA) Act (2023).

Figure 21. National Regulations Governing NDC Sectors

International Commitments	
National Legislation	
Climate Change	UN Paris Agreement (Impl.) Act 2016, Climate Change Management Act (2015, Amends 2021/2023), NDC regulation (2022)
Disaster risk management	Disaster Management Act 1984, Emergency general power Act (2018)
Environmental Protection	Conservation and Environmental Management Authority (2014, Amend. 2019), Environment law (2000), Protected Areas Act (2024)
Water	National Water & Sanitation Act (1986, Amend 2016); Water Resource Regulation (1982), Public Health Act (1973), Environment law (2000)
Fishery	Maritime Zone Act (2015)
Land	Building Act (Amend. 2022), Land Act (1996, Amend. 2020), Land Commission Act (2022)
Agriculture	National Agricultural Research Institute Act (1996)
Forestry	Forestry Act (1991)
Gas/Petrol	Oil and Gas Act (1998, consolidated 2007)
Energy	National Energy Authority Act (2023 Amend.)
Investment	Investment Promotion Act (Amend. 2023)

Source: IMF Staff.

Gaps and Opportunities

76. Revenue mobilization related to climate provisions will require revision and careful implementation in consultation with Treasury. The CCMA introduces the collection of a carbon levy on liquid fuels to be paid to the Climate Change and Green Growth Trust Fund, but the CCDA had to stop the application of the levy after a year due to its non-compliance with Section 209 of the Constitution. The NTRA. This Act assigns the responsibility of levy collection and management to the Department of Treasury. Since then, in consultation with the Department of Treasury, efforts have been made by the CCDA to address the inconsistencies between the CCMA and Non-Tax Revenue Administration Act (NTRAA) and the Excise Tariff Act. The recent discussions between the Treasury and

the CCDA reflect the importance of a close collaboration between both institutions to ensure consistency across legislative acts and consideration with domestic revenue mobilization priorities as reflected in the government agenda.

77. PNG has a robust legislative foundation to confront climate change; nevertheless, existing legislative gaps undermine NDC implementation. Despite important progress in adopting key climate related laws and regulations, some complementary sector legislations are missing or have been delayed. There are several examples of missing or pending legislations. The authorities, with the support of the EU, are preparing on a pilot basis a sustainable land use plan for the Enga province that will inform the preparation of a National Sustainable Land Use Plan. Yet, in order to be effective, the plan needs a legal foundation for governing land resources and incorporating climate mitigation and adaptation. Separately, the Agriculture Administration Law has been slow to progress, delaying opportunities to enhance coordination within the sector. Climate actions at the subnational level have a provision for establishing a consultation process on the GHG emission impact of projects but lack a legal foundation for coordination, planning and reporting. Subnational government (SNG) can play an important role in addressing climate change (Box 6). Several provisions of the CCMA, i.e. those related to incentives for the promotion of climate change initiatives (Article 42), the deforestation levy (Article 24) or the establishment of the Climate Finance Steering Committee (CFSC, Article 14 A), need supporting regulations. Also, most NDC sectors lack implementing regulations or require updated regulations. Water regulations for abstraction and wastewater discharge have not been updated since 2002; regulations for efficient water use and those against depletion of water resources are lacking. The absence of regulations for renewable energy generation (solar and wind) hamper PNG's target of meeting 70 percent renewable energy in generation capacity by 2030. The lack of regulations for waste management contribute to an increase in GHG emissions due to improper disposal of waste and lost opportunity for waste generation minimization and recycling. Methane and fugitive emissions are also not regulated contributing to emissions in extractive industry.

78. The delay in updating the DRM law has postponed the adoption of a holistic approach to disaster risk management. PNG's DRM, governed by the DRM law 1984, is based on a centralized government system focusing on emergency response. However, in the absence of formalized local coordination, this can lead to fragmented and inefficient responses, increased vulnerability, and greater economic and social losses. Without integrated planning, efforts may be duplicated or overlooked, resulting in inadequate preparedness and recovery. While PNG's DRM efforts are limited to the use of government resources, effective engagement with locally operating civil society organizations and private sector actors will be a key to ensure that PNG's institutional system moves beyond the current 'emergency response' oriented DRM system to more resilience focused system, where ex-ante disaster risk reduction together with response efforts can be embedded within the ongoing community development efforts.

Box 5. International Experience of Integrating Climate Aspects into Subnational Legislation

Climate change policies take many forms, and many of those activities indeed can be implemented by SNGs. In many countries, SNGs do play significant roles on certain types of decarbonization actions, such as managing land use, housing codes, water and power utilities, waste disposal, or transport systems. On the side of adaptation actions, SNGs have also been, in many countries, on the front line of disaster response and climate adaptation programs. There are significant variations in how countries organize the division of responsibilities and financing arrangements regarding policies and programs to fight climate change.

Belgium: Kyoto-agreed targets with the EU were reallocated to the regional level through a process of negotiation, and regional climate plans were prepared to implement those regional targets. The regional governments design and implement their own policies within the national policy framework. For this framework, there is an Inter-Ministerial Conference on the Environment (IMCE), composed of the federal and subnational environment ministers, that is in charge of coordinating intergovernmental cooperation on climate change policies.

India: Policy targets are set in a mix of national and subnational regulations. Functional responsibilities are shared between the central government and the state governments on the basis of the *National Action Plan on Climate Change* (NAPCC) at the Union level and the states' "State Action Plan on Climate Change (SAPCCs).

Portugal: Introduced an ecological fiscal transfer for land conservation in its 2007 Portuguese Local Finances Law (LFL). The transfer provides significant incentives for those local governments that set aside a large proportion of their land under protected status.

Amazon Fund: Created in Brazil, the Fund seeks to raise donations (international and domestic) to prevent, monitor, and combat deforestation and to promote the conservation and sustainable use of forests in the Amazon Biome. It is managed by a public bank, the Brazilian Development Bank (BNDES), and it functions as a private fund. As part of the same objectives, the federal Ministry of Environment periodically publishes a list that identifies municipalities responsible for the greatest share of deforestation in the region. Once included on the list, municipalities become prioritized for environmental and land control actions executed by the state and federal governments. In addition to becoming subject to intense surveillance, these municipalities are prohibited from obtaining new land clearing authorizations, apart from special cases described by decree.

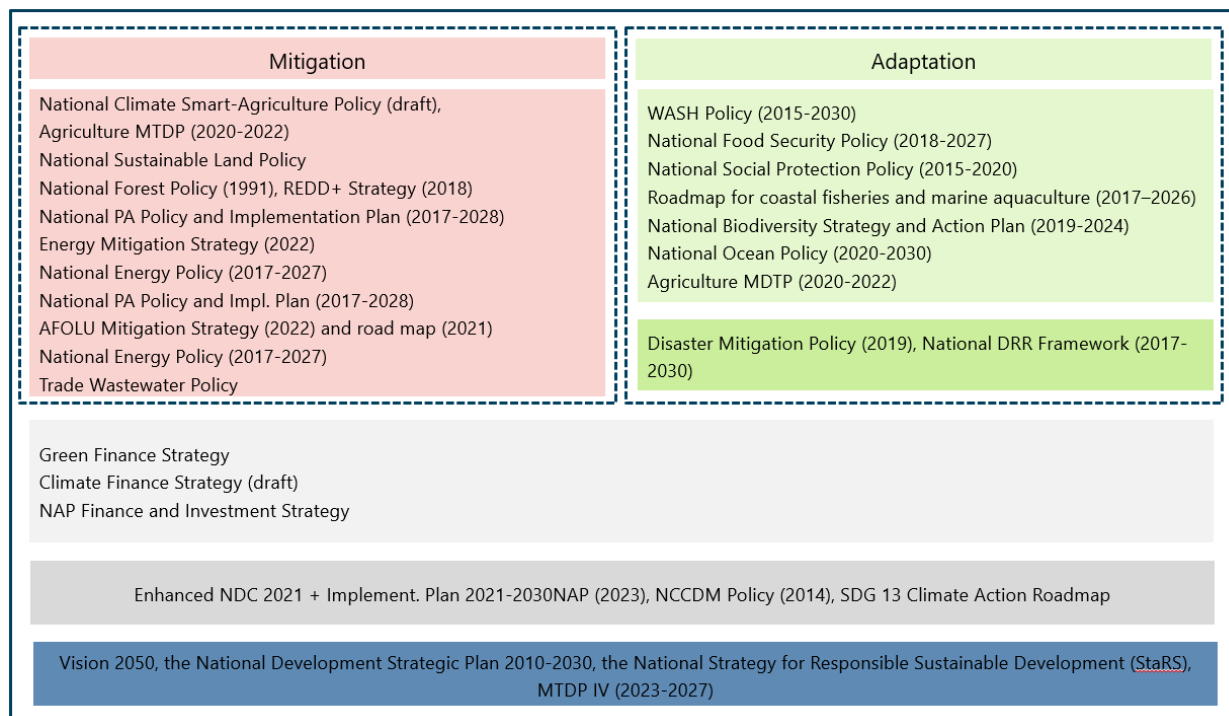
Source: World Bank, *Adapting Fiscal Decentralization Design to Combat Climate Change*, 2021.

B. Policy Framework

79. The government has established a strong climate policy governance framework supporting the implementation of the country's climate agenda. Government's commitment to address climate change is anchored in its national policies and strategies, such as the Vision 2050. In compliance with the UNFCCC reporting requirements, the country has prepared and submitted its First and Second National Communication (2002, 2014), its NDCs (2016 and 2020) and its First and Second Biennial Update Report (2019 and 2022) and the SDG 13 climate action roadmap (2020). The establishment of the CCDA has provided an additional boost to the development of several mitigation strategies and plans to support adaptation while also introducing frameworks for emissions reduction and energy transition. Several policies are being drafted such as the EV policy, the blue carbon policy and forest policy. Aligned with the mandate of the CCMA and led by the CCDA, the NAP identifies actions to be implemented through sectoral climate change adaptation plans in agriculture, health, transport, and infrastructure as well as incentivize adaptation planning at national and provincial level.

Implementation progress has been uneven, with delays in the preparation of sectoral adaptation plans while efforts to integrate climate change considerations into policy and planning are evident at five Provinces. Actions on disaster risk reduction are guided by PNG’s National Disaster Risk Reduction Framework (NDRRF) (2017- 2030). (Figure 24).

Figure 22. PNG’s Climate Policy Framework



Source: IMF staff.

Gaps and Opportunities

80. The development of multiple climate policy documents puts a strain on coordination and resources. Climate policies and sector strategies are often developed along different tracks, the former usually led by the CCDA. Even though efforts are made for consultations, climate sector documents are at times not known by stakeholders or are prepared in silos. Climate policies are also largely donor funded showing the dependency of climate policy development on external resource availability. Key stakeholders, such as the Treasury and National Planning departments, do not play a leading role in climate policy development, despite their crucial involvement in fiscal policy, public policy and capital investment oversight. Climate policy development requires coordination to ensure ownership and alignment of efforts toward achieving the NDCs. In a tight fiscal setting, implementing numerous plans remains also challenging. Like many developing countries, PNG faces numerous barriers, including limited resources, institutional and capacity constraints, and competing development priorities.

81. PNG is currently implementing MTDP IV in which climate change is a strategic priority area (SPA). However, opportunities exist to set climate change as a driver of growth. The MTDP is based on 12 key Strategic Priority Areas with one covering climate change and natural environmental protection (SPA10). The Government seeks to implement the SPA through three programs, called (i)

climate change mitigation and adaptation, (ii) environmental protection, (iii) natural disaster management. These programs have been costed at K499.5 million for the five-year period of the MTDP IV, equivalent to 1 percent of the total investment cost. With the objective of growing the PNG economy and creating one million additional jobs by 2030, the MTDP's Strategic Priority Areas include growth initiatives such as downstream processing of natural resources, value-added manufacturing, mining and petroleum operations and strategic trade and investments. Policy response to foster climate action, including public investments, regulations, and carbon prices, may also enhance growth. Climate change can drive economic growth through the promotion of green technologies and sustainable practices. The transition to renewable energy sources, such as solar and wind power, opens up new markets and job opportunities in the clean energy sector. There is scope to integrate policy response to climate change systematically across all SPAs, allowing to unlock significant growth, opportunities for job creation and other development benefits, while generating a variety of cost savings that alleviate pressure on public budgets.

82. The Government has made important progress in establishing an environment for green financing. Launched in 2023, the Inclusive Green Finance Policy (IGFP) aims to address environmental and climate change challenges through innovative inclusive climate finance and green investment mechanisms in the financial and banking sector. The policy includes a green taxonomy, designed to identify, monitor, and demonstrate the scope and volume of the investors inclusive and green financial flows. By disclosing green activities through key performance indicators to the public and investors, financial institutions will be held accountable for their direct and indirect impact on PNG's environment and global climate change. The IGFP is accompanied by an implementation roadmap identifying activities to create an enabling environment for effective application of the taxonomy. Current efforts focus on the development of a technical screening criteria, bankable green projects and mobilizing funding.

83. While adaptation and decarbonization targets are reflected in the country's Vision 2050, the government lacks a long-term planning framework that sets the fundamental transformation across all sectors of the economy in the context of climate change. The absence of a long-term low emissions development strategy (LT-LEDS) for climate change can lead to policies that fail to address the root causes of climate change, resulting in inadequate mitigation and adaptation efforts. Without a strategic vision, investments in renewable energy, resilient infrastructure, and sustainable practices are often inconsistent and insufficient, jeopardizing future generations' well-being and the overall stability and health of ecosystems and societies. Long-term strategies can provide a long-term vision to inform short-term decisions, helping to avoid investments incompatible with a low-emissions, climate-resilient future. The CCDA is seeking to secure funding to prepare such a long-term strategy (See Box 7).

Box 6. Some Key Conclusions from the Review of the First 29 Long-Term Climate Strategies Submitted to the United Nations Framework Convention on Climate Change (UNFCCC)

Under the Paris Agreement, countries are encouraged to communicate "long-term low greenhouse gas (GHG) development strategies," setting out detailed plans for aligning their climate goals with development up to 2050. At present, 58 countries have officially submitted a long-term strategy (LTS) to the United Nations Framework Convention on Climate Change (UNFCCC), including developed economies like Japan and Canada, emerging economies like South Africa, vulnerable nations and small island states (Benin, Fiji and the Marshall Islands). The LTS makes it possible to:

- Establish a long-term vision for climate action, covering mitigation, adaptation and/or development.
- Consider fundamental changes in all sectors of the economy (macro, fiscal and distributive analysis to support the achievement of climate and other long-term policy objectives).
- Recognize the impacts of future climate change on all sectors of the economy, and describe the environmental, social, human and economic risks of inaction.
- Mention the importance of a just transition, recognizing that future transformations will disproportionately affect those whose livelihoods are tied to a high-carbon economy.

Some key points to remember:

- LTS must remain relevant and useful throughout their multi-decade implementation period. Consequently, these strategies should have appropriate legal backing and be linked to national development policies.
- There should be adequate engagement with key stakeholders in the development and implementation of strategies, particularly with vulnerable populations.
- Plans should be in place to monitor and revise strategies over time, keeping abreast of the latest scientific advances and market developments.

Source: World Resource Institute, Insights on the First 29 Long-Term Climate Strategies, submitted to the UNFCCC, September 2021, [What are Long-term Climate Strategies, and how can they help us tackle climate change? | Climate Promise \(undp.org\)](#).

C. Institutions

84. The CCMA and 2021 NDC Regulation establish the institutional mechanism for climate related policy making and implementation at the national level. The CCMA mandates the establishment of several bodies including the Climate Change and Development Authority, the Climate Change Board and the Climate Finance Steering Committee, while the NDC Regulations mandates the establishment of a Technical Advisory Committee. The operationalization of these bodies demonstrates varying degree of progress:

- **Climate Change and Development Authority (CCDA).** Initially established as an office within the Department of the Prime Minister, the CCDA became a regulatory agency under the CCMA. The CCDA is the central coordinating agency for climate related policy development, regulations and all NDC implementation activities and projects that contribute to the NDC targets achievement.
- **National Climate Change Board (NCCB).** The NCCB is responsible for policies and oversight of CCDA, ensuring proper regulation related to trading schemes, and administration of the adaptation and REDD+ programs. In 2023, PNG's Parliament passed an amendment to the CCMA clarifying arrangements that introduce and govern the Board. Currently, PNG is in the process of appointing members to the NCCB, which is expected to become operational this year.
- **Climate Finance Steering Committee (CFSC).** CFSC will be responsible to oversee the coordination of climate finance at the national level. It also identifies relevant accredited climate finance entities that can facilitate the development of project proposals consistent with national laws and policies. CCDA's plans to establish the CFSC as a subcommittee to the Board within the provisions of the CCMA, comprising a broad range of high-level representatives from across government, each with the convening power and authority to develop climate finance.
- **Technical Advisory Committee (TAC).** The TAC is mandated to advise the CCDA or the board on matters related to NDC monitoring and implementation, to monitor the implementation of NDC targets, and to coordinate data collection and activities from sub-committee. The timing for operationalizing this Committee has not yet been determined.
- **Sector Coordination.** Only a few departments have institutionalized climate planning, for instance, the DAL has a climate focal point and the Department of Works and Highways has set up a climate unit. The CCDA has created several working groups for mitigation, low carbon, MRV, REDD+ and adaptation that are operational and support engagement and coordination on sector specific activities. The NDC 2022 regulation provides for the establishment of additional sectoral committees depending on future NDC targets.

85. While subnational engagement is critical to effectively address climate change at the provincial, local government and community level; in practice this engagement is still in its early stages. The CCDA is gradually establishing a presence with the deployment of Provincial Climate Change Coordinators in five provinces (East Sepik, Madang, Morobe, Northern, and New Ireland) and has piloted the creation of Provincial Climate Change Committees. These Committees serve as the

interface between national and subnational governments and other stakeholders and seek to develop locally relevant climate plans for adoption at the provincial level. Still climate resilience has yet to be systematically integrated into regular provincial government planning and budgeting processes. Significant differences in fiscal capacity to adapt exist across provinces, with some having greater access to resource royalties than others.

86. In addition to the CFCS, two units are being formalized for tracking and managing climate finance. The Green Finance Centre (GFC) is being created under the auspice of the Central Bank to spearhead and coordinate activities concerning inclusive and/or green finance initiatives. Its broad mission will be to lead the transformation of PNG's financial sector into inclusive, resilient and green financial products and services. Supported by Australian Climate Finance Initiative for Resilience and a Sustainable Transition project, the CCDA will also establish a Climate Finance Unit to manage and report on climate finance, in accordance with the UNFCCC's reporting regulations. This underscores the need for a climate unit within the Department of Treasury to serve as the interface between various coordination mechanisms.

Gaps and Opportunities

87. Setting up coordination mechanism for climate change in PNG needs careful consideration of mandates and capacities. In line with the CCMA, operationalizing the NCCB, the CFSC and the TAC would strengthen sectoral coordination, the pooling of resources and consistency of climate data and reporting. To create space for climate policy discussions at the ministerial level, considerations might be given for making CFSC a body that convenes and makes coordinating arrangements. Several other coordination mechanisms might be set up -- the Climate Change and Environmental Protection Coordination Committee, responsible to monitor implementation of SPA10 – or the NDC National Climate Change Committee) and risk to drain down staff resources if synergies and mandates are not well mapped out.

88. There is room to institutionalize structures at central and sectoral agencies starting with the Treasury. To date, only few climate units have been embedded in agencies. The units are important for planning, coordination, resource mobilization and effective use of climate resources. The Department of Treasury might consider setting up a climate unit to support mainstreaming climate change considerations into fiscal policy formulation, taxation, expenditure planning, and financing and debt management (see Box 8). Climate change responsibilities could be also mainstreamed in the organizational structures of the departments. Climate units within each department should have clear tasks and serve a coordination function with other agencies. CCDA institutional set up is still aligned with its initial office structure and not with the structure needed for implementing the CCMA as an Authority. For an effective transformation, it would need to be accompanied with an increase in staffing and resources to support develop and implement effective climate policies and actions.

Box 7. Strengthening the Role of Ministries of Finance in Driving Climate Action

Ministries of Finance can mainstream climate into their three typical core functions:

Economic strategy and vision: using their responsibility for oversight or involvement in national development strategies, sector plans and capital investment planning to participate in the development of national climate strategies, greening national development and sector plans, shaping industrial and innovation strategies, and assessing investment needs for the transition—in partnership with relevant line ministries.

Fiscal policies and budget management: using their primary responsibility for fiscal policy, taxation, and budget planning and execution to design carbon taxation and new forms of environmental taxation, reform fossil fuel subsidies, introduce new fiscal incentives for green sectors, reform multi-annual expenditure frameworks and annual budgets, and green public investment and procurement strategies. The Ministry of Finance's central role in the budget formulation process is a particularly important entry point for driving climate action and investment.

Financial policy and regulation and oversight of the financial system: using their core responsibility for the regulation of state-owned banks and enterprises, sovereign wealth funds, financial institutions and debt markets, interfaces with central banks, and shareholdings and relationships with the international finance institutions and multilateral development banks to green the entire financial system, improve financial resilience and stability, and mobilize finance into sustainable investments. This can be achieved through frameworks for green bonds, catalyzing private capital, adaptation and disaster risk finance and insurance, and international climate finance—in partnership with central banks and the private sector.

To enhance these core functions, three capabilities are critical:

Leadership capability: strengthening the range of champions for climate action at the political and officials' level, strengthening the Ministry's vision, mission and mandate to drive climate action, and creating clear responsibilities and organizational structures for climate leadership.

Coordination capability: driving effective collaboration across government and with the private sector, civil society and international financial institutions, and multilateral platforms and processes supported by effective strategies for consultation and communication.

Human and analytical capability: ensuring dedicated staffing resources for climate action, upgrading expertise in climate policy, and revamping tools and analytical approaches for data collection and economic decision-making.

Source: Coalition of Finance Ministers for Climate Action.

D. Climate Finance

89. A large gap remains between NDC funding needs and available resources. PNG's financial requirements for NDC implementation are detailed in the Enhanced NDC Implementation Plan (2021-2030), the NDC Implementation Road Map for the Electricity Sector, and the NDC Implementation Road Map for the AFOLU Sector. It is estimated that over US\$1 billion will be needed over a 10-year period to achieve the Enhanced NDC targets. PNG has also received external support for climate change activities, benefiting from a total of 25 largely grant funded projects since 2017. Public expenditures on climate action are difficult to track but the amount suggests being small as evidenced by the small share of the total public investment. This shows that funding from all sources of climate finance, including from

the government, development partners and lenders, does not meet the level required to achieve the enhanced NDC, implement the NAP, and support a green transition.

Gaps and Opportunities

90. Establishing an environment conducive to scaling up climate finance is a key priority for the authorities. PNG has not fully tapped into the global climate finance pool. Available data indicates that PNG received only 9 percent (approximately US\$260 million) of the total international climate finance allocated to the Pacific region since 2015, significantly less than other countries on a per-capita basis. Similar to many countries, PNG does not have an accredited entity to access the Green Climate Fund. It needs to use regional organization to submit proposals, and subsequently competes for proposals with other countries in the region. The authorities are committed to remove barriers and mobilize climate finance. Key areas for reform include (i) building climate finance readiness, i.e. strengthening capacity to prepare and implement projects, (ii) creating a pipeline of bankable projects, (iii) leading coordination of development partners on funding opportunities and streamlining different climate financing sources and (iv) enhancing climate finance tracking and oversight under the leadership of the department of Treasury in close coordination with CCDA and the CFSC. Box 9 outlines potential fiscal policy options that can help incentivize private sector investment.

91. A more robust investment environment and clear signals to investors would be necessary to attract quality projects. The private sector has yet to play a significant role in meeting PNG's investment or finance needs. At present, most green capital flows come from public and donor finance, with only a small portion from private sources. Substantial efforts are needed to encourage both large- and small-scale private investments in key sectors such as renewable energy, energy efficiency, water resources, agriculture, and land-use and forestry. The set up of the Green Finance Window, together with the recently developed green taxonomy, provides an important opportunity to mobilize private sector funding. The Investment Promotion Act can be also instrumental in stimulating green and resilient investment activities that employ for instance new green and resilient technologies related to energy efficiency, renewable energy or data driven digital systems. Climate policies reducing the macro critical risks associated with climate change can also create an enabling environment to catalyze green foreign direct investment.

Box 8. Fiscal Policies to Incentivize Private Investment

The private sector must play a crucial role in financing climate mitigation investments in emerging markets and developing economies (EMDEs) due to limited fiscal space and challenging market conditions. Many EMDEs already struggle to attract private sector capital, even before accounting for barriers specific to climate finance. In some EMDEs, high political risks, legal and institutional uncertainties, and implementation risks further elevate financing costs. Additionally, the lack of investable climate project pipelines often hinders private capital deployment. A comprehensive mix of policies is necessary to create a favorable environment for private capital in EMDEs.

- Strong climate policies and commitments, such as legally enshrined national commitments to achieve net-zero emissions by a specified date, send a clear signal to private investors.
- Carbon pricing can effectively redirect capital flows toward low-carbon investments, but policymakers must complement it with additional measures (e.g strengthening of social safety nets) to unlock private climate finance in EMDEs.
- Environmental regulations can set standards for activities or technologies, thus promoting climate innovation and financing. Green subsidies for both the adoption of existing technologies and research and development of new technologies can accelerate the transition.
- Structural reforms and policies that aim to overcome fundamental investment barriers, enhance domestic resource mobilization, and attract private capital are essential. These include strengthening macroeconomic fundamentals, deepening financial markets, improving policy predictability, and fostering robust institutional and governance frameworks.
- Regulators in EMDEs should consider developing transition taxonomies, a valuable alignment tool for mobilizing the financing of green activities.
- Financial sector policies, such as climate-related disclosure requirements, taxonomies, and standards for sustainable financial instruments and products should incentivize the transition toward and financing of a low-carbon economy.
- Green and resilient public investment in infrastructure can complement private innovation and investment in low-carbon and adaptation technologies. A predictable pipeline of quality projects that directly support a country's climate objectives is necessary to attract private investors.
- Public-private risk sharing is crucial to fostering private climate investments in EMDEs. Financing structures that allow for pooling, diversification, and credit enhancements can help reduce the cost of private capital and attract a wide range of institutional investors.
- Expanded use of guarantees by multilateral development banks (MDBs) and donors can be an effective instrument to reduce real and perceived risks in EMDEs, thereby broadening the potential private investor base.
- Strengthening the climate information architecture—data, disclosures, and alignment approaches (including taxonomies)—is an important part of the policy mix. Investors rely on high-quality, reliable, and comparable data, which many EMDEs currently lack.

Source: IMF, Chapter 3, Financial Sector Policies to Unlock Private Climate Finance in Emerging Market and Developing Economies, IMF, Fiscal Monitor, 2023.

Recommendations

- Develop and adopt a long-term strategy that can guide NDCs, transition and climate finance.
- Ensure consistency between the Climate Change Management Act, the Non-Tax Revenue Administration Act (NTRAA) and the Excise Tariff Act and foster close collaboration with the Department of Treasury on climate policy and climate finance mobilization.
- Operationalize the CCMA's provision to establish the National Climate Change Board, Technical Advisory Committee, and the Climate Finance Steering Committee to support NDC coordination, implementation and monitoring.
- Establish a Climate Unit at the Treasury department to enhance climate informed policy development and resource mobilization for climate actions.
- Incentivize private investments in adaption and mitigation by (i) elaborating regulations for the promotion of climate change initiatives under the CCMA, (ii) provisions of incentives for green/climate investments in the Investment Promotion Act 2023, and (iii) elaborating regulations related to the development of green financial products and services as part of the Inclusive Green Finance Policy.
- Consider regulations assigning responsibilities for policy, coordination, planning and reporting for climate change to provincial governments.
- Strengthen governance arrangements for climate finance reporting.
- Strengthen regulatory framework related to agricultural sector financial inclusion (building on ongoing needs assessment and feasibility studies conducted).
- Ensure alignment of DMA 1983 update with ongoing efforts to strengthen decentralized planning, youth engagement and volunteerism, identifying effective channels to mainstream community-based DRM.
- Strengthen coordination between CCDA and DRM activities (e.g. related to climate risk/vulnerability assessments and early warning)

Annex I. Disaster Response Expense in 2024

- **East New Britain with Flood disaster** –the Government through National Disaster Centre supported the Provincial Disaster Committee with a funding of **K500,000**.
- **Oro Province with Flood disaster** – The Government through National Disaster Centre supported the Provincial Disaster Committee with a funding of **K1.0 million**.
- **East Sepik flood & Earthquake disasters** – The Government through National Disaster Centre supported Provincial Disaster Committee with logistics.
- **Morobe Province with Flood disaster** -The Government through National Disaster Centre supported Provincial Disaster Committee with a funding of **K2.0 million**.
- **Eastern Highlands with Flood disaster** - The Government through National Disaster Centre supported Provincial Disaster Committee with a funding of **K500,000**.
- **Simbu Province with Flood disaster** - The Government through National Disaster Centre supported Provincial Disaster Committee with a funding of **K1.0 million**.
- **Madang Province with Ramu flood disaster** - The Government through National Disaster Centre supported Provincial Disaster Committee with a funding of **K1.0 million**.
- **Jiwaka Province with Flood disaster**-- The Government through National Disaster Centre supported Provincial Disaster Committee with a funding of **K1.0 million**.
- **Western Highlands province with flood disaster** – The Government through National Disaster Centre supported Provincial Disaster Committee with a funding of **K1.0 million**.
- **Central Province with Flood and drought disasters** - The Government through National Disaster Centre supported Provincial Disaster Committee with a funding of **K500,000**.
- **Gulf Province Flood/King Tide disasters** – The Government through National Disaster Centre supported Provincial Disaster Committee with a funding of **K2.0 million**.
- **Western Province Flood disaster** – The Government through National Disaster Centre supported Provincial Disaster Committee with a funding of **K1.0 million**, through the Prime Minister with **K10.0 million** and the Ok Tedi Ltd with **K20.0 million**
- **Milne Bay Province with Drought disaster** – The Government through National Disaster Centre supported Provincial Disaster Committee with a funding of K200,000 paid to a supplier in Alotau.
- **Enga Province – Wapanamanda Flood/landslide disaster**. The Government through National Disaster Centre supported Provincial Disaster Committee with a funding of **K250,000**.
- **Enga - Mulitaka Landslide Disaster** - The Government through National Disaster Centre supported Provincial Disaster Committee with a funding of **K1.0 million** and through Prime Minister a total of **K20.0 million** while other funding support from other provincial and international donors are kept by Enga Provincial Disaster Committee.

Annex II. Climate Policy Assessment Tool

The IMF-World Bank (WB) Climate Policy Assessment Tool (CPAT) is a spreadsheet-based ‘model of models’. It allows for the rapid estimation of effects of mitigation policies for over 200 countries.⁶⁷

CPAT helps governments design and implement climate mitigation strategies. It allows for:

- **Quantification of many impacts...** This includes impacts on energy production, consumption, trade, and prices; emissions of local and global pollutants including reductions needed to achieve NDCs; GDP and economic welfare; revenues; industry incidence (across many sectors); household incidence (across deciles, urban vs. rural samples, and horizontal equity); and development co-benefits (local air pollution and health impacts). This allows for assessment of tradeoffs (e.g., among efficiency, equity, or administrative burden) and, hence, **tailoring of policy design to each country’s context**.
- **...for many climate mitigation policies...** CPAT can evaluate mitigation policies including carbon taxes, ETs, fossil fuel subsidy reform, energy price liberalization, electricity and fuel taxes, removals of preferential VAT rates for fuels, energy efficiency and emission rate regulations, feebates, clean technology subsidies, and, most importantly, combinations of these policies (‘policy mixes’).
- **...for many countries...** CPAT covers over 200 countries accounting for more than 95 percent of global GHG emissions. CPAT’s input data is complete and **there is no need for external data inputs**.
- **...in a transparent, user-friendly, and consistent framework.** Results are presented rapidly via a chart-driven interface, allowing for experimentation (and sensitivity analyses) in designing new policies or assessing existing proposals and quick incorporation of results into reports.

Additionally, CPAT contributes to national and global analysis by:

- **Emphasizing the importance of a ‘just transition’ through estimation of impacts on poverty, equity, and welfare across income groups and between urban and rural households.** It is increasingly recognized that mitigation policies should support vulnerable households. CPAT estimates impacts on households from changes in energy and non-energy prices, both across consumption deciles (vertical equity), within deciles (horizontal equity), and between urban and rural sub-groups.
- **Approximating the best available science.** CPAT is parametrized to be broadly in the mid-range of ex ante models and parameterized to ex post empirical literature. The model is streamlined, with transparent underlying parameters which are readily adjustable for sensitivity analyses.
- **Allowing for cross-country analysis, including through quantitative comparisons of all NDCs.** The model allows for consistent comparisons of mitigation ambition for over 200 countries, including all signatories of the landmark 2015 Paris Agreement (194 countries). Most signatories of the Paris Agreement have quantifiable emissions targets and CPAT converts these to a single, comparable metric (required emissions reductions vs. BAU).
- **Collating new, comprehensive datasets:** CPAT contains and contributes to new global datasets, including energy consumption and prices; GHGs; local air pollutants; price and income elasticities; environmental costs; and NDCs. It also includes comparable decile-level data on household consumption of energy and non-energy goods for 84 countries—one of the largest household budget survey (HBS) harmonization efforts to date. Lastly, CPAT includes new datasets from the IMF’s Climate Change Indicators Dashboard and spreadsheets accompanying IMF products.

⁶⁷ CPAT is being made available to governments for internal use – more details can be found at www.imf.org/cpat.

Annex III. Options for Recycling Carbon Tax Revenues

Instrument	Metric		
	Impacts on income distribution	Impact on economic efficiency	Administrative burden
General Revenue Uses			
Environmental investment	May disproportionately benefit low-income households (for example, if their vulnerability to natural disasters is reduced)	May be less efficient than broader uses of revenues	Modest
General investments	May disproportionately benefit low-income households (for example, if basic education, healthcare, and infrastructure provided)	Potentially significant	Modest
Universal transfers	Highly progressive (disproportionately benefits the poor relative to higher income)	Forgoes efficiency benefits	New capacity needed (but should be manageable)
Payroll tax	Benefits are largely proportional across working households	Improves incentives for formal work effort	Minimal
Personal income tax	Typically, benefits are skewed to higher-income groups	Improves incentives for formal work effort, and saving reduces tax sheltering	Minimal
Consumption tax	Largely proportional to households' consumption	Some improvements in incentives for formal work effort	Minimal
Corporate income tax	Benefits are skewed to higher-income groups	Improves incentives for investment	Minimal
Deficit reduction	Benefits accrue to future generations	Significant (lowers future tax burdens and macro-financial risk)	Minimal
Targeted assistance			
Means-tested cash, in-kind transfers	Effective in helping low-income groups if social safety nets are comprehensive	Efficiency impacts unclear but likely modest	Low, if builds on existing capacity, otherwise significant
Assistance for household energy bills	Provides partial relief for all households (for example, does not help with indirect pricing burden)	Modest reduction in environmental effectiveness	Low, if builds on existing capacity, otherwise significant

Source: IMF staff.