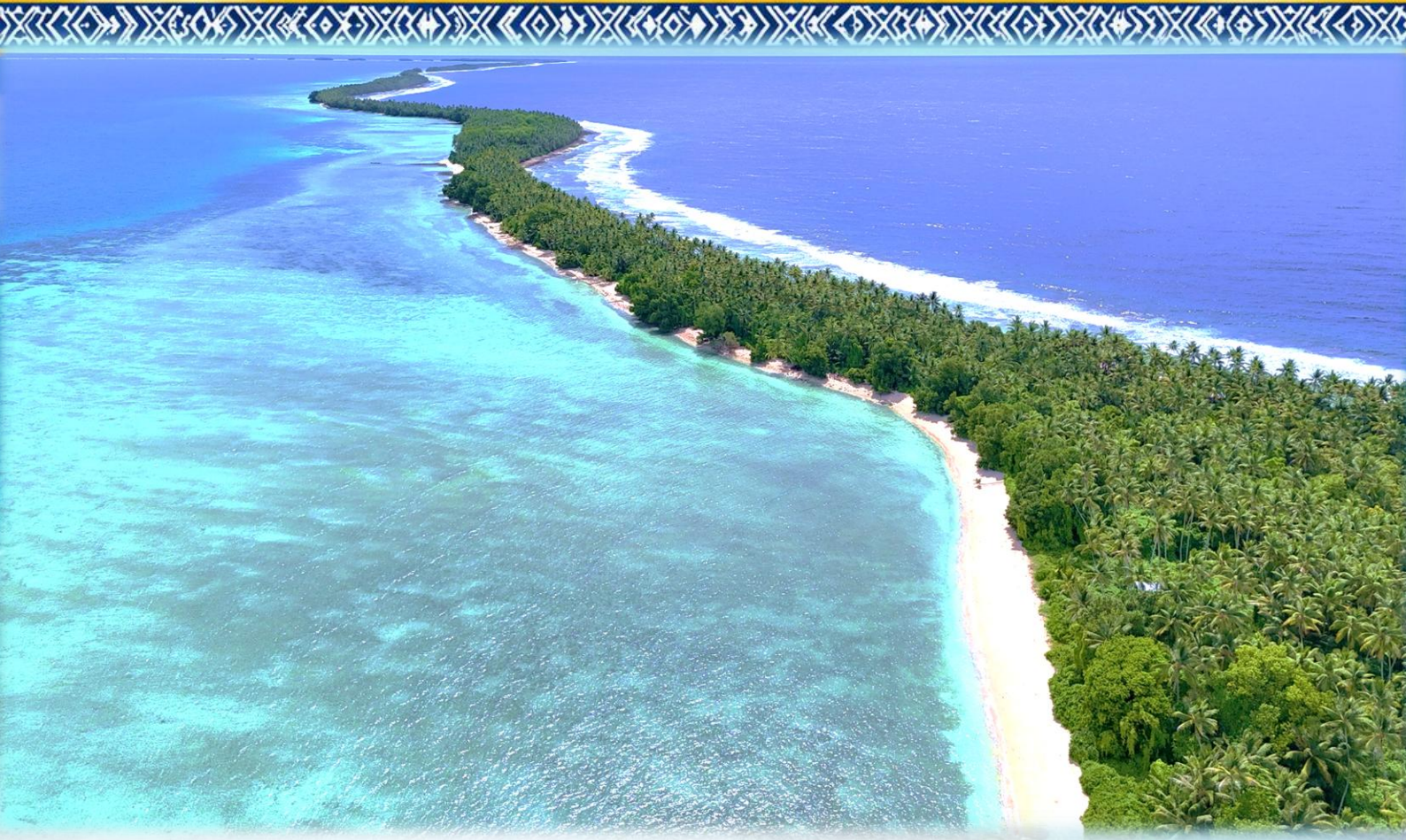




GOVERNMENT OF TUVALU



# TUVALU'S FIRST BIENNIAL TRANSPARENCY REPORT

UNITED NATIONS FRAMEWORK CONVENTION ON CLIMATE CHANGE

SEPTEMBER 2025



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## Foreword



With great pride, the Government of Tuvalu presents its First Biennial Transparency Report to the United Nations Framework Convention on Climate Change (UNFCCC). This report is a testament to our nation's commitment to transparency, accountability, and climate action.

As a small island developing state, Tuvalu is acutely vulnerable to the impacts of climate change, including sea-level rise, coastal erosion, and extreme weather events. We recognize the urgent need to strengthen our climate resilience and reduce greenhouse gas emissions.

This report provides a comprehensive overview of our climate change efforts, including our Nationally Determined Contribution (NDC) and our progress toward achieving its targets. It also highlights our efforts to adapt to the impacts of climate change, such as investing in coastal protection infrastructure and promoting sustainable land use practices.

We extend our sincere gratitude to the individuals and organizations that have contributed to the development of this report. Their expertise and dedication have been invaluable. We also acknowledge the support provided by the international community, particularly through climate finance and technology transfer.

By sharing our experiences and lessons learned, we hope to inspire other countries to take bold climate action. Together, we can build a more sustainable and resilient future for all.

A handwritten signature in blue ink, reading "Maina Vakafua Talia". The signature is fluid and stylized, with a long horizontal line extending to the right.

Honorable. Dr. Maina Vakafua Talia,

Minister for Home Affairs, Climate Change and Environment, Government of Tuvalu.

16 September 2025

## Abbreviations

|                   |                                                              |
|-------------------|--------------------------------------------------------------|
| AFOLU             | Agriculture, Forestry, and Other Land Use                    |
| AIFFP             | Australian Infrastructure Financing Facility for the Pacific |
| AOSIS             | Association of Small Island States                           |
| APEC              | Asia-Pacific Economic Cooperation                            |
| BTR               | Biennial Transparency Report                                 |
| CCD               | Climate Change Department                                    |
| CH <sub>4</sub>   | Methane                                                      |
| CIFs              | Climate Investment Funds                                     |
| CO                | Carbon Monoxide                                              |
| CO <sub>2</sub> e | Carbon Dioxide equivalent (also for CO <sub>2</sub> -eq)     |
| CSD               | Central Statistics Division                                  |
| CTFs              | Common Tabular Formats                                       |
| DOE               | Department of Energy                                         |
| EEZ               | Exclusive Economic Zone                                      |
| GCF               | Green Climate Fund                                           |
| GEF               | Global Environment Facility                                  |
| Gg                | Giga Gram                                                    |
| GGGI              | Global Green Growth Institute                                |
| GHG               | Greenhouse Gas                                               |
| GoT               | Government of Tuvalu                                         |
| GPG               | Good Practice Guidance                                       |
| GWP               | Global Warming Potential                                     |
| HFCs              | Hydro Fluorocarbons                                          |
| IPCC              | Intergovernmental Panel on Climate Change                    |
| IPPU              | Industrial Processes and Product use                         |
| LDC               | Least Developed Countries                                    |
| LPG               | Liquefied Petroleum Gas                                      |
| L-TAP             | Long-Term Adaptation Plan                                    |
| M&E               | Monitoring and Evaluation                                    |
| MNR               | Ministry of Natural Resources                                |
| MHACCE            | Ministry of Home Affairs, Climate Change and Environment     |
| MoF               | Ministry of Finance                                          |
| MPGs              | Modalities, Procedures, and Guidelines                       |
| MPUI              | Ministry of Public Works, Utility and Infrastructure         |
| MPWIW             | Ministry of Public Works, Infrastructure and Water           |
| MTECI             | Ministry of Transport, Energy, Communication and Innovation  |
| MTET              | Ministry of Transport, Energy and Tourism                    |
| N <sub>2</sub> O  | Nitrous Oxide                                                |
| NACCC             | National Advisory Council on Climate Change                  |
| NAP               | National Adaptation Plan                                     |
| NAPA              | National Adaptation Programme of Action                      |
| NASP              | National Agriculture Sector Plan                             |
| NCs               | National Communications                                      |
| NDC               | Nationally Determined Contributions                          |



|                 |                                                           |
|-----------------|-----------------------------------------------------------|
| NGOs            | Non-Governmental Organizations                            |
| NI              | National Inventory                                        |
| NIIP            | National Inventory Improvement Plan                       |
| NIR             | National GHG Inventory Report                             |
| NMVOC           | Non-methane volatile organic compounds                    |
| ODS             | Ozone Depleting Substance                                 |
| OPM             | Office of the Prime Minister                              |
| PIFS            | Pacific Islands Forum Secretariat                         |
| PMU             | Project Management Unit                                   |
| PPP             | Purchasing Power Parity                                   |
| PROP            | Tuvalu Pacific Islands Regional Oceanscape Program        |
| PSC             | Project Steering Committee                                |
| QA/QC           | Quality Assurance/Quality Control                         |
| R2R             | Ridge to Reef                                             |
| SIDS            | Small Island Developing States                            |
| SNC             | Second National Communication                             |
| SO <sub>2</sub> | Sulfur Dioxide                                            |
| SPREP           | Secretariat of the Pacific Regional Environment Programme |
| TAC             | Technical Advisory Committee                              |
| TCAP            | Tuvalu Coastal Adaptation Project                         |
| TEC             | Tuvalu Electricity Corporation                            |
| TNA             | Technology Needs Assessment                               |
| TNC             | Third National Communication                              |
| TTF             | Tuvalu Trust Fund                                         |
| TWGs            | Thematic Working Groups                                   |
| UNDP            | United Nations Development Programme                      |
| UNEP            | United Nations Environment Program                        |
| UNFCCC          | United Nations Framework Convention on Climate Change     |
| V&A             | Vulnerability and Adaptation                              |

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# Executive Summary

## Chapter 1: National Circumstances and Institutional Arrangements

Tuvalu, a small Polynesian island nation in the Pacific, faces unique challenges due to its geographic, climatic, and economic circumstances. Comprising nine low-lying islands with a total land area of just 26 square kilometres, Tuvalu's highest elevation is only 4.6 meters above sea level, making it one of the most vulnerable nations to climate change impacts such as sea-level rise, coastal erosion, and extreme weather events. With a population of approximately 10,645 during the 2017 Mini-census, the country also contends with limited freshwater resources, environmental degradation, and economic dependence on external aid and revenues from fishing licenses and its ".tv" internet domain.

Tuvalu's climate is characterized by a tropical pattern with distinct wet and dry seasons, heavily influenced by the South Pacific Convergence Zone. Annual rainfall varies across the islands, with the country being prone to cyclones and other climate-induced risks. The economy relies heavily on subsistence agriculture and fishing, with limited diversification due to geographic constraints. The Tuvalu Trust Fund, fishing licenses, and the ".tv" domain provide critical revenue streams, while development strategies such as the "Te Kakeega" and "Te Kete" National Strategies focus on building economic resilience and improving living standards.

To address climate challenges, Tuvalu has established robust institutional arrangements. The Climate Change Department (CCD), under the Ministry of Home Affairs, Climate Change and Environment (MHACCE), serves as the focal point for implementing climate-related projects. At the same time, the National Advisory Council on Climate Change (NACCC) coordinates interagency efforts and advises the Prime Minister on climate strategies. The country has also formed thematic working groups to address specific aspects of climate change, including GHG inventories, vulnerability assessments, and mitigation analysis.

Despite significant challenges, Tuvalu has progressed in adaptive measures such as promoting renewable energy, developing sustainable agriculture and fisheries, and building cemented tar pits to combat soil salinity. Training programs and stakeholder consultations have strengthened local capacity for climate change mitigation, adaptation, and reporting. The institutional frameworks and national strategies outlined in this chapter highlight Tuvalu's commitment to building resilience, meeting international obligations, and pursuing sustainable development.

## Chapter 2: National inventory report of anthropogenic emissions by sources and removals by sinks of GHGs

This chapter presents Tuvalu's National Greenhouse Gas (GHG) Inventory as part of its First Biennial Transparency Report (BTR) under the UNFCCC, detailing emissions by sources and removals by sinks for the year 2023 and time series data from 2010 and 2015–2023. Prepared using the 2006 IPCC Guidelines, the inventory provides a comprehensive account of Tuvalu's emissions trends, key contributing sectors, and mitigation challenges.

Tuvalu, as a developing country Party under the UNFCCC, has utilized the Modalities, Procedures, and Guidelines (MPGs)' flexibility provisions to report its GHG emissions inventory in its BTR. The inventory covers a consistent time series from the NDC baseline year of 2010 through 2023, aligning



with its Updated NDC (2022) and meeting the requirement to report data from at least 2020 onwards. The latest reporting year, 2023, is within three years of the BTR submission. This inventory uses the best available data and IPCC methodologies, ensuring transparency, accuracy, and alignment with the MPGs while addressing capacity constraints.

In 2023, Tuvalu's total GHG emissions were estimated at 25.89 kt CO<sub>2</sub>e, marking a 15% increase since 2010. The inventory excludes emissions of HFCs, PFCs, and SF<sub>6</sub> due to negligible applications in Tuvalu. Key GHGs include CO<sub>2</sub> (61%), CH<sub>4</sub> (33%), and N<sub>2</sub>O (6%). The three major emitting sectors are Energy, Agriculture, and Waste, which together highlight the country's dependence on fossil fuels, livestock-based agriculture, and underdeveloped waste management systems.

The Energy Sector was the largest contributor to national emissions, accounting for 61% (15.81 kt CO<sub>2</sub>e) of the total. Emissions primarily resulted from fossil fuel combustion for electricity generation, transport, and residential activities. Despite Tuvalu's commitment to achieving 100% renewable energy by 2030, the country remains reliant on imported petroleum. Electricity generation contributed 28% of national emissions, while transport accounted for 27%, with road transport dominating the subsector.

The Agriculture Sector was the second-largest emitter, contributing 33% (8.53 kt CO<sub>2</sub>e). Methane emissions from manure management and enteric fermentation were the primary sources, with nitrous oxide emissions arising from managed soils. Emissions from agriculture have declined over time, attributed to a reduction in livestock populations. The need for modern manure management systems offers opportunities to further reduce emissions.

The Waste Sector, responsible for 6% (1.56 kt CO<sub>2</sub>e) of emissions, faced challenges related to open dumpsites and untreated wastewater. Methane emissions stemmed from the anaerobic decomposition of solid waste, while nitrous oxide emissions were linked to untreated wastewater discharge. Improvements in solid waste management and the establishment of wastewater treatment facilities are critical to mitigating these emissions.

Tuvalu's GHG inventory, prepared by the CCD and TWG, involves institutional collaboration and established processes for data collection, QA/QC, and archiving. However, operationalizing a robust national system is significantly hampered by resource and capacity limitations. Manual data collection continues to lead to data gaps, particularly in agriculture and waste, impacting accuracy. The lack of dedicated inventory software, coupled with reliance on spreadsheets for some data and limited hardware (basic desktop computers), restricts analysis and QA/QC capabilities. These challenges are compounded by persistent issues such as limited activity data, lack of country-specific emission factors, and uncertainty in emissions estimation, particularly in the energy, agriculture, and waste sectors.

A GHG data repository, developed with SPREP's support through the Regional Pacific NDC Hub, has been established to aid in data collection and management and aims to assist Tuvalu in fulfilling UNFCCC reporting guidelines and meeting ETF requirements, including the use of the 2006 IPCC Guidelines, its effectiveness is currently limited by the resource and capacity constraints. Capacity building remains crucial to maximize the repository's utility and ensure its long-term sustainability in supporting Tuvalu's reporting obligations under the Paris Agreement.

The inventory underscores Tuvalu's progress in addressing emissions and aligning with its Nationally Determined Contributions (NDCs). It provides a robust basis for climate policy, capacity building, and future inventories while identifying critical areas for improvement, such as data systems - data systems



are hampered by data collection challenges (especially in agriculture and waste), limited tools (reliance on spreadsheets due to lack of dedicated software), restricted hardware, and the need for capacity building- renewable energy integration, and waste infrastructure. While this chapter aims to track emissions and guide climate strategies, its effectiveness is limited by existing data and resource constraints.

## Chapter 3: Tracking Progress in Implementing and Achieving Tuvalu's NDC

This chapter outlines Tuvalu's progress in implementing its Nationally Determined Contribution (NDC) under Article 4 of the Paris Agreement, with a focus on mitigation strategies, institutional arrangements, and monitoring frameworks. As a small island developing state (SIDS) and Least Developed Country (LDC), Tuvalu faces significant challenges due to its geographic isolation, limited natural resources, and high vulnerability to climate change. Despite these constraints, Tuvalu remains committed to ambitious climate goals, including achieving 100% renewable energy in the electricity sector by 2030 and a zero-carbon development pathway by 2050.

Tuvalu's institutional framework, led by the Climate Change Department (CCD), facilitates transparent, participatory, and effective NDC implementation. A multi-tier governance structure, including a Project Steering Committee, Technical Advisory Committee, and Thematic Working Groups, ensures coordinated action across key sectors such as energy, transport, agriculture, and waste. These efforts are supported by robust monitoring and evaluation mechanisms, including Common Tabular Formats (CTFs) for transparent reporting and a centralized climate information archiving system under development.

The energy sector is a key focus of Tuvalu's mitigation strategy. Significant progress has been made in integrating renewable energy, with outer islands achieving 41% solar-based electricity generation and Funafuti reaching 6%, with an overall 14% in the whole of Tuvalu. Tuvalu is on track to meet its target of 100% renewable energy by 2030. Efforts to enhance energy efficiency are underway, although challenges in scaling programs to residential and commercial sectors remain. Transport sector initiatives include transitioning to electric vehicles (EVs), replacing inefficient maritime engines, and introducing shore-side electrical supplies for docked vessels, though these programs require accelerated implementation to meet 2030 goals.

Agriculture, forestry, and other land use (AFOLU) emissions, primarily from livestock and soil management, account for 33% of national GHG emissions. Mitigation measures include improved manure management and sustainable farming practices, with plans to scale up biogas projects for methane reduction. The waste sector contributes 6% of emissions, driven by poor landfill management and methane from waste decomposition. Tuvalu's Integrated Waste Policy and Action Plan targets these challenges with initiatives to improve waste segregation, recycling, and methane capture.

Tuvalu's updated NDC (2022) sets ambitious, sector-specific targets, including a 60% reduction in total energy sector emissions from 2010 levels by 2030. These targets are supported by an NDC Implementation Roadmap and Investment Plan, which identifies six key mitigation projects across the energy and transport sectors with an estimated investment need of USD 19.85 million by 2030. The roadmap emphasizes the importance of stakeholder engagement, capacity building, and international cooperation in achieving Tuvalu's climate goals.

This chapter underscores Tuvalu's proactive approach to climate action, balancing ambitious mitigation goals with the challenges of limited resources and high vulnerability. It highlights the importance of



sustained investments, capacity enhancements, and international partnerships to ensure Tuvalu meets its NDC commitments while fostering resilience and sustainable development.

## Chapter 4: Climate Change Impacts and Adaptation Under Article 7

Chapter 4 of Tuvalu's First Biennial Transparency Report (BTR) provides a comprehensive overview of the nation's vulnerability to climate change, the impacts it is experiencing, and the adaptation efforts underway in accordance with Article 7 of the Paris Agreement. Tuvalu's unique biogeophysical and socioeconomic context significantly exacerbates its susceptibility to a range of climate-related risks. The nation's low-lying atolls, with a maximum elevation of only 4.6 meters above sea level, render it exceptionally vulnerable to the impacts of sea-level rise, coastal erosion, and extreme weather events, posing an existential threat to its very existence.

These risks are further compounded by Tuvalu's economic reliance on climate-sensitive sectors such as fisheries, its dependence on remittances, and its reliance on international aid. The health and productivity of vital coastal ecosystems, including coral reefs and mangroves, which provide crucial livelihoods and natural coastal protection, are also severely threatened by ocean warming and acidification.

The chapter details the specific climate change impacts already being experienced by Tuvalu. Sea-level rise is inundating coastal areas, eroding shorelines, and contaminating freshwater resources. Increased cyclone intensity and frequency are damaging infrastructure, disrupting essential services, and displacing communities. Ocean warming and acidification are degrading coral reefs and impacting fish stocks, threatening food security and livelihoods. Changes in rainfall patterns are exacerbating water scarcity in some areas and increasing the risk of flooding in others.

In response to these challenges, Tuvalu has prioritized adaptation across key sectors. Coastal zone management strategies include the construction of seawalls and other coastal defences to protect vulnerable infrastructure and communities. Mangrove restoration projects aim to enhance natural coastal protection and provide valuable ecosystem services. Efforts to improve water security include investments in desalination plants to supplement dwindling freshwater supplies and the promotion of water conservation measures. Climate-resilient agriculture initiatives are being explored to enhance food security in the face of changing climatic conditions. Ecosystem restoration projects are underway to protect and rehabilitate degraded ecosystems, recognizing their critical role in providing ecosystem services and buffering the impacts of climate change.

The chapter also highlights the institutional framework supporting Tuvalu's adaptation efforts. The Climate Change Department (CCD) plays a central role in coordinating and implementing adaptation activities. The National Advisory Council on Climate Change (NACCC) provides policy guidance and facilitates inter-ministerial coordination. These institutions are instrumental in integrating climate change considerations into national planning and budgeting processes.

Despite the progress made, Tuvalu faces significant barriers to effective adaptation. Limited financial resources pose a major constraint, hindering the implementation of planned adaptation measures. Technical capacity remains a challenge, requiring ongoing training and support to develop the necessary expertise to design and implement effective adaptation strategies. Tuvalu's geographic constraints, including its small size, dispersed islands, and limited land area, further complicate adaptation efforts. The chapter emphasizes the critical need for sustained and predictable international support, including financial resources, technical assistance, and capacity building, to address these challenges. Enhanced community engagement is also recognized as essential to ensure that adaptation measures are locally appropriate and effectively address community needs. Strengthened governance frameworks are needed to ensure effective coordination, transparency, and accountability in the implementation of adaptation



initiatives. The chapter concludes by reiterating Tuvalu's commitment to adapting to the impacts of climate change and emphasizes the urgency of international cooperation to support its efforts.

## **Chapter 5: Financial, Technological, and Capacity Support Needed and Received under Articles 9–11 of the Paris Agreement**

Tuvalu, a small island nation in the Pacific, is on the front lines of the global climate crisis. With a total land area of just 26 square kilometres and an average elevation of only two meters above sea level, the country is highly susceptible to the impacts of climate change, particularly rising sea levels, coastal erosion, saltwater intrusion, and extreme weather events. These threats have severe implications for Tuvalu's infrastructure, freshwater resources, agriculture, fisheries, and public health, making climate resilience a critical national priority.

Tuvalu's climate response is guided by a series of strategic documents, including its updated Nationally Determined Contribution (NDC), the Te Kete National Strategy for Sustainable Development (2021–2030), and the Te Vaka Fenua o Tuvalu: National Climate Change Policy (2020–2030). These policies emphasize achieving net-zero emissions by 2050, enhancing resilience across key sectors, and integrating climate adaptation and mitigation into national development plans. Priority actions include transitioning to 100% renewable energy, improving energy efficiency, strengthening coastal protection, and enhancing disaster risk management.

To implement these strategies, Tuvalu relies heavily on international climate finance, technology transfer, and capacity-building support. Key projects, such as the Tuvalu Coastal Adaptation Project (TCAP) and the Ridge to Reef (R2R) initiative, have been funded through partnerships with the Green Climate Fund (GCF), Global Environment Facility (GEF), and other bilateral and multilateral donors. However, challenges remain, including limited access to sustainable financing, insufficient technical capacity, and the need for enhanced coordination across government institutions and stakeholders.

Institutional arrangements, led by the Ministry of Finance and the Department of Climate Change, play a pivotal role in coordinating climate actions and aligning them with international frameworks like the Paris Agreement. Despite progress, Tuvalu faces significant constraints in project implementation due to limited human resources, technical expertise, and data availability. Addressing these gaps requires a multifaceted approach, including investment in renewable energy, sustainable infrastructure, climate-smart agriculture, and improved water resource management.

Tuvalu's future resilience depends on securing predictable and adequate climate finance, fostering private sector engagement, and leveraging traditional knowledge alongside modern technological innovations. Enhancing community awareness and participation in climate action, particularly in outer islands, is essential for building a sustainable and inclusive response to the ongoing climate crisis. The government's long-term vision, encapsulated in initiatives such as the Long-Term Adaptation Plan (L-TAP), underscores the need for comprehensive and integrated solutions to safeguard Tuvalu's sovereignty, culture, and environment in the face of escalating climate risks.



# 1 Chapter 1 - National Circumstances and Institutional Arrangements

## 1.1 Introduction

Tuvalu, formerly the Ellice Islands, is a small Polynesian island nation in the Pacific Ocean, located midway between Hawaii and Australia. Its nearest neighbours are Kiribati, Samoa, and Fiji. Tuvalu comprises four reef islands and five true atolls<sup>1</sup>, with a total land area of 26 square kilometres, making it the fourth smallest country in the world. The population of Tuvalu was 10,645 during the 2017 census, ranking it the second least-populated sovereign state globally.

Tuvalu's terrain consists of low-lying coral atolls, with the highest elevation at only 4.5 meters above sea level, making it highly vulnerable to rising sea levels. Funafuti is the largest atoll, with an annular reef rim surrounding a central lagoon. The nation faces environmental challenges such as poor soil, a lack of reliable freshwater, and vulnerability to king tides, which could submerge the islands in the future. Tuvalu experiences westerly gales and heavy rain from November to March, while tropical temperatures are moderated by easterly winds from March to November. In this chapter of the first Biennial Transparency Report (BTR), Tuvalu explores its national context, delving into crucial aspects across several distinct sections to depict the country's current circumstances and pertinent considerations. The report offers detailed insights, incorporating relevant subsections as needed.

## 1.2 Administrative Structure

Tuvalu is a constitutional monarchy and parliamentary democracy that gained independence from the United Kingdom on October 1, 1978. The government is based on the constitution enacted on the same day. The country operates with a unicameral parliament, known as the House of Assembly, which comprises 16 members elected every four years. The head of government, the Prime Minister, is elected by a majority of the members of parliament and leads the cabinet. There are no formal political parties in Tuvalu, and members of parliament tend to form informal groupings while maintaining close ties with their island constituencies.

**Head of State:** His Majesty King Charles III, represented by the Governor General, His Excellency Reverend Sir Tofiga Vaevalu Falani.

**Prime Minister:** The head of government, chosen by a majority of the parliament members, who also appoints the cabinet.

**Parliament:** The unicameral House of Assembly, consisting of 16 members responsible for legislation and government oversight, with members elected every four years.

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<sup>1</sup> An atoll is a ring-shaped coral reef, often surrounding a lagoon. The reef may emerge from the sea as low-lying islands, typically with a maximum elevation of only a few meters above sea level. Tuvalu, an atoll nation comprised of nine islands, exemplifies this vulnerability. Its highest point reaches only 4.6 meters above sea level (Government of Tuvalu, *Second National Communication to the United Nations Framework Convention on Climate Change*, 2015), making it exceptionally susceptible to the impacts of sea-level rise, coastal erosion, and extreme weather events. This low-lying nature, combined with the limited land area, poses significant challenges for adaptation and even threatens the very existence of these island nations. The other two atoll nations in the Pacific are the Marshall Islands and Kiribati.

**Judicial Branch:** The judicial system includes the High Court and eight Island Courts with limited jurisdiction. Decisions from the High Court can be appealed to the Court of Appeal in Fiji.

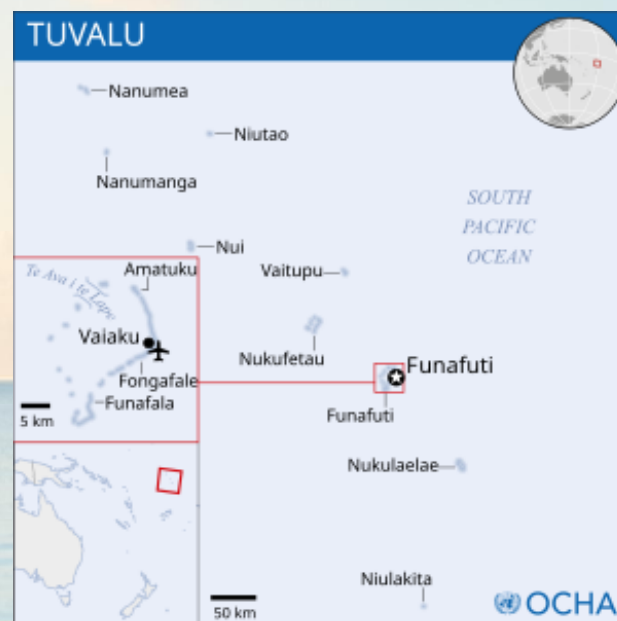
**Political Structure:** Tuvalu does not have organized political parties; instead, members of parliament form informal alliances and maintain strong connections with their local island communities.

**Latest Election:** The most recent general election took place on January 26, 2024, with the final results announced on January 27, 2024. The new government, led by Prime Minister Feleti Teo OBE, was established on February 28, 2024.

**Languages:** Tuvaluan and English.

**Official Currency:** The Tuvaluan dollar and the Australian dollar are both used.

**Figure 1: Map of Tuvalu**



### 1.3 Geography

The archipelago of Tuvalu lies between latitudes 5° to 11° south and longitudes 176° to 180° east, approximately 1,100 km north of Fiji and 1,400 km south of Kiribati. It consists of nine islands stretching over 579 km, with a total land area of 26 km<sup>2</sup> and an Exclusive Economic Zone (EEZ) covering 719,174 km<sup>2</sup> of ocean. The islands have an average height of less than 3 meters above sea level, with the highest point at 4.6 meters in Niulakita. Tuvalu's islands include five classic "true atolls" (Nanumea, Nui, Nukufetau, Funafuti, and Nukulaelae), three raised limestone islets without central lagoons (Niutao, Nanumaga, and Niulakita), and one intermediate island, Vaitupu, which is the largest with a land area of 5.6 km<sup>2</sup>. The islands' low elevation, with most areas only 1 to 2 meters above sea level, makes them vulnerable to rising sea levels, coastal erosion, and other climate-related impacts.

The geographic isolation of Tuvalu is exacerbated by its remoteness and limited inter-island transportation. Only two islands, Funafuti and Nukufetau, have natural harbours for oceangoing ships. Climate change and human activities are stressing foraminifera, the marine organisms crucial to the islands' formation, further increasing the vulnerability of Tuvalu to environmental threats. Additionally, there are no rivers on the islands, and groundwater is scarce.



## 1.4 Climate

Tuvalu has a tropical climate characterized by two distinct seasons: a wet season from November to April and a dry season from May to October. This seasonal cycle is strongly influenced by the South Pacific Convergence Zone. The southern islands of Tuvalu receive an average annual rainfall of 3,400 mm, while the northern islands average 2,900 mm. Temperatures remain relatively stable throughout the year, ranging from 25°C to 30°C. The tropical cyclone season occurs during the wet season, from November to April.

Tuvalu is particularly vulnerable to cyclone-generated winds, storm surges and swells, as well as spring tides. Since 1993, Tuvalu's sea level has been rising by approximately 5 mm per year.

## 1.5 Population

Tuvalu's population, as meticulously documented in the 2017 Census, totalled 10,645 (this sums up the 10,507 permanent residents and 138 visitors or non-residents), a figure that underscores its position as the world's second least-populated sovereign nation. This census provides a critical baseline for understanding Tuvalu's demographic makeup at that specific moment in time. The nation's total land area is approximately 26 sq. km (10 sq. mi), resulting in a population density of roughly 409 people per sq. km (1,059 per sq. mi). This relatively high density, especially given the limited land resources and the islands' vulnerability to the impacts of climate change, particularly rising sea levels, presents significant challenges for sustainable development, resource management, and long-term habitability. The delicate balance between population size and environmental carrying capacity is a crucial consideration for Tuvalu's future.

The table below presents data on Tuvalu's population, growth, and density across its islands and nationally.

**Table 1: Tuvalu's population, growth, and density across its islands and nationally**

| ISLAND                             | POPULATION |       |        |        | ANNUAL GROWTH RATE* |      |      | DENSITY |       |       |       |
|------------------------------------|------------|-------|--------|--------|---------------------|------|------|---------|-------|-------|-------|
|                                    | 1991       | 2002  | 2012   | 2017   | 2002                | 2012 | 2017 | 1991    | 2002  | 2012  | 2017  |
| FUNAFUTI                           | 3,086      | 3,962 | 5,436  | 6,320  | 2.3                 | 3.2  | 3.0  | 1,102   | 1,415 | 1,941 | 2,360 |
| OUT ISLANDS                        | 5,695      | 5,397 | 5,204  | 4,187  | -0.5                | -0.4 | -4.3 | 250     | 237   | 228   | 178   |
| Nanumea                            | 893        | 855   | 612    | 512    | -0.4                | -3.3 | -3.6 | 229     | 219   | 157   | 146   |
| Nanumaga                           | 714        | 710   | 551    | 491    | -0.1                | -2.5 | -2.3 | 255     | 254   | 197   | 167   |
| Niutao                             | 884        | 817   | 694    | 582    | -0.7                | -1.6 | -3.5 | 354     | 327   | 278   | 248   |
| Nui                                | 657        | 610   | 729    | 610    | -0.7                | 1.8  | -3.6 | 235     | 218   | 260   | 170   |
| Vaitupu                            | 1,286      | 1,310 | 1,542  | 1,061  | 0.2                 | 1.6  | -7.5 | 230     | 234   | 275   | 197   |
| Nukufetau                          | 826        | 701   | 666    | 597    | -1.5                | -0.5 | -2.2 | 275     | 234   | 222   | 178   |
| Nukulaelae                         | 361        | 392   | 364    | 300    | 0.7                 | -0.7 | -3.9 | 201     | 218   | 202   | 157   |
| Niulakita                          | 74         | 2     | 46     | 34     | -32.8               | 31.4 | -6.0 | 185     | 5     | 115   | 81    |
| TUVALU                             | 8,781      | 9,359 | 10,640 | 10,507 | 0.6                 | 1.3  | -0.3 | 343     | 366   | 416   | 402   |
| *Annual average rate of growth (%) |            |       |        |        |                     |      |      |         |       |       |       |

The urban drift of people from the outer islands is constantly increasing from 2002 to 2017 as shown in the below Figures. The main reason for this is the fact of seeking job opportunities as well as education at the Fetuvalu High School and the USP center.

**Figure 2: Population of Funafuti by home island, 2002 -2017**

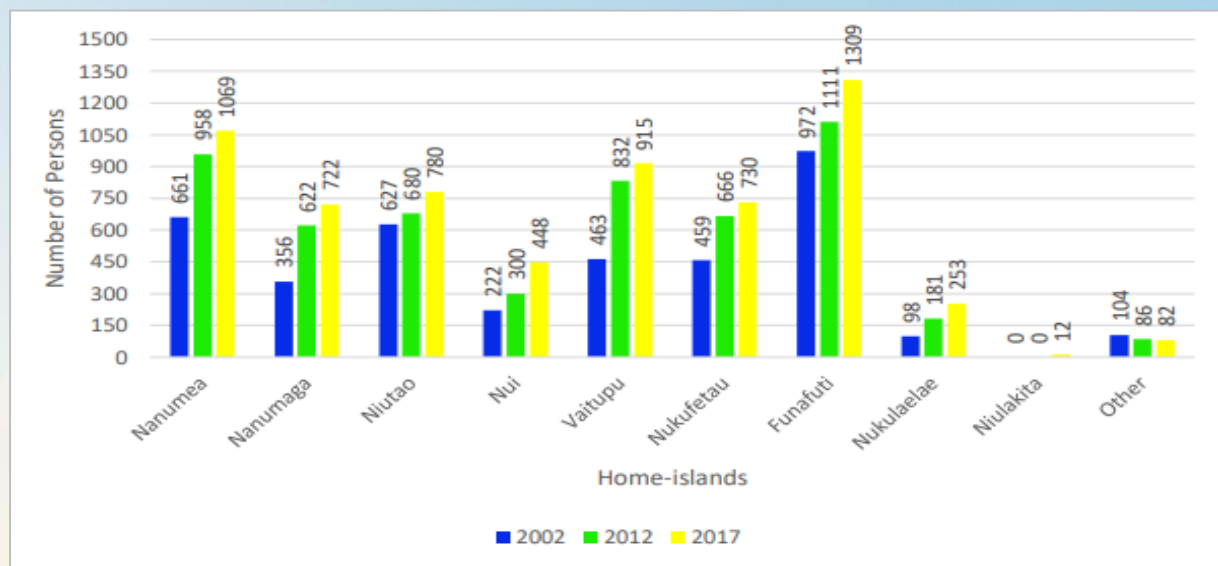
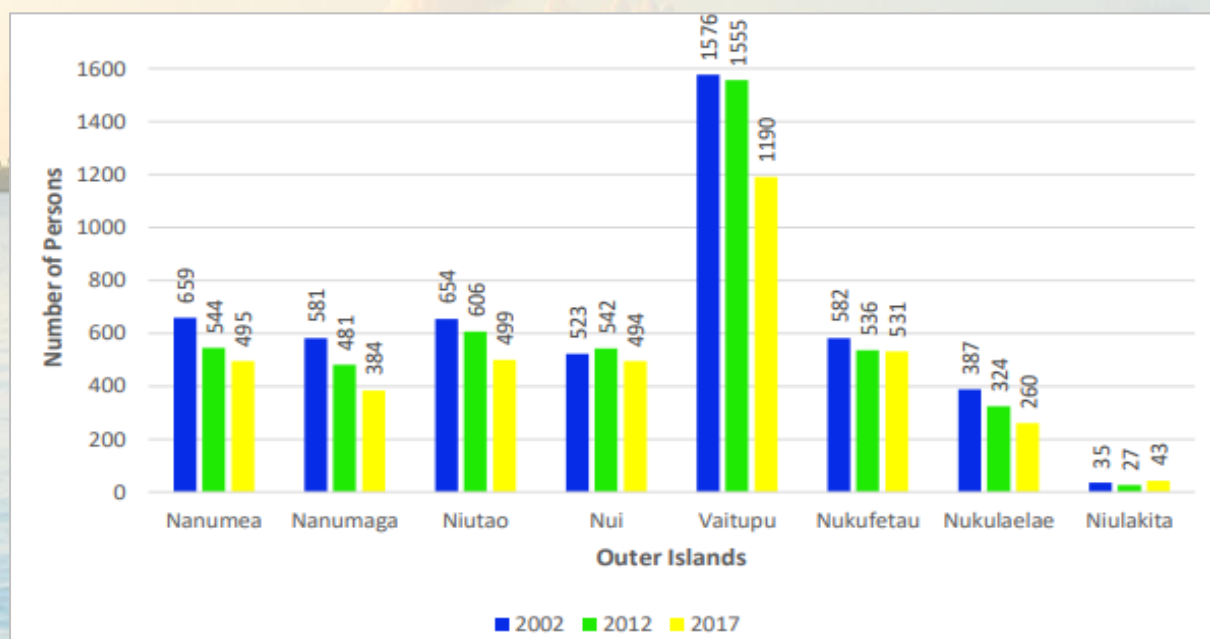


**Figure 3: Population at the Outer Islands, 2002 – 2017**





The population pyramid for Tuvalu in 2024 illustrates the age and gender distribution of its 10,954 residents. It displays age groups from 0–4 years to 70+ years, with males represented on the left and females on the right. The pyramid shows a youthful population, with a higher number of young individuals compared to older age groups. As age increases, the population gradually declines, indicating fewer elderly people. The balanced shape in younger and middle-aged groups suggests steady birth rates. At the same time, the narrowing at older ages reflects lower life expectancy and higher mortality rates in the senior population.

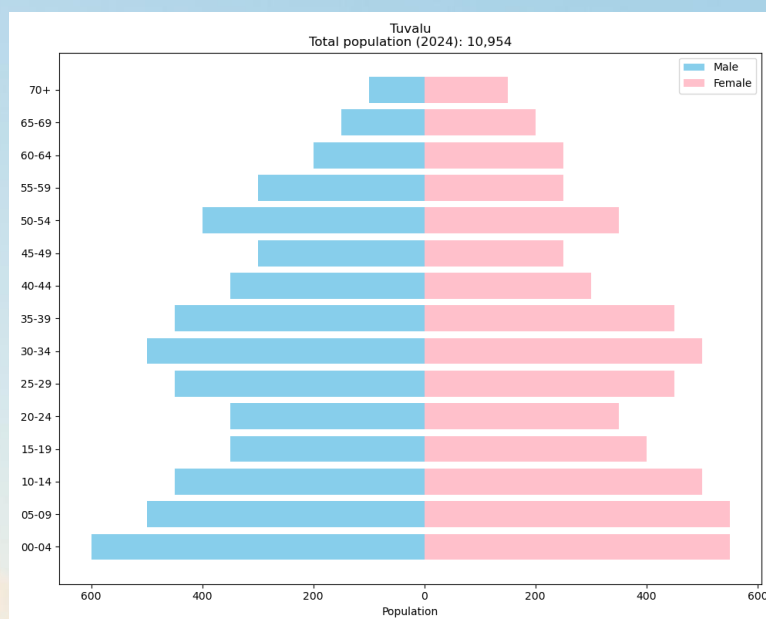


**Figure 4: Population Pyramid.** Source: Statistics for Development Division

Population projections for Tuvalu estimate a gradual population increase over the next 20 years. Tuvalu's population is forecasted to reach 13,300 by 2025 and 15,600 by 2035 (SPC, 2013). The expected growth in population will push the population density from 421 persons per km<sup>2</sup> in 2012 to 600 persons per km<sup>2</sup> in 2035.

## 1.6 Economy

Tuvalu, classified as an upper-middle-income Pacific Island economy, faces the dual challenges of limited natural resources and environmental fragility. Its economy is heavily reliant on external support, primarily foreign aid and remittances, with significant contributions from international donors. The Tuvaluan dollar, pegged to the Australian dollar, provides a degree of monetary stability. Subsistence agriculture and fishing remain central to local livelihoods. The Tuvalu Trust Fund (TTF), a managed overseas investment fund initially capitalized at A\$27 million at independence and now valued at A\$76 million, contributes approximately 11% of the annual government budget, providing a buffer against fluctuating income from fishing and royalties from the ".tv" internet domain. Tourism, though limited by remoteness and high travel costs, primarily caters to government officials and aid workers. Government revenue streams include stamp and coin sales, fishing licenses, TTF income, and the commercially valuable ".tv" domain, which has funded key infrastructure projects. Tuvalu's national development strategy, "Te Kakeega," prioritizes sustainable development goals to enhance living standards and build economic resilience.

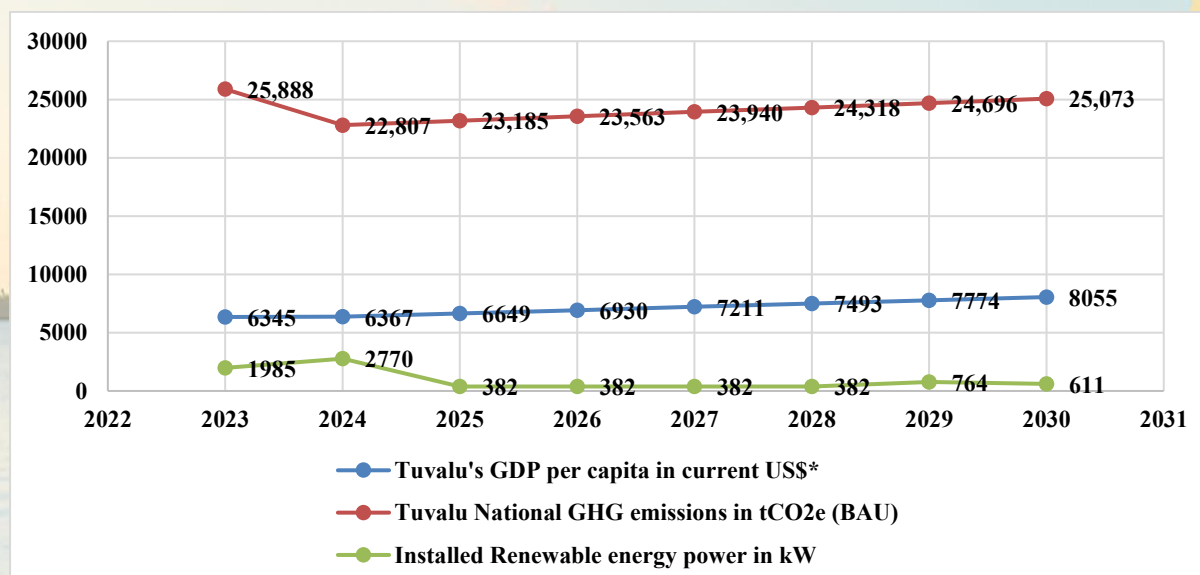
In 2022, Tuvalu's GDP reached \$61.3 million in purchasing power parity (PPP), with a modest growth rate of 0.677%, reflecting the constraints of its small size and limited economic diversification. This economic landscape is shaped by the interplay of environmental vulnerabilities, dependence on external assistance, and the persistent challenge of decoupling economic progress from environmental impact. This challenge is particularly pertinent in the context of Tuvalu's commitment to achieving 100% renewable energy by 2030. A thorough analysis of Tuvalu's economic landscape is crucial for understanding the feasibility and impact of its renewable energy targets. GDP per capita has shown a general upward trend, increasing from US\$3,025 in 2010 to US\$6,345 in 2023 (World Bank Data). However, this growth has not consistently translated into a reduction in GHG emissions.

**Table 2: Tuvalu's Economic, GHG emissions and Renewable energy trends till 2030**

| Year | Tuvalu's GDP per capita in current US\$* | Tuvalu National GHG emissions in tCO <sub>2</sub> e (BAU) | Installed Renewable energy power in kW |
|------|------------------------------------------|-----------------------------------------------------------|----------------------------------------|
| 2023 | 6345                                     | 25,888                                                    | 1985                                   |
| 2024 | 6367                                     | 22,807                                                    | 2770                                   |
| 2025 | 6649                                     | 23,185                                                    | 382                                    |
| 2026 | 6930                                     | 23,563                                                    | 382                                    |
| 2027 | 7211                                     | 23,940                                                    | 382                                    |
| 2028 | 7493                                     | 24,318                                                    | 382                                    |
| 2029 | 7774                                     | 24,696                                                    | 764                                    |
| 2030 | 8055                                     | 25,073                                                    | 611                                    |

\* This GDP has been forecasted linearly based on the World Bank's available Data till 2023.

**Figure 5: Tuvalu's Economic, GHG emissions and Renewable energy trends graph till 2030**



While the nation is actively pursuing its renewable energy target, with installed capacity reaching 1,985 kW in 2023 and further expansion planned, the available data offers insights into the complex dynamics of decoupling economic growth and GHG emissions, highlighting areas for further exploration and learning. Although GDP per capita has increased, GHG emissions have fluctuated, suggesting that economic activity and energy demand continue to influence the nation's carbon footprint. The projected emissions pathway, even with increased renewable energy generation, suggests that achieving full decoupling will require additional, targeted interventions. These include but are not limited to: (1) Energy Efficiency: Implementing measures to improve energy efficiency across all sectors. (2) Sustainable Transportation: Promoting low-carbon transportation options. (3) Waste Management: Implementing sustainable waste management practices. (4) Economic Diversification: Diversifying the economy to reduce reliance on high-emission sectors. (5) Data Collection and Monitoring: Strengthening data collection and monitoring systems. Tuvalu's experience highlights the need for a holistic and integrated approach to sustainable development, combining investments in renewable energy with broader efforts to promote resource efficiency, reduce consumption, and foster a circular economy. International cooperation and financial assistance are crucial for Tuvalu to achieve its ambitious climate and development goals. Further research and analysis are needed to fully understand



the complex relationship between economic development, GHG emissions, and renewable energy deployment in Tuvalu, enabling evidence-based policymaking and effective implementation of sustainable development strategies.

## 1.7 Agriculture

Agriculture in Tuvalu is predominantly subsistence-based, focusing on food provision for the local population. The country's agricultural export opportunities are limited due to its small land area, geographical constraints, and challenges related to freshwater scarcity and climate change. However, Tuvalu can explore potential agricultural exports, particularly in coconut products, fresh produce, and processed seafood. The staple foods include coconut, pulaka, and taro, while supplemental crops consist of bananas, papaya, and breadfruit. The primary agricultural export remains copra, the dried flesh of the coconut, with most other products consumed locally.

The National Agriculture Sector Plan (NASP) for Tuvalu (2016–2023) outlines six key goals to strengthen the agriculture sector through sustainability, resilience, and inclusivity. It aims to create a robust policy framework, enhance the Department of Agriculture, and encourage farmers to adopt climate-resilient practices. The plan focuses on increasing domestic food production, promoting home gardening, and incentivizing sustainable practices while ensuring food safety and improving land-use planning. It advocates for organic farming, and compliance with environmental standards, and addresses monopolies in the coconut industry. The NASP also seeks to enhance market access and support rural development by promoting entrepreneurship and increasing the participation of youth and women. Additionally, it emphasizes disaster resilience through preparedness plans, emergency food stockpiles, and early warning systems to protect the agriculture sector from climate impacts. These strategies aim to ensure the agriculture sector contributes effectively to national food security and sustainable economic growth.

Despite challenges, Tuvaluans have established a sustainable farming system for pulaka (swamp taro) and taro, utilizing extensive composting techniques with deep pits filled with compost. The NAPA 1 Project successfully developed cemented pulaka pits on Nanumaga Island to address soil salinity from salt intrusion, proving effective during droughts. The Climate Change Department plans to replicate this project on Niutao, Nanumea, Nui, and Nukulaelae. Other crops include breadfruit, pandanus, fig, banana, and pawpaw, while the bird nest fern is a local delicacy. Home gardens grow tomatoes, cucumbers, cabbage, sweet potatoes, and pumpkins, with larger-scale production supported by Taiwanese Government farms in Funafuti and Vaitupu.

The European Union, SPC, and GCCA project, "Improving Agroforestry Systems to Enhance Food Security and Build Resilience to Climate Change," introduced intercropping in coconut woodlands in Funafuti and Nukufetau. Additionally, the Live and Learn Project, currently expanding from Nukulaelae to Nukufetau, focuses on community-level vegetable production to improve nutrition and provide small incomes.

## 1.8 Fisheries

Tuvalu is one of the most fishery-dependent countries in the world, with fish being a vital part of its diet and economy due to limited land and poor soils. Although seafood consumption per capita has decreased with the availability of imported foods, it remains among the highest globally. Fisheries are crucial for food security, offering a healthier alternative to imports, while oceanic resources generate significant national revenue.



The Tuvalu Fisheries Department aims to promote sustainable small-scale fisheries to support income, food security, and healthier diets, while optimizing revenue from ocean fisheries. Inshore fisheries are managed locally, while oceanic fisheries require regional cooperation. The department's mission focuses on enhancing fisheries' contribution to socio-economic development and improving quality of life.

The department's 4th Corporate Plan (2023-2025) sets goals to develop sustainable commercial fisheries, manage oceanic and coastal fisheries, improve data-driven decision-making, increase the value of fishing licenses, and build capacity for a future Fisheries Authority. It also emphasizes public education on fisheries issues. Long-term goals include transitioning the department to a statutory authority for greater efficiency, establishing a food safety authority to access higher-value markets, expanding a local fishing fleet, and managing lagoon fisheries to prevent overfishing.

Given the dynamic nature of the fisheries sector, the plan highlights the need for adaptive management to respond to emerging challenges and priorities. Sustainable management of fisheries remains essential for Tuvalu's food security, economic resilience, and public health.

The Tuvalu Pacific Islands Regional Oceanscape Program (PROP) Project aims to the restructuring of the Tuvalu Fisheries Department (TDF) to achieve greater effectiveness, and for several initiatives to be undertaken towards generating greater revenues for the GoT and employment for Tuvaluans at sea, and to improve the management of inshore fisheries resources. It covers four major components to provide the basis for sustainable and increased economic benefits to the country. The four components include:

1. Sustainable Management of Oceanic Fisheries (US\$5.77 m IDA) aiming to help participating Pacific Island countries strengthen the management of the region's purse seine and long-line tuna fisheries.
2. Sustainable Management of Coastal Fisheries (US\$1.13 m IDA; US\$0.91 m GEF).
3. Sustainable Financing of the Conservation of Critical Fishery Habitats. This component will be implemented at the regional level.
4. National Program Management, Monitoring and Evaluation (US\$0.1 m IDA).

## 1.9 Biodiversity

Tuvalu's Exclusive Economic Zone (EEZ) spans approximately 900,000 km<sup>2</sup> of oceanic territory. Geologically young, the islands have poor, sandy, or gravel-like soils, limiting plant diversity. Of the over 300 plant species recorded, only about 65 are native, with the remainder introduced, often by early settlers who planted coconuts and food crops.

Terrestrial biodiversity includes 28 indigenous bird species, with around 20 being seabirds, some migratory. Land crabs, insects, and a few lizard species are also present, with only one lizard confirmed as endemic. The marine environment is particularly rich, consisting of six main ecosystems: oceanic, outer reef, lagoonal, back reef, lagoon floor, patch reefs, and natural channels. These ecosystems support coral communities, invertebrates, algae, fish, plankton, marine mammals, and reptiles. About 350 species of fish have been recorded in these waters.

Flora in Tuvalu is essential for food, construction, medicine, and crafting household items, with plants used for house building, canoe making, compost, firewood, handicrafts, and traditional costumes. These natural resources play a critical role in sustaining both the livelihoods and cultural practices of the Tuvaluan people.



Tuvalu faces significant challenges regarding biodiversity and ecosystem services (BES), marked by a decline in species diversity and populations across key ecosystems. This degradation includes the loss of agricultural diversity within traditional farming systems. The most threatened ecosystems are coastal forests, mangroves, agricultural areas (especially swamp taro gardens and traditional food crops), and coral reefs along with near-shore marine ecosystems. Over half of the more than 1,000 named species in Tuvalu are considered extirpated, rare, or threatened. Key endangered species include various finfish (eels, sharks, rays, dolphins, and turtles), shellfish, octopus, squid, marine and land crabs, sea cucumbers, corals, and a range of native plants vital for cultural practices. This loss highlights the urgent need for effective conservation and sustainable management strategies to safeguard Tuvalu's biodiversity and support local communities.

Tuvalu's marine environment serves as the primary source of animal protein for the local population and provides products, such as shells, for handicraft production. Additionally, the marine resources generate revenue through licensing agreements with foreign fishing nations operating within Tuvalu's Exclusive Economic Zone (EEZ). While local exploitation is primarily for subsistence, there is limited commercial fishing of finfish and shellfish for local sale and occasional export, particularly on Funafuti. This reliance on marine resources underscores the importance of sustainable management practices to ensure the health of these ecosystems and the livelihoods of local communities.

## 1.10 Hydrology and Freshwater Resources

Tuvalu has no surface freshwater resources, with the only natural source being groundwater, which exists as a lens of slightly brackish water floating on denser saltwater beneath. The extent and development of this groundwater lens significantly influence the health of local vegetation and wildlife, as well as the positioning of village wells and excavated taro pits. The replenishment of this lens is dependent on rainfall, which is variable in Tuvalu. On Funafuti, the freshwater lens is most developed on the largest islet, Fongafale; however, the available freshwater resources remain extremely limited relative to the population size. Consequently, much of Fongafale relies on household and community rainwater catchment systems. These systems are essential for water supply but can be severely affected by periodic droughts, which limit the ability to replenish rainwater reserves.

## 1.11 Energy

Tuvalu's energy sector, the largest contributor to national greenhouse gas (GHG) emissions (61% in 2023), faces significant challenges in transitioning to a sustainable and resilient energy system. The nation's heavy dependence on imported fossil fuels, primarily diesel, for electricity generation creates vulnerabilities related to energy security, price volatility, and high operational costs, exacerbated by electricity tariffs insufficient for cost recovery. In 2023, electricity generation alone accounted for 28% of total national emissions and 45% of energy sector emissions, highlighting its centrality within Tuvalu's energy landscape. While outer islands have made considerable progress, generating 80-90% of their electricity from renewable sources with limited diesel backup, the main island of Funafuti's generation capacity of 2,550 kW in 2020 remained 74% diesel based.

Tuvalu has committed to achieving 100% renewable electricity by 2030 (a revision from the initial 2025 target) and a 30% improvement in energy efficiency, as articulated in its updated Nationally Determined Contribution (NDC) and the Enetise Tutumau 2012-2020 Master Plan. The Tuvalu Electricity Corporation (TEC) is the sole entity responsible for electricity generation and distribution. Projected electricity demand is expected to increase by 35% between 2020 and 2030, reaching 11,740 MWh, driven by a 3% annual growth rate despite near-universal electrification. Current renewable energy



penetration stands at approximately 14%, primarily through solar power, necessitating substantial scaling up to achieve national targets.

Several ongoing and planned projects are crucial to this transition. A New Zealand-funded initiative will add 770 kW of solar PV and 1 MWh of battery storage in Funafuti. Furthermore, World Bank and Asian Development Bank (ADB) supported projects will contribute an additional 2 MW of solar PV, 2 MWh of battery storage, and a small wind turbine. These projects are anticipated to be completed by the end of 2024, raising Funafuti's renewable energy contribution to around 90% and correspondingly increasing the national average. Funafuti's existing power system comprises 3 x 600kW diesel generators and 735 kWp of operational solar PV capacity. The 2019 Funafuti Road Map outlines the path to 100% renewable energy for Funafuti, requiring 7.6 MW of solar PV and 3 MW / 14 MWh of battery energy storage by 2030. While some project funding is secured, further investment, estimated at US\$21.1 million, is crucial for achieving Tuvalu's ambitious renewable energy goals.

Complementing these efforts, the Energy Sector Development Project aims to enhance energy security by reducing reliance on imported fuel and improving electricity system efficiency. Its three components include: Renewable Energy Investments (solar PV, wind systems, batteries, inverters, and a satellite communication system for TEC), Energy Efficiency Investments (prepayment and smart meters, energy-saving measures in buildings, and consumer awareness campaigns), and Technical Assistance and Project Management Support (capacity building for TEC and government staff). These initiatives align with the Tuvalu National Energy Policy Framework, which outlines government strategies for the energy sector over the next 15 years, emphasizing its critical role in achieving socio-economic development goals and improving livelihoods. The framework and the national energy policy share the overarching goal of establishing a sustainable and efficient energy system to support Tuvalu's development aspirations, aiming to profitably deliver clean, reliable, affordable, and safe electricity, sourced entirely from renewable resources by 2030. This transition is vital given Tuvalu's vulnerability to climate change impacts, particularly sea-level rise, making a resilient and low-carbon energy system a national priority. The national energy policy's specific objective is to profitably deliver clean, reliable, affordable, and safe electricity, with a commitment to providing all energy from renewable resources by 2030.

## 1.12 Transport

The main island of Funafuti spans 15 km, and due to the lack of road infrastructure on the outer islands, there is no need for road transport operators in Tuvalu. Small flat-deck trucks (3-5 MT) and utility vehicles primarily transport unpackaged imported goods directly from containers at the port. The Public Works Department operates two 10 MT dump trucks for moving aggregate and similar loads, along with a 10 MT flat-deck truck equipped with a Hi-B lifting crane. Given the island's small area, this existing fleet is sufficient to meet current transport needs and effectively manage surge demands.

Funafuti is the only port, though a deep-water berth exists in the lagoon at Nukufetau. In May 2023, the Australian Infrastructure Financing Facility for the Pacific (AIFFP) approved AUD 21.4 million (USD 15 million) as part of an AUD 120.6 million (USD 84.4 million) fund led by the Asian Development Bank (ADB) to finance the construction of passenger and cargo facilities on Pacific Islands. The AIFFP funds, along with an AUD 11 million (USD 7.2 million) in-kind contribution from the Government of Tuvalu, will support projects at Niutao and Nui to construct workboat harbours, including a navigation channel, boat ramp, passenger terminal, cargo shed, and shoreline reclamation.

The total surfaced length of the upgraded road network is 15.5 km, with an average width of 5 meters. Traffic loading is generally light, with approximately 1,200 vehicles on the island, consisting mainly of



motorbikes (75%), motor vehicles (20%), and light to heavy commercial vehicles (5%). While the main roads on Funafuti are paved, many roads on the island and in the outer islands remain unpaved. Night driving on unlit secondary roads can pose hazards due to the presence of animals and unaware pedestrians.

Funafuti International Airport is the only international airport in Tuvalu, with Fiji Airways operating services three times a week (Tuesday, Thursday, and Saturday) between Suva and Funafuti using ATR 72-600 aircraft, which has a capacity of 72 passengers. Starting March 18, 2024, flights will also operate on Mondays between Nadi and Funafuti.

## **1.13 Institutional Arrangements for Climate Change**

The national institutional arrangements in Tuvalu support the establishment and sustainability of procedures for collecting, processing, reporting, and archiving essential data on climate change. These arrangements facilitate effective coordination among relevant stakeholders in both the public and private sectors to meet reporting requirements under the UNFCCC while addressing broader climate change issues at the national level. Key objectives include:

- a) Meeting reporting requirements under the Convention.
- b) Building national capacities to ensure the sustainability of reporting processes.
- c) Informing national and international policymakers at various levels.
- d) Institutionalizing activities related to climate change reporting.

### **1.13.1 Institutional Arrangements for Climate Change Reporting**

In line with the UNFCCC Guidelines for preparing national communications from non-Annex I Parties, Tuvalu has provided descriptions of its existing institutional arrangements for continuous communication preparation. Tuvalu has submitted two national communications to the UNFCCC: the First National Communication (1999) and the Second National Communication (2018). As a non-Annex I Party, Tuvalu is obligated to submit its Third National Communication, which is the current document, to the Conference of Parties (COP) of the UNFCCC.

The preparation of Tuvalu's Climate Change Reporting such as Nationally Determined Contributions (NDCs), National Communications (NCs), and National GHG Inventory Report (NIR) are implemented by the Climate Change Department under the Ministry of Home Affairs, Climate Change and Environment, sponsored by the Global Environment Facility (GEF) through the United Nations Environment Program (UNEP). The overall implementation is managed by the Climate Change Department (CCD) in collaboration with a selected Project Management Unit (PMU) and alongside other projects funded by the Green Climate Fund (GCF) and GEF.

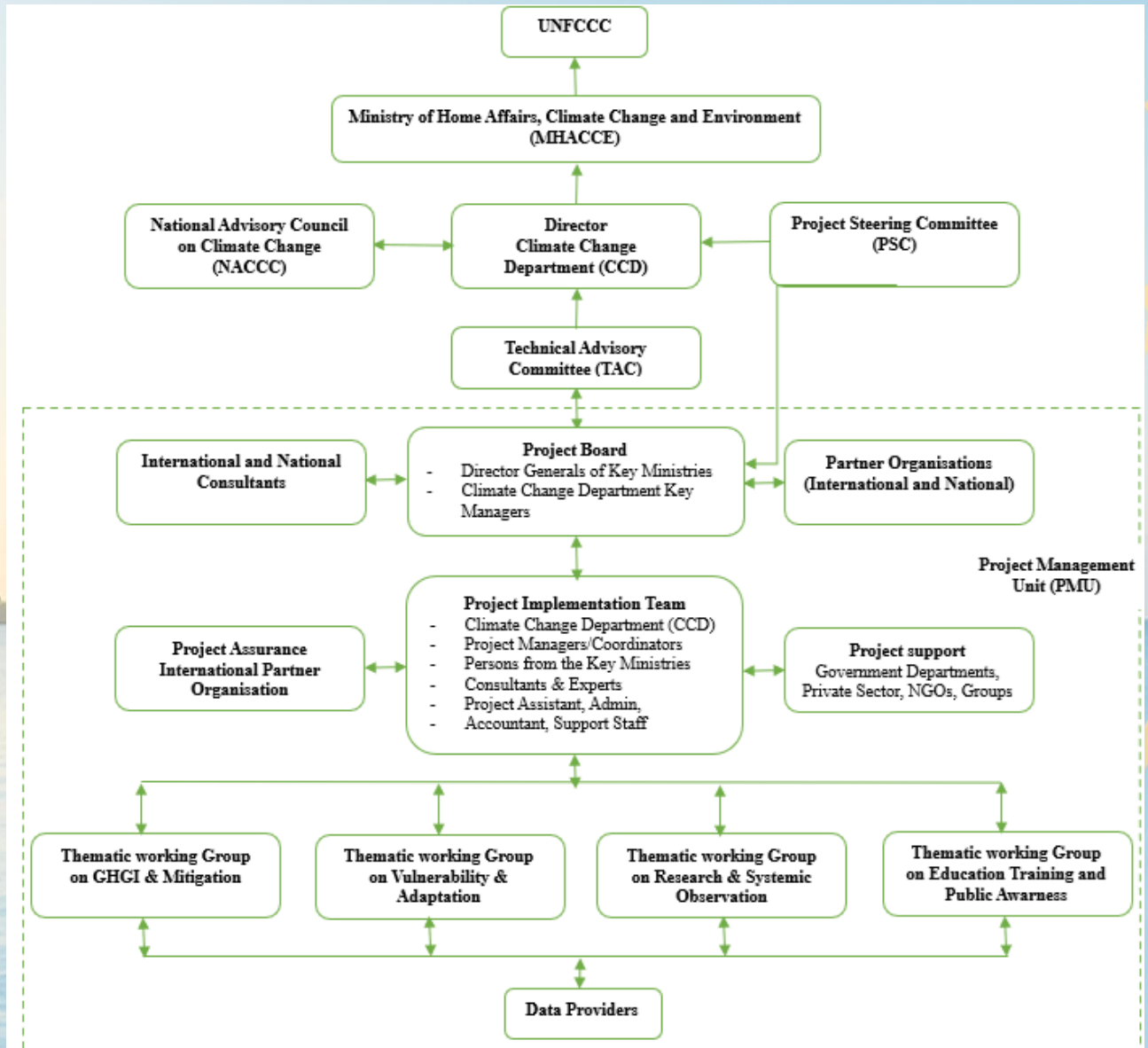
Key steps in preparing the Climate Change Reporting and GHG Inventory include:

- Project organization structuring
- Thematic Working Groups (TWGs) formation
- Stakeholder consultation processes
- Training and capacity-building programs
- Data collection, identification of data gaps, and uncertainty assessment
- Document/data review for quality assurance
- Preparation of the GHG Inventory Report

- Preparation of the respective Climate Change Report
- Review and approval of the Report and GHG Inventory

### Project Organization Structure

**Figure 6: Institutional Arrangements and Organization Structure for Tuvalu**



The Director of the Climate Change Department (CCD) serves as the Project Director, who identifies a Project Manager/Coordinator to oversee the preparation of the reports and manage coordination among various stakeholders involved in developing different components. The Project Manager/Coordinator liaises with national technical experts and consultants appointed for drafting sections on National Circumstances, Mitigation, Adaptation, Constraints & Gaps, and related financial, technological, and capacity-building needs. This role also involves facilitating communication and coordination among stakeholder agencies and project partners at the national level. The Project Assistant supports the overall administration and logistical needs of the project.

The Technical Advisory Committee (TAC) comprises technical experts whose primary responsibility is to provide advice and input related to project implementation. This committee shares knowledge,



reviews planned activities, verifies findings, and disseminates lessons learned to stakeholders at the national level. All technical documents and reports are subject to internal review by the TAC before finalization. Project Management Unit (PMU) (which includes the Project Board and Project Implementation Team) is with the TAC.

The Project Steering Committee (PSC) is established to provide financial, policy, and administrative oversight. Its primary focus is on final decisions regarding procurement, institutional arrangements, and financial management of the project. The PSC includes the Project Director, representatives from national departments, a representative from the Partner Organizations, the Project Manager/Coordinator, and the Project Assistant.

Tuvalu has procedural guidelines, aligned with international best practices i.e. IPCC, for collecting GHG emissions. This ensures consistent, accurate, and transparent data collection by data providers and custodians. Data flows from these providers to TWGs and consultants, with reports reviewed by the TAC and approved by the CCD Director. The CCD then submits the finalized Climate Change Report (NDCs, NCs, NIRs) to the UNFCCC.

**Ministry of Home Affairs, Climate Change and Environment (MHACCE):** In Tuvalu, the Ministry of Home Affairs, Climate Change and Environment (MHACCE) serves as the national focal point for climate change and oversees the Climate Change Department (CCD). It is also the primary contact for various international climate-related organizations and funding bodies, including:

- United Nations Framework Convention on Climate Change (UNFCCC)
- Intergovernmental Panel on Climate Change (IPCC)
- Green Climate Fund (GCF)
- Global Environment Facility (GEF)
- Adaptation Fund
- Climate Investment Funds (CIF)
- World Bank
- Pacific Islands Forum Secretariat (PIFS)
- Pacific Community (SPC)
- Secretariat of the Pacific Regional Environment Programme (SPREP)
- United Nations Development Programme (UNDP)
- United Nations Environment Programme (UNEP)
- Global Green Growth Institute (GGGI)
- Asia-Pacific Economic Cooperation (APEC)
- Association of Small Island States (AOSIS)

**Climate Change Department (CCD):** The Climate Change Department (CCD), under the Ministry of Home Affairs, Climate Change and Environment (MHACCE), is responsible for preparing and submitting Climate Change Reports (NDCs, NCs, and NIRs) and managing all climate change-related project implementations. It acts as the national focal point for climate change and serves as the Secretariat for the National Advisory Council on Climate Change (NACCC).

**National Advisory Council on Climate Change (NACCC):** Established in early 2014, the NACCC advises the Prime Minister on coordinating a whole-of-government approach to climate change challenges. Its main functions include:

- Identifying strategies to achieve energy efficiency and increase renewable energy use.

- Encouraging the private sector and NGOs to reduce greenhouse gas emissions and develop locally appropriate technologies for adaptation and mitigation.
- Ensuring a unified government response to adaptation and climate-related disaster risk reduction.
- Exploring policy options for Tuvalu's engagement with the international community on climate change.
- Identifying funding options for adaptation and mitigation projects.

The NACCC collaborates with the Director of CCD and the Tuvalu Ambassador for Climate Change and consults with private sector representatives, NGOs, and community stakeholders as needed.

| Department/Organization              |
|--------------------------------------|
| Secretary (MHACCE) - Chair           |
| Director of CCD - Secretariat        |
| Chief of Protocols (Foreign Affairs) |
| Director of Environment              |
| Director of Planning & Budget        |
| Director of Energy                   |
| Director of Agriculture              |
| Director of Fisheries                |
| Chief Meteorological Services        |
| Director of Public Works             |
| Director of Disaster Management      |
| Director of Lands & Survey           |
| Director of Health                   |
| Director of Rural Development        |
| Director of TuCAN                    |
| Director of Waste Management         |
| Coordinator TNCW                     |
| Coordinator TANGO                    |
| Coordinator TNPSO                    |
| Tuvalu Red Cross Society             |
| Kaupule Funafuti                     |
| Secretary EKT                        |

### Thematic Working Groups

| TWG                          | Members                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| TWG - National Circumstances | Central Statistics Division (CSD), Ministry of Home Affairs, Climate Change & Agriculture (MHACCE), Tuvalu Electricity Corporation (TEC), National Disaster Management Office (NDMO), Gender Affairs Department (GAD), Tuvalu Meteorological Service (TMS), Ministry of Education and Human Resource Development (MEHRD)                                                                                                                                   |
| TWG - GHG Inventory          | Climate Change Department (CCD), Department of Energy (DOE), Tuvalu Electricity Corporation (TEC), Ministry of Natural Resources (MNR), Department of Waste Management, Ministry of Transport, Energy, Communication and Innovation (MTECI), Central Statistics Division (CSD), Department of Agriculture, Ministry of Public Works, Infrastructure and Water (MPWIW), Department of Environment, Department of Meteorological Services, National Disaster |



|                                                   |   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|---------------------------------------------------|---|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                   |   | Management Office (NDMO), Tuvalu Revenue and Customs Services, Department of Marine Services, Pacific Energy and Kaupule Funafuti.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| TWG Mitigation Analysis                           | - | National Disaster Management Office (NDMO), Development Coordination Committee (DCC), Ministry of Finance, National Advisory Council on Climate Change (NACCC), National Climate Change Resilience Forum, Tuvalu Electricity Corporation (TEC), Ministry of Transport, Energy, Communication and Innovation (MTECI), Ministry of Public Works, Infrastructure and Water (MPWIW), Department of Waste Management, Department of Agriculture, Department of Environment                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| TWG Vulnerability Assessment and Adaptation (V&A) | - | National Disaster Management Office (NDMO), Tuvalu Association of Non-Government Organisations (TANGO), Climate Change Department (CCD), Department of Environment, Department of Marine, Department of Fisheries, Department of Agriculture, Department of Labour, Gender Affairs Department, Home Affairs & Rural Development, Lands & Survey Department, Ministry of Health and Social Welfare, Ministry of Public Works, Infrastructure and Water (MPWIW), Energy, TEC, Ministry of Finance, Department of Trade, Ministry of Transport, Energy, Communication and Innovation, Ministry of Education and Human Resources Development (MERHD), Tuvalu Meteorological Services, Tuvalu Central Statistics Division, Information and Communications Technology (ICT) Department, Department of Local Government, Department of Agriculture, Tuvalu Red Cross, Kaupule Funafuti (Funafuti Town Council) |
| TWG Research & Systematic Observation             | - | National Disaster Management Office (NDMO), Tuvalu Meteorological Service (TMS), Lands & Survey Department                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| TWG Education, Training & Public Awareness        | - | Climate Change Department (CCD), Department of Environment, Island Care, Tuvalu Red Cross, Funafuti Kaupule (Funafuti Town Council), Ekalesia Kelisiano Tuvalu (EKT), Tuvalu National Council of Women (TNCW), Tuvalu National Private Sector Organisation (TNPSO)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |

### 1.13.2 Institutional Arrangements for Tracking Tuvalu's NDC Under Article 4

To effectively track the progress in implementing and achieving its Nationally Determined Contribution (NDC) under Article 4 of the Paris Agreement, Tuvalu has established a comprehensive institutional framework. This framework is intricately designed to facilitate transparency, stakeholder engagement, and compliance with UNFCCC Modalities, Procedures, and Guidelines (MPGs).

**Overview of Institutional Structure:** The institutional structure supporting Tuvalu's NDC implementation includes several key committees, agencies, and stakeholders, each playing a critical role in data collection, assessment, review, management, verification, reporting, and monitoring:

#### 1. Project Steering Committee (PSC):

- Comprised of representatives from various government ministries and agencies, the PSC provides oversight and guidance on NDC implementation, ensuring effective resource allocation and alignment with national priorities.
- The PSC is responsible for financial, policy, and administrative oversight and makes key decisions regarding procurement, institutional arrangements, and financial management.

#### 2. Technical Advisory Committee (TAC):

- Consisting of technical experts, the TAC provides guidance on climate initiatives and reviews progress reports.
- This committee shares knowledge, verifies findings, and disseminates lessons learned to stakeholders, ensuring technical accuracy before finalizing reports.



### 3. Thematic Working Groups (TWGs):

- These specialized groups focus on specific sectors (e.g., energy, agriculture, waste management) and are tasked with monitoring and reporting sectoral progress towards NDC targets.

### 4. Project Director and Manager:

- The Project Director appoints a Project Manager/Coordinator responsible for overseeing report preparation and coordinating with stakeholders.
- The Project Manager facilitates communication among agencies and liaises with national experts and consultants on various NDC components, including mitigation, adaptation, and capacity-building.

**Key Government Agencies and Responsibilities:** Below are the main government agencies and departments involved in implementing and tracking Tuvalu's NDC:

- **Department of Climate Change (CCD):**

- Under the Ministry of Home Affairs, Climate Change and Environment, the CCD serves as the primary coordinating body for Tuvalu's climate policies, including NDC implementation.
- The CCD acts as the national focal point for climate agreements, handles data collection and analysis, and submits National Communications to the UNFCCC.

- **National Advisory Council on Climate Change (NACCC):**

- Established in 2014, NACCC provides advice to the Prime Minister on unified government response to climate change.
- Its roles include advising on energy efficiency strategies, coordinating with the private sector and NGOs, and overseeing funding options for adaptation and mitigation projects.

- **Development Coordination Committee (DCC):**

- Situated under the Ministry of Finance, the DCC prioritizes projects for donor funding and submits them to the Cabinet for approval.

- **Tuvalu Electricity Corporation (TEC):**

- As the sole electricity provider, TEC is working towards Tuvalu's goal of achieving 100% renewable energy by 2030.

- **Ministry of Transport, Energy, Communication and Innovation (MTECI) and Department of Energy (DOE):**

- MTECI oversees TEC and handles grid expansion, renewable energy accommodation, and maritime transport, while DOE is responsible for energy sector planning, including fuel and appliance imports.

### Additional Ministries and Departments Involved:

- **Ministry of Public Works, Infrastructure and Water (MPWIW):**

- Provides public infrastructure, assesses civil damage, manages water storage, and oversees sanitation and environmental infrastructure.

- **Tuvalu Police Force (TPF):**

- Maintains data on traffic-related accidents and enforces compliance, contributing to national transportation data.

- **Other Relevant Ministries:**

- **Ministry of Health and Social Welfare, Ministry of Education and Human Resource Development (MERHD):** These ministries contribute to cross-sectoral climate initiatives.
- **Ministry of Transport, Energy, Communication & Innovation (MTECI):** Ensures quality transport and communication services.
- **Ministry of Natural Resources (MNR):** Oversees trade and fisheries development, promoting sustainable practices within these sectors.

**International Coordination and Funding:** The Ministry of Home Affairs, Climate Change and Environment (MHACCE) serves as the national climate change focal point and primary contact for international organizations, including UNFCCC, IPCC, GCF, GEF, Adaptation Fund, CIF, World Bank, PIFS, SPC, SPREP, UNDP, UNEP, GGGI, APEC, and AOSIS



This institutional arrangement ensures that Tuvalu's NDC tracking aligns with the national climate objectives and international reporting requirements. This robust framework involves key agencies and committees, each playing a specific role in achieving Tuvalu's GHG mitigation targets effectively and transparently.

Tuvalu's overall climate change reporting institutional arrangement, as detailed in Section 1.13.1, provides a comprehensive framework that integrates the NDC tracking system (Section 1.13.2) with the National GHG Inventory Institutional Arrangements and Organization Structure (Section 2.1.1). In this unified framework, the Climate Change Department (CCD) under the Ministry of Home Affairs, Climate Change and Environment (MHACCE) serves as the central coordinating body, ensuring that roles and responsibilities are clearly defined and consistently executed across both NDC tracking and GHG inventory preparation. Strategic oversight is provided by the Project Steering Committee and Technical Advisory Committee, while operational responsibilities are managed by the Project Management Unit and thematic working groups. This integrated approach harmonizes data collection, quality control, and reporting processes, thereby ensuring transparency, consistency, and reliability in Tuvalu's climate reporting. The established arrangement not only facilitates compliance with international guidelines but also supports continuous improvement in climate action through effective inter-agency coordination and stakeholder engagement.

### 1.13.3 Monitoring and Evaluation Framework

Tuvalu has developed a structured mechanism for monitoring, evaluating, and reporting on the progress of its Nationally Determined Contributions (NDC). This monitoring and evaluation (M&E) framework are designed to enhance transparency, accountability, and ownership across government agencies in achieving the targets outlined in Tuvalu's NDC Implementation Roadmap and Investment Plan.

#### Key elements of the Monitoring and Evaluation Framework:

- **National Greenhouse Gas (GHG) Inventory:** The National GHG Inventory is updated regularly to track emissions trends and assess progress toward mitigation targets. Compiled with technical assistance from international partners, the inventory ensures accuracy and reliability in tracking emissions and removals over time.
- **Common Tabular Formats (CTFs):** Tuvalu employs CTFs as part of its reporting to the United Nations Framework Convention on Climate Change (UNFCCC). These standardized tables facilitate transparent reporting on emissions, removals, and key progress indicators, aiding in the consistent communication of NDC achievements.

**Monitoring and Evaluation Framework Components:** This high-level M&E framework, coordinated by the Department of Climate Change involves a systematic approach to measure progress, build accountability and encourage ownership within the government structure. The framework comprises three components:

- **Reporting Structure:** Assigns clear responsibilities to government employees.
- **Monitoring Structure:** Tracks progress transparently and regularly.
- **Evaluation Structure:** Establishes accountability measures for timely project completion.

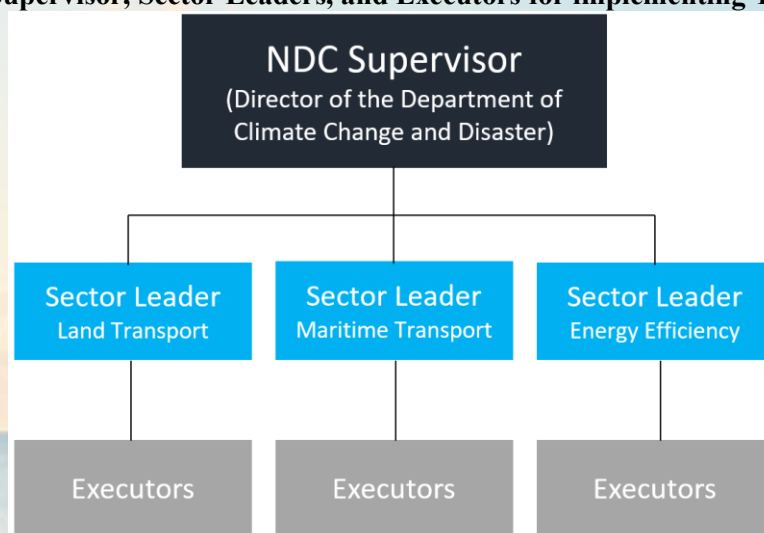
**Reporting Structure:** Under the M&E framework, project responsibility is organized in to a three-tier structure:

- **NDC Supervisor:** The NDC Supervisor, ideally the Director or CCD, holds ultimate responsibility for overseeing NDC implementation across Tuvalu. The Supervisor reports to a senior official (e.g. the Minister of Finance) or another designated representative from the Government of Tuvalu (GoT), as determined by national consensus.

- **Sector Leaders:** Sector Leaders are government officials from relevant ministries who are accountable for implementing and reporting on specific NDC actions within their assigned sectors (e.g., maritime transport and energy). For instance, the Director of Marine and the Director of Energy lead initiatives within their respective domains, while a senior CCD staff member assumes responsibility for land transport until a formal director is appointed.
- **Executors:** Executors are government staff members responsible for the day-to-day implementation and management of sector-specific projects. They include managers and line staff who form the base tier of the reporting structure, working closely with Sector Leaders to ensure project continuity and completion.

The figure below outlines the NDC reporting structure, detailing roles for the NDC Supervisor, Sector Leaders, and Executors. This structure was established following extensive consultations, gaining approval from key stakeholders for its effectiveness and relevance.

**Figure 7: NDC Supervisor, Sector Leaders, and Executors for implementing Tuvalu’s NDC**



**Communication and Coordination:** Effective communication is vital for monitoring NDC progress. The NDC Supervisor, Sector Leaders, and Executors should engage in regular discussions to assess project developments, address challenges, and maintain alignment with NDC targets. Sector Leaders convene monthly to monitor day-to-day tasks, consult with external consultants, and update a centralized monitoring spreadsheet.

The centralized monitoring spreadsheet, maintained by CCD, captures quarterly updates on each project’s implementation status, including:

- **Project Status:** Indicated as Planning, Implementation, or Complete.
- **Funding Status:** Classified as Not Funded, Partially Funded, or Fully Funded, along with target funding sources.
- **Estimated GHG Emissions Reductions:** Including assumptions and calculation methodologies.
- **Additional Notes:** Such as new barriers encountered, or technological developments.

This platform is accessible to all implementation team members, including Executors, ensuring shared visibility of project progress.

**Reporting and Evaluation Processes:** Sector Leaders submit quarterly updates to the NDC Supervisor, summarizing sector-specific progress in mitigation projects. Annually, the NDC Supervisor compiles a comprehensive NDC progress report, which includes:

- Evaluation of each project against established targets and indicators.
- Recommendations for timeline adjustments or additional resources if needed.
- Identification of responsible staff for each project to maintain accountability.



- Suggestions for future project opportunities aligned with NDC goals.

This annual report is submitted to the Office of the Prime Minister and released publicly, reinforcing transparency and Tuvalu's commitment to climate action.

**Evaluation Structure and Accountability:** The CCD undertakes regular evaluations to ensure adherence to the NDC roadmap and timely project completion. The evaluation draws on inputs from the reporting and monitoring structures, including documented updates from Sector Leaders and monitoring spreadsheets. Evaluation meetings—between the NDC Supervisor, Sector Leaders, and Executors—assess progress, identify potential areas for improvement, and recognize team members who excel or may require further support.

The NDC Supervisor and Sector Leaders are responsible for maintaining an adaptive timeline, adjusting as necessary to meet targets. They also implement accountability measures to address any delays or failures in action completion. If a project cannot be completed on schedule, both Sector Leaders and Executors are held accountable, fostering a sense of responsibility and continuous improvement across the implementation team.

#### 1.13.4 Stakeholder Engagement

Effective implementation of Tuvalu's Nationally Determined Contribution (NDC) relies heavily on active stakeholder engagement. The Climate Change Department (CCD) regularly conducts consultations with a range of stakeholders, including local communities, civil society organizations, the private sector, and various government departments. These consultations provide a valuable platform for open dialogue and collaboration, allowing diverse voices to contribute to the development and continuous refinement of Tuvalu's climate policies. Engaging stakeholders at all levels ensures that Tuvalu's NDC implementation reflects a broad range of perspectives, fostering transparency and accountability in decision-making processes.

Stakeholder consultation for Tuvalu's NDC implementation has been structured in phases to enhance its effectiveness. In the initial phase, CCD introduced key objectives of the NDC, including approaches, methodologies, and processes crucial to achieving the goals outlined in Tuvalu's climate commitments. Stakeholders were briefed on the primary steps involved in NDC implementation and consulted on specific aspects of GHG inventory sectors, such as data collection, climate change mitigation, adaptation, and vulnerability assessment (V&A) management. Additionally, participants were educated on the 2006 IPCC Guidelines and Best Practices to ensure alignment with international standards for developing the national GHG inventory.

The second phase of consultation focused on presenting interim results, which included the National GHG Inventory covering the years 2015 to 2021. During this phase, stakeholders received detailed insights into the data, standards, and assumptions applied in estimating and compiling Tuvalu's National GHG Inventory. This phase aimed to validate the inventory's foundational assumptions and standards, inviting input from a broader group of stakeholders to ensure the robustness and accuracy of the inventory. This engagement was critical in addressing data gaps, uncertainties, and issues impacting the inventory's quality, completeness, and transparency. Stakeholders were also updated on the National GHG Inventory Improvement Plan (NIIP), which outlines steps to enhance future inventories and improve data quality over time.

In summary, Tuvalu's approach to stakeholder engagement in NDC implementation has established a framework for inclusive and transparent climate action. By involving stakeholders across multiple



sectors and levels, Tuvalu ensures that its climate actions are rooted in shared understanding and collective commitment, strengthening the national response to climate change and enhancing the credibility of its NDC progress.

### 1.13.5 Training and Capacity Building

Tuvalu's Training and Capacity Building program for the NDC is designed to strengthen the skills of the Project Implementation Unit (PIU)/Project Management Unit (PMU) team and other key stakeholders, enhancing their expertise in developing national GHG inventories. This program aims to build a solid foundation of knowledge by sharing experiences from previous National Inventory Reports (NIRs), understanding data collection protocols, and aligning with the UNFCCC's guidelines. The training covers essential GHG estimation methods, referencing the latest IPCC Guidelines (2006 and 2019 updates), and ensures that participants understand how to apply these guidelines within Tuvalu's national context. Additionally, the training provides guidance on implementing Quality Assurance/Quality Control (QA/QC) and review processes, along with using tools for conducting mitigation analysis and vulnerability and adaptation (V&A) assessments.

Despite these efforts, the delivery of training through ad-hoc project initiatives and general training events has not resulted in sustained capacity for climate change adaptation and mitigation, particularly in the outer islands. While awareness of climate change impacts has increased, meaningful capacity building—especially for long-term adaptation measures—remains a challenge for communities in remote areas. To address this, the CCD team conducts internal training sessions whenever a participant returns from regional training or conferences conducted overseas, promoting knowledge sharing within the team.

However, several challenges limit the effectiveness of the Training and Capacity Building program:

- Lack of continuity in ad-hoc project-based training often means limited follow-up, resulting in gaps in long-term knowledge retention.
- Limited resources in terms of finances and human capital further constrain Tuvalu's ability to establish a sustainable, comprehensive capacity-building program.
- Access to training opportunities also remains unequal, with outer island communities often excluded due to geographic barriers.
- Additionally, a tailored approach is essential, as one-size-fits-all training models may not adequately address the specific needs of different communities, especially in remote locations.
- Integrating local knowledge and traditional practices into capacity-building efforts can enhance local adaptive capacity, fostering resilience grounded in Tuvalu's cultural heritage.
- The self-capacity needs assessment, conducted during the Second National Communication (SNC) project, was valuable in identifying training and capacity gaps. However, a similar assessment was not conducted during the Third National Communication (TNC) project, leaving critical gaps in understanding evolving capacity-building needs.

Addressing this shortfall by completing a self-capacity needs assessment before the next reporting cycle of the NDC, NC, NIR, and BTR reporting to the UNFCCC is essential to tailor future training efforts effectively, ensuring that the program remains responsive to Tuvalu's unique challenges and evolving climate priorities.



### 1.13.6 Quality Assurance/Quality Control and Review Mechanism

A comprehensive Quality Assurance (QA), Quality Control (QC), and review mechanism have been implemented to enhance the transparency, consistency, comparability, completeness, and accuracy of Tuvalu's National Communications and GHG inventories. This mechanism, integral to supporting the NDC, is designed to ensure that data and processes meet the highest standards, thereby enabling robust climate action planning.

An internal QA/QC plan was developed to outline specific roles and responsibilities for members of the GHG Inventory Team, establishing a structured approach to data verification and error reduction. Key components of this plan include routine checks on data provided by stakeholders from various sectors, including government agencies, private sector representatives, and non-governmental organizations. These checks focus on data consistency, integrity, completeness, and accuracy. In cases where data discrepancies or incomplete information are identified, the inventory team consults with relevant stakeholders and technical experts to correct inaccuracies, minimize uncertainties, and address any identified gaps or omissions.

To further enhance data quality, sectoral and sub-sectoral GHG calculations are regularly reviewed by experts. These technical reviews focus on critical areas, such as activity data, emission factors, estimation methodologies, and calculation parameters, ensuring the reliability of GHG estimates. Feedback from these reviews is used to refine the calculations and improve data robustness. Once finalized, the GHG inventory calculations are compiled into a draft report, which is shared with stakeholders for review and feedback. This consultative approach, involving routine stakeholder engagement, not only strengthens the inventory's credibility but also aligns it more closely with Tuvalu's national priorities.

In addition to the GHG inventory, the QA/QC process extends to other key NDC reports, including mitigation analysis and vulnerability and adaptation (V&A) assessments. Draft versions of these reports are presented in stakeholder consultations, allowing for valuable input and refinement before finalization. This inclusive approach ensures that the inventory and accompanying analyses reflect a broad consensus and are informed by sectoral insights.

The QA/QC and review process has resulted in substantial improvements in data collection, calculation accuracy, and reporting quality. Notably, it has enabled the incorporation of uncertainty estimates and key criteria analyses, fostering transparency and reliability. These improvements also pave the way for continuous enhancement through the National Inventory Improvement Plan (NIIP) (elaborated in Chapter 2 section 2.7.1), which builds on the QA/QC outcomes to further refine future GHG inventories. This iterative process of improvement ensures that Tuvalu's GHG inventory remains a credible and valuable tool for monitoring and achieving the nation's NDC targets.

### 1.13.7 Climate Information Archiving System for Climate Change Reporting:

Tuvalu is in the preparatory stages of establishing a comprehensive climate information archiving system to support its NDC, NCs, GHG Inventory, Biennial Transparency Report (BTR), and broader climate reporting commitments. This archiving system will serve as a centralized repository for all climate-related data, structured to meet international standards for transparency, consistency, and reliability. Currently, Tuvalu's climate data collection relies on a combination of methods, including manual data entry, as well as limited digital databases managed by various government ministries and

their respective departments such as the Ministry of Finance, the Department of Environment, Climate Change Department, and the Tuvalu Meteorological Office. Data archiving practices are similarly decentralized within different agencies. This decentralized approach has presented challenges in data management, accessibility, and consistency, hindering efficient climate reporting and analysis. A recent needs assessment has highlighted these challenges and emphasized the need for a centralized, standardized system. The planning for the new system involves defining the repository's architecture, including early-stage digital infrastructure and stakeholder consultations to ensure it meets the unique data management needs of Tuvalu's climate initiatives, such as its vulnerability to sea-level rise and the specific data requirements for adaptation planning.

Key aspects of the system include standardized data collection and documentation processes, robust quality assurance/quality control (QA/QC) mechanisms, and defined role-based access to ensure secure data handling. A capacity-building program is being developed to equip the GHG Inventory Team and relevant stakeholders, including staff from the Ministries and government departments, with the skills needed to manage the system sustainably, covering data entry, validation, and reporting practices aligned with IPCC and UNFCCC guidelines.

To future-proof the system, Tuvalu is planning for ongoing updates and a National Inventory Improvement Plan (NIIP) to identify and address any gaps or areas for enhancement. The system's development also includes exploring regional data-sharing partnerships with initiatives like the Pacific Islands Climate Change Cooperative (PICCC) and the Secretariat of the Pacific Regional Environment Programme (SPREP) to collaborate with other Pacific Island nations, fostering knowledge exchange and access to technical resources. Through these preparatory efforts, Tuvalu aims to strengthen its climate reporting infrastructure, ensuring accuracy, transparency, and readiness for future climate data requirements and international commitments.



## 2 Chapter 2: National inventory report of anthropogenic emissions by sources and removals by sinks of GHGs

Tuvalu's National GHG Inventory, as presented in this First Biennial Transparency Report (BTR), is developed in strict accordance with the United Nations Framework Convention on Climate Change (UNFCCC) and the Enhanced Transparency Framework (ETF) under the Paris Agreement. The inventory assesses anthropogenic emissions by sources and removals by sinks of greenhouse gases (GHGs) not controlled by the Montreal Protocol and ensures compliance with Decision 4/CMA.1 of the UNFCCC MPGs. In line with Decision 5/CMA.3, Paragraph 17, the inventory adheres to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories while integrating the latest methodological improvements from the 2019 Refinement and the IPCC Good Practice Guidance (GPG). The inventory adheres to the 2006 IPCC Guidelines and incorporates the 2019 Refinements to update key methodologies, emission factors, key category analysis, and uncertainty assessment. This guidance has been integrated across all sectors most notably within the energy, agriculture, and waste sectors to enhance methodological consistency, accuracy, and comparability of the reported data. Additionally, the inventory follows the IPCC Good Practice Guidance (GPG) to uphold the core principles of transparency, accuracy, completeness, comparability, and consistency (TACCC). Covering the reporting years 2010 and 2015 to 2023, this approach ensures that Tuvalu's GHGI reflects the latest scientific advancements and international best practices, providing a robust basis for tracking emission trends and informing national climate policy.

The Accounting Approach and Reporting Consistency are explained in Section 3.4.3. The inventory covers all key GHG sources and sinks across the Energy, Agriculture, Forestry and Other Land Use (AFOLU), Industrial Processes and Product Use (IPPU), and Waste sectors, using standardized reporting formats aligned with Common Reporting Tables (CRTs) and Common Tabular Formats (CTFs) (Annexures 5, 6, and 7). Section 2.14 explains the Recalculations, Consistency, Improvements, and Capacity-Building.

By integrating IPCC guidelines, applying MPGs flexibilities where appropriate due to capacity constraints, and striving for adherence to TACCC principles, Tuvalu's GHG inventory provides a robust foundation for tracking Nationally Determined Contribution (NDC) progress, informing national climate policies, and strengthening transparency under the ETF. Tuvalu is committed to continuous improvement of its reporting and recognizes current capacity limitations while aiming to enhance future reporting quality.

### Sectors Covered in the Inventory:

- **Energy:** The largest contributor to emissions, accounting for **15.81 kt CO<sub>2</sub>e in 2023**, primarily from fuel combustion in electricity generation, transportation, and residential activities. The Tier 1 methodology is applied using fuel import data and IPCC default emissions factors.
- **Agriculture, Forestry, and Other Land Use (AFOLU):** Accounts for **8.53 kt CO<sub>2</sub>e in 2023**, with methane (CH<sub>4</sub>) from manure management and enteric fermentation being the major contributors. The Tier 1 methodology is applied using livestock population estimates.
- **Waste:** Contributed **1.56 kt CO<sub>2</sub>e in 2023**, with methane emissions from landfill waste disposal and wastewater treatment. Tier 1 methodologies are used for this sector due to limited data availability.

The table below presents the summary of Tuvalu's GHG emissions and removals in accordance with the common reporting table 10 emission trends – summary.

**Table 3: Summary of Tuvalu's GHG Emission and Removals trends in kt CO<sub>2</sub>e: 2010 to 2023**

| <b>GREENHOUSE GAS EMISSIONS AND REMOVALS</b>                                     | <b>Reference year/period for NDC <sup>(1)</sup> (Base Year 2010) *</b> | <b>2015</b>  | <b>2016</b>  | <b>2017</b>  | <b>2018</b>  | <b>2019</b>  | <b>2020</b>  | <b>2021</b>  | <b>2022</b>  | <b>2023</b>  | <b>Change from [2010] [base year] [reference][year][period]] to latest reported year</b> |
|----------------------------------------------------------------------------------|------------------------------------------------------------------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|------------------------------------------------------------------------------------------|
|                                                                                  | <b>CO<sub>2</sub> equivalents (kt) <sup>(3)</sup></b>                  |              |              |              |              |              |              |              |              |              | <b>(%)</b>                                                                               |
| CO <sub>2</sub> emissions without net CO <sub>2</sub> from LULUCF                | 13.28                                                                  | 9.48         | 9.73         | 8.20         | 6.87         | 12.27        | 13.82        | 8.56         | 9.89         | 15.66        | 17.90                                                                                    |
| CO <sub>2</sub> emissions with net CO <sub>2</sub> from LULUCF                   | 13.28                                                                  | 9.48         | 9.73         | 8.20         | 6.87         | 12.27        | 13.82        | 8.56         | 9.89         | 15.66        | 17.90                                                                                    |
| CH <sub>4</sub> emissions without CH <sub>4</sub> from LULUCF                    | 8.64                                                                   | 8.03         | 8.01         | 7.99         | 8.91         | 8.91         | 8.90         | 8.88         | 8.87         | 8.87         | 2.74                                                                                     |
| CH <sub>4</sub> emissions with CH <sub>4</sub> from LULUCF                       | 8.64                                                                   | 8.03         | 8.01         | 7.99         | 8.91         | 8.91         | 8.90         | 8.88         | 8.87         | 8.87         | 2.74                                                                                     |
| N <sub>2</sub> O emissions without N <sub>2</sub> O from LULUCF                  | 1.34                                                                   | 1.36         | 1.35         | 1.32         | 1.30         | 1.37         | 1.38         | 1.29         | 1.30         | 1.36         | 0.94                                                                                     |
| N <sub>2</sub> O emissions with N <sub>2</sub> O from LULUCF                     | 1.34                                                                   | 1.36         | 1.35         | 1.32         | 1.30         | 1.37         | 1.38         | 1.29         | 1.30         | 1.36         | 0.94                                                                                     |
| HFCs                                                                             | FX                                                                     | FX           | FX           | FX           | FX           | FX           | FX           | FX           | FX           | FX           | FX                                                                                       |
| PFCs                                                                             | FX                                                                     | FX           | FX           | FX           | FX           | FX           | FX           | FX           | FX           | FX           | FX                                                                                       |
| Unspecified mix of HFCs and PFCs                                                 | FX                                                                     | FX           | FX           | FX           | FX           | FX           | FX           | FX           | FX           | FX           | FX                                                                                       |
| SF <sub>6</sub>                                                                  | FX                                                                     | FX           | FX           | FX           | FX           | FX           | FX           | FX           | FX           | FX           | FX                                                                                       |
| NF <sub>3</sub>                                                                  | FX                                                                     | FX           | FX           | FX           | FX           | FX           | FX           | FX           | FX           | FX           | FX                                                                                       |
| <b>Total (without LULUCF)</b>                                                    | <b>23.26</b>                                                           | <b>18.87</b> | <b>19.09</b> | <b>17.52</b> | <b>17.08</b> | <b>22.55</b> | <b>24.09</b> | <b>18.73</b> | <b>20.06</b> | <b>25.89</b> | <b>11.29</b>                                                                             |
| <b>Total (with LULUCF)</b>                                                       | <b>23.26</b>                                                           | <b>18.87</b> | <b>19.09</b> | <b>17.52</b> | <b>17.08</b> | <b>22.55</b> | <b>24.09</b> | <b>18.73</b> | <b>20.06</b> | <b>25.89</b> | <b>11.29</b>                                                                             |
| <b>Total (without LULUCF, with indirect)</b>                                     | <b>NA</b>                                                              | <b>NA</b>    | <b>NA</b>    | <b>NA</b>    | <b>NA</b>    | <b>NA</b>    | <b>NA</b>    | <b>NA</b>    | <b>NA</b>    | <b>NA</b>    | <b>NA</b>                                                                                |
| <b>Total (with LULUCF, with indirect)</b>                                        | <b>NA</b>                                                              | <b>NA</b>    | <b>NA</b>    | <b>NA</b>    | <b>NA</b>    | <b>NA</b>    | <b>NA</b>    | <b>NA</b>    | <b>NA</b>    | <b>NA</b>    | <b>NA</b>                                                                                |
| <b>Summary of Tuvalu's GHG Emission and Removals in kt CO<sub>2</sub>e: 2023</b> |                                                                        |              |              |              |              |              |              |              |              |              |                                                                                          |



| GREENHOUSE GAS SOURCE AND SINK CATEGORIES                | Reference year/period for NDC (1)<br>(Year 2010) * | 2023  | 2023  | 2023  | 2023  | 2023  | 2023  | 2023  | 2023  | 2023  | 2023  | Change from [2010]<br>[base year]<br>[reference[year]][period]]<br>to latest reported year |
|----------------------------------------------------------|----------------------------------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------------------------------------------------------------------------------------------|
|                                                          | CO2 equivalents (kt) (3)                           |       |       |       |       |       |       |       |       |       |       | (%)                                                                                        |
| 1. Energy                                                | 13.39                                              | 9.57  | 9.82  | 8.28  | 6.92  | 12.40 | 13.96 | 8.61  | 9.96  | 15.81 | 18.06 |                                                                                            |
| 2. Industrial processes and product use                  | NO                                                 | NO    | NO    | NO    | NO    | NO    | NO    | NO    | NO    | NO    | NA    |                                                                                            |
| 3. Agriculture                                           | 8.46                                               | 8.74  | 8.71  | 8.68  | 8.66  | 8.63  | 8.61  | 8.58  | 8.55  | 8.53  | 0.83  |                                                                                            |
| 4. Land use, land-use change and forestry <sup>(4)</sup> | NO                                                 | NO    | NO    | NO    | NO    | NO    | NO    | NO    | NO    | NO    | NA    |                                                                                            |
| 5. Waste                                                 | 1.42                                               | 0.56  | 0.56  | 0.56  | 1.50  | 1.51  | 1.52  | 1.53  | 1.55  | 1.56  | 9.79  |                                                                                            |
| 6. Other                                                 | NO                                                 | NO    | NO    | NO    | NO    | NO    | NO    | NO    | NO    | NO    | NA    |                                                                                            |
| Total (with LULUCF) <sup>(8)</sup>                       | 23.26                                              | 18.87 | 19.09 | 17.52 | 17.08 | 22.55 | 24.09 | 18.73 | 20.06 | 25.89 | 11.29 |                                                                                            |

A Key Category Analysis (KCA) was conducted using both Level and Trend Assessment Approaches, identifying key emission sources such as fuel combustion (energy sector), manure management (AFOLU), and solid waste disposal (waste sector). A summary table presenting the total emissions by sector for 2023 is provided below:

**Table 4: Tuvalu's total sectoral emissions for 2023**

| Sector       | GHG Emissions (kt CO <sub>2</sub> e) | Percentage Contribution |
|--------------|--------------------------------------|-------------------------|
| Energy       | 15.81                                | 61%                     |
| Agriculture  | 8.53                                 | 33%                     |
| Waste        | 1.56                                 | 6%                      |
| <b>Total</b> | <b>25.89</b>                         | <b>100%</b>             |

Tuvalu has applied the best available activity data for estimating emissions and maintains methodological consistency across reporting years to ensure comparability.

As a Small Island Developing State (SIDS) and Least Developed Country (LDC), Tuvalu has applied flexibility provisions under the Enhanced Transparency Framework (ETF) of the Paris Agreement, specifically Paragraph 7(c) of the Modalities, Procedures, and Guidelines (MPGs) as outlined in Decision 4/CMA.1, due to national capacity constraints. These flexibilities are further explained in Section 2.7 – Flexibility Provision and Future Improvements.

In this First Biennial Transparency Report (BTR), Tuvalu has implemented key improvements in its GHG inventory, including disaggregated fuel consumption data in the Energy sector, and refined waste characterization studies for improved methane emissions estimates. The IPCC 2006 Guidelines and 2019 Refinements have been adopted, with IPCC category-specific default emission factors applied where country-specific data is unavailable, and interpolation techniques used to estimate missing fuel import statistics.

No recalculations were performed for previously submitted inventories, as this BTR covers years post-last submission, ensuring that the last inventories and historical emission trends remain unchanged. Initial QA/QC has been integrated, and capacity-building efforts are underway to enhance future reporting with duly defined and implemented QA/QC mechanisms. Moving forward, Tuvalu aims to further improve its inventory by implementing automated data tracking, developing country-specific emission factors, and expanding sectoral data collection as additional resources and technical capacity become available.

## 2.1 National circumstances, institutional arrangements and cross-cutting information

Tuvalu, recognized as both a Small Island Developing State (SIDS) and a Least Developed Country (LDC), faces unique vulnerabilities and capacity constraints. As such, it has approached the development and reporting of this Biennial Transparency Report (BTR), including its greenhouse gas (GHG) emissions inventory, with careful consideration of the flexibilities afforded to SIDS and LDCs under the UNFCCC's Modalities, Procedures, and Guidelines (MPGs). While SIDS and LDCs are encouraged to develop and report BTRs at their discretion, and flexibility provisions are applicable, Tuvalu is committed to transparency and accountability in its climate action reporting. This BTR leverages these flexibilities while striving to provide the most comprehensive and accurate information possible. Specifically, regarding the GHG emissions inventory, Tuvalu has applied the relevant flexibility provisions of the MPGs.

The inventory covers a consistent annual time series from its Nationally Determined Contribution (NDC), the year 2010 as the baseline year, and assessed the inventory for the year 2010 and from 2015 to 2023. This timeframe aligns with its Updated NDC (2022) and meets the requirement to report a



consistent time series from at least 2020 onwards. Including 2023, the latest reporting year ensures the report is submitted within three years of that year, consistent with the flexibility provisions for developing countries. The inventory compilation utilizes the best available activity data and IPCC methodologies, promoting transparency, accuracy, and adherence to the MPGs while acknowledging Tuvalu's inherent capacity limitations. The following section 2.5 provides a detailed explanation of Tuvalu's GHG emissions inventory.

Tuvalu's 2023 GHG inventory and 2015-2023 time series (with 2010 as a reference year) utilize the Tier 1 approach from the 2006 IPCC Guidelines, 2019 refinement, and Good Practice Guidance (GPG). Due to capacity and data limitations as a SIDS and LDC, and in line with flexibility provisions relating to this requirement under the MPGs, Tier 1 was chosen, prioritizing a consistent inventory within available resources. This reflects Tuvalu's commitment to transparent reporting while building capacity for future methodological advancements. Tuvalu's National GHG Inventory Key Category Analysis (KCA) for 2023 follows the 2006 IPCC Guidelines, using the Level and Trend Assessment Approaches with a 95% threshold to identify key emission sources, ensuring compliance with UNFCCC MPGs (Decision 4/CMA.1). The analysis identifies the following key IPCC categories and GHGs: 1.A Fuel Combustion Activities (CO<sub>2</sub>), 3.B Manure Management (CH<sub>4</sub>), 5.A Solid Waste Disposal (CH<sub>4</sub>), 3.B.5 Indirect N<sub>2</sub>O Emissions from Manure Management (N<sub>2</sub>O), 3.D.1 Direct N<sub>2</sub>O Emissions from Managed Soils (N<sub>2</sub>O), and 3.A Enteric Fermentation (CH<sub>4</sub>).

The overall uncertainty in national GHG emissions was estimated, with percentage uncertainty in total inventory and emission trend analysis conducted between the base year and the current year. The Energy sector and AFOLU sector contributed the highest uncertainty, followed by the Waste sector. To enhance transparency, Section 2.2 Key Category Analysis -2023 of this BTR will present a tabular format showing the individual and cumulative percentage contributions of key categories. Tuvalu has elected to use the flexibility provision under the UNFCCC MPGs but has chosen to apply the 95% threshold for the Key Category Analysis in this BTR, ensuring consistency with international reporting standards while addressing national circumstances. Future reporting cycles will explicitly clarify any adjustments to flexibility provisions as needed.

In Tuvalu, key uncertainties are associated with data availability, missing data, lack of comprehensive information, data archiving, and lack of country-specific emission factors. It is recognized that having country-specific emission factors and more detailed activity data will help reduce uncertainty in future inventory. For example, in the energy sector, there is good data available on fuel imports into the country but there is a lack of information on end usage.

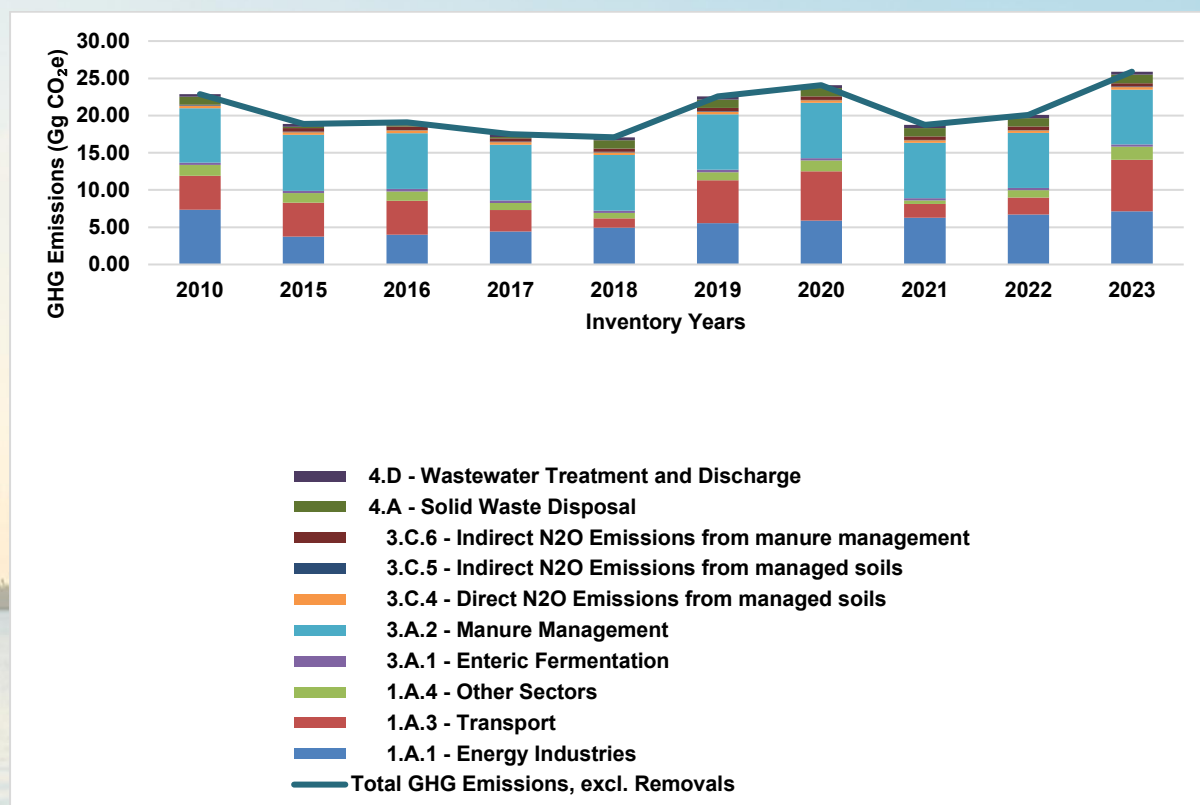
The preparation of this inventory has been another opportunity to strengthen the credibility of the results, and the rigor of the national system used to produce the inventory estimates. This inventory serves as a key source of evidence on Tuvalu's National greenhouse gas emissions trends and aids in monitoring progress made towards the reduction of GHG emissions. It also acts as an important tool for Tuvalu's policy recommendations on climate change in alignment with the NDC and enables to measurement success of such policies.

In terms of greenhouse gas (GHG) emissions, Tuvalu's total emissions for 2023 were estimated at 25.89 kt CO<sub>2</sub>e, with the Energy sector contributing 15.81 kt CO<sub>2</sub>e (61%), followed by Agriculture, Forestry, and Other Land Use (AFOLU) at 8.53 kt CO<sub>2</sub>e (33%), and Waste at 1.56 kt CO<sub>2</sub>e (6%). The electricity generation and transport subsectors were the dominant sources within the Energy sector, while livestock emissions and soil management were the primary contributors in AFOLU. Although Tuvalu's emissions are negligible on a global scale (0.01% of global emissions), the country remains highly committed to climate action. Through its Nationally Determined Contribution (NDC) and institutional arrangements under the Climate Change Department (CCD) within the Ministry of Home Affairs, Climate Change

and Environment, Tuvalu continues to strengthen its transparency, reporting, and mitigation efforts in alignment with the Paris Agreement and the Enhanced Transparency Framework (ETF).

The current GHG inventory provides comprehensive information on GHG emissions for the years 2010 and 2015 to 2023 and reflects the trend in emission levels since 2010. The GHG emissions results for the inventory period 2010-2023 reveal a varying trend over the reporting period with the annual variation dominated by fuel consumption in the energy sector.

**Figure 8: Tuvalu's total GHG emissions by sectors (excluding removals) in kt CO<sub>2</sub>e: 2010-2023**



The compilation of the GHG inventory continues to remain a major challenge, especially in terms of the availability of activity data for the estimation of GHG emissions. The key findings and recommendations of this inventory development exercise have been identified during and highlighted in previous sections of the report. However, data collection, monitoring, and verification for the GHG emission sector is a key takeaway of this exercise. For the future GHG inventory, Tuvalu shall minimize the data gaps and uncertainty specifically in the Energy, Livestock, and Waste sectors.

The First BTR report of Tuvalu is being implemented by the Climate Change Department under the Ministry of Finance. The Climate Change Project Board is comprised of Director Generals (DGs) of key stakeholder ministries and is led by the Director of Climate Change. The thematic working group (TWG) for the national GHG inventory included representatives from the Department of Energy (DOE), Tuvalu Electricity Corporation (TEC), Ministry of Natural Resource (MNR), Ministry of Transport, Energy, Communication and Innovation (MTECI), Central Statistics Division (CSD), Department of Local Government, Department of Agriculture, Ministry of Public Works, Infrastructure and Water (MPWIW), Department of Environment, Tuvalu Meteorological Services and National Disaster Management Office, Tuvalu Revenue and Customs Services, Pacific Energy, Kaupule Funafuti and private sector representatives, etc. The BTR project's overall implementation was under the Climate Change Department (CCD), which is under the Ministry of Home Affairs, Climate Change and

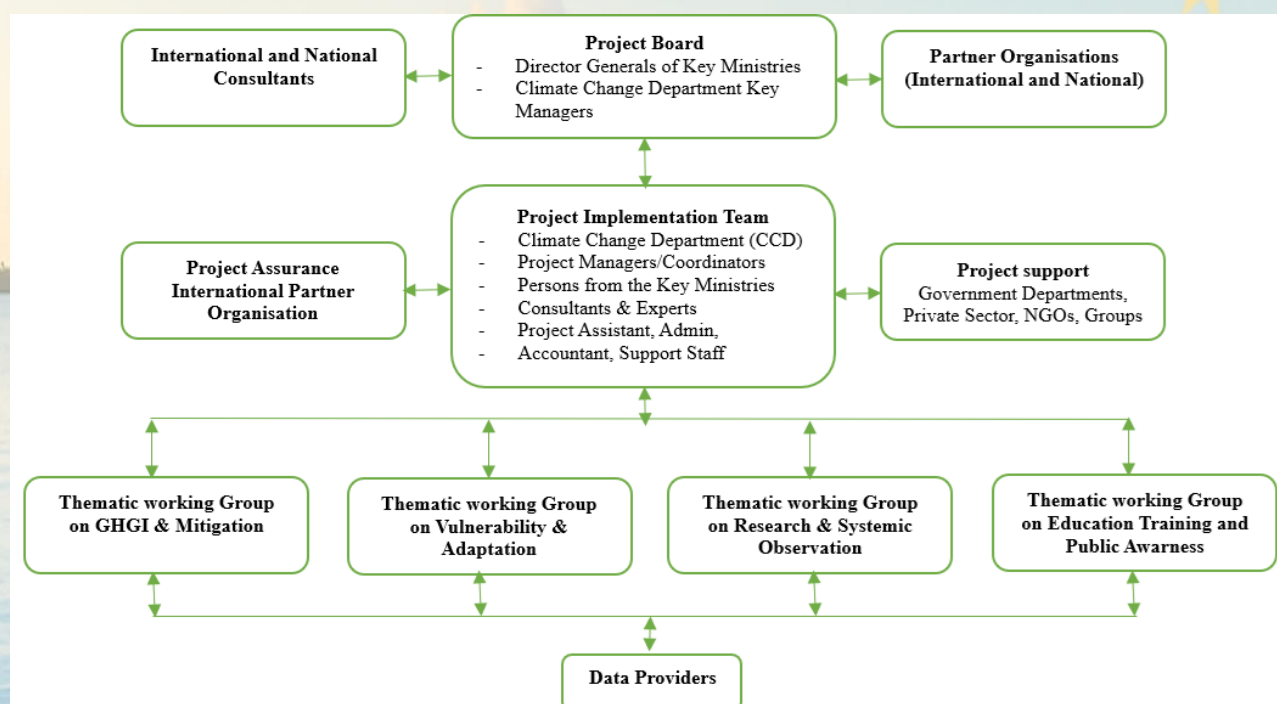


Environment (MHACCE) through the selected Project Management Unit (PMU) and alongside other large-funded projects from the Green Climate Fund (GCF) and GEF.

### 2.1.1 Institutional Arrangements and Organization Structure for Inventory Preparation

Tuvalu has established a structured institutional framework to ensure the estimation, reporting, verification, and Quality Assurance/Quality Control (QA/QC) review of its National Greenhouse Gas (GHG) Inventory, addressing the requirements of UNFCCC MPGs Paragraph 19. This framework, led by the Climate Change Department (CCD) under the Ministry of Home Affairs, Climate Change and Environment (MHACCE), supports inventory planning, preparation, and management, ensuring alignment with national climate policies, development priorities, and international reporting commitments under the Enhanced Transparency Framework (ETF) of the Paris Agreement. The institutional arrangements are comprehensively described in Section 1.13 – Institutional Arrangements for Climate Change, which outlines Tuvalu’s governance structure for overall climate change reporting.

**Figure 9. Institutional Arrangement and Organization Structure for National GHG Inventory**



The GHG inventory planning process is coordinated by the CCD, ensuring integration with Tuvalu’s Updated Nationally Determined Contribution (NDC, 2022) and broader national development strategies. The Project Steering Committee (PSC), comprising Director Generals (DGs) of key ministries, provides strategic oversight, while the Technical Advisory Committee (TAC) offers technical guidance, as detailed in Section 1.13.1 – Institutional Arrangements for Climate Change Reporting. The Project Board, which includes representatives from UNDP and international technical advisors, further ensures quality assurance and methodological consistency in the planning phase.

Tuvalu’s institutional arrangements are further supported by climate finance initiatives from the Global Environment Facility (GEF), the Green Climate Fund (GCF), and the United Nations Environment Program (UNEP). These financial and technical support mechanisms support Tuvalu’s ability to develop a systematic, transparent, and science-based inventory.

The GHG inventory preparation process is a collaborative effort managed by the CCD's Project Management Unit (PMU), engaging multiple government agencies, research institutions, and private sector stakeholders. The thematic working group (TWG), as outlined in Section 1.13.1 – Institutional Arrangements for Climate Change Reporting, includes representatives from:

- Department of Energy (DOE) – energy sector emissions
- Tuvalu Electricity Corporation (TEC) – electricity generation and fuel use
- Ministry of Natural Resources (MNR) – emissions from fisheries, agriculture and lands and survey.
- Ministry of Transport, Energy, Communication and Innovation (MTECI) – transport sector emissions
- Central Statistics Division (CSD) – socio-economic and statistical data
- Ministry of Home Affairs, Climate Change and Environment – emissions from land use
- Ministry of Public Works, Infrastructure and Water – cross-sectoral environmental data
- Private sector representatives – industry and waste management data

The CCD and PMU facilitate data collection and validation through inter-agency collaboration. Where country-specific data is unavailable, IPCC default emission factors are applied to maintain methodological consistency.

Tuvalu ensures inventory management, data archiving, and documentation through a structured system overseen by the CCD under the Ministry of Home Affairs, Climate Change and Environment (MHACCE) and in partnership with the Ministry of Finance (MoF) and the CSD. A data repository is maintained to store activity data, emissions factors, calculation methodologies, and inventory records, ensuring full transparency and traceability of emissions estimates. Section 2.1.4 and Section 1.13.6 – Quality Assurance/Quality Control and Review Mechanism outline the QA/QC framework that ensures that all reported estimates undergo internal verification, consistency checks, and documentation reviews before submission.

Further, the National GHG Inventory Improvement Plan (NIIP), described in Section 2.7.1, outlines strategies to strengthen data quality, improve institutional coordination, and enhance technical capacity for inventory compilation and management.

Tuvalu recognizes the critical need for continuous improvement of its Greenhouse Gas (GHG) inventory system arrangements and is committed to the following key enhancements:

- **Strengthened Inter-agency Coordination:** Tuvalu will enhance inter-agency coordination to facilitate more efficient and streamlined data collection and reporting processes, ensuring a collaborative approach to inventory development.
- **Dedicated Digital Data Management System:** A dedicated digital data management system will be developed to streamline and modernize inventory processes, improving data storage, retrieval, and analysis capabilities. This system will enhance efficiency and facilitate more robust data management.
- **Expanded QA/QC Procedures:** Quality Assurance/Quality Control (QA/QC) procedures will be expanded and strengthened to minimize uncertainties, improve data reliability, and ensure the highest possible quality of the GHG inventory. This will include QA/QC improvements, e.g., improved data validation checks, uncertainty analysis, etc.
- **Enhanced QA/QC Framework and National Inventory Improvement Plan (NIIP):** Tuvalu will improve and enhance its QA/QC framework, procedures, and National Inventory Improvement Plan (NIIP). This will result in a more robust national inventory with higher quality and more accurate data collection. The improved inventory will support verification processes and enable data usage for multiple purposes, as required by relevant standards. Furthermore, it will facilitate the development of a digitized and centralized data storage system.
- **Capacity Building:** Investments in capacity-building programs will be prioritized to strengthen technical expertise in emissions estimation, specific emissions factors, inventory management, and



the implementation of the enhanced QA/QC framework and NIIP. This will ensure long-term sustainability and continuous improvement of the national GHG inventory.

These improvements are essential for enhancing Tuvalu's ability to meet international reporting standards, track progress toward its NDC commitments, and ensure sustained compliance with the ETF requirements.

By integrating institutional arrangements, systematic planning, inter-agency collaboration, and continuous improvement measures, Tuvalu's National GHG Inventory meets the highest standards for transparency, accuracy, completeness, comparability, and consistency (TACCC). This structured approach ensures compliance with MPGs' requirements, supporting Tuvalu's long-term climate reporting and policy implementation objectives.

## **2.1.2 Brief Background and Process**

This National Greenhouse Gas (GHG) Inventory of Tuvalu has been developed as part of Tuvalu's First Biennial Transparency Report (BTR) to the United Nations Framework Convention on Climate Change (UNFCCC) for the reporting year 2023. The inventory follows the 2006 IPCC Guidelines for National GHG Inventories and the 2019 Refinement to the IPCC Guidelines, ensuring transparency, accuracy, completeness, consistency, and comparability. Tuvalu's inventory includes three key sectors: Energy, Agriculture, Forestry, and Other Land Use (AFOLU), and Waste, while the Industrial Processes and Product Use (IPPU) sector is not occurring, as Tuvalu lacks large-scale industrial manufacturing, chemical production, and industrial product use that would result in significant emissions. The Energy sector is the largest contributor to emissions, primarily from fuel combustion activities related to electricity generation, transport (land and marine), and other fuel uses, with key sub-categories including public electricity, residential and commercial energy use, and domestic aviation. However, fugitive emissions from fuels are not occurring due to the absence of fossil fuel extraction and refining infrastructure and activities. The AFOLU sector covers emissions from livestock (enteric fermentation and manure management), direct and indirect N<sub>2</sub>O emissions from managed soils, though carbon stock changes in forest land, cropland, and wetlands are not reported due to data limitations and Tuvalu's small land area.

The Waste sector accounts for emissions from solid waste disposal, wastewater treatment and discharge, with key sub-categories including landfill methane emissions, and domestic wastewater management. Additionally, GHG emissions from international aviation bunkers have been estimated and reported as a memo item, in line with UNFCCC and IPCC reporting guidelines, but these emissions are excluded from Tuvalu's total national GHG emissions as per international conventions. Future improvements will focus on enhancing data collection, refining methodologies, and strengthening institutional capacity to improve completeness and accuracy in Tuvalu's GHG Inventory reporting.

In this report, a detailed description of Tuvalu's anthropogenic Greenhouse Gas (GHG) inventory is presented for the year 2023, covering emissions of carbon dioxide (CO<sub>2</sub>), methane (CH<sub>4</sub>), and nitrous oxide (N<sub>2</sub>O) by sources, excluding removal by sinks. Tuvalu has elected to apply the applicable flexibility provisions under the UNFCCC Modalities, Procedures, and Guidelines (MPGs) regarding the number of gases reported, as permitted for Least Developed Countries (LDCs) and Small Island Developing States (SIDS). As a result, hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF<sub>6</sub>) are not included in this inventory, as Tuvalu has negligible or no emissions of these gases due to the absence of significant industrial and refrigeration-related activities. The Tier 1 methodological approach and IPCC default emission factors have been employed for GHG estimation,



ensuring consistency with the 2006 IPCC Guidelines while considering national circumstances and data availability constraints.

The GHG Emissions for the inventory years 2010 and from 2015 to 2023 have been estimated using the Tier 1 approach in accordance with the 2006 IPCC Guidelines for Greenhouse Gas Inventories and IPCC Good Practice Guidance (GPG) and with all the Greenhouse Gas emissions divided as per the 2006 IPCC Guidelines i.e., Sectoral, Sub-sectors and Gas type categorization. The default emission factors provided in the 2006 IPCC guidelines have been used due to a lack of country-specific emission factors. The sectors and gases assessed for the estimation of this national GHG inventory include the emissions by sources (excluding removals by sinks) of all anthropogenic GHGs (excluding the precursor gases and gases covered under the Montreal protocol).

This NI estimates the GHG emissions from the following sectors which are relevant to Tuvalu:

1. Energy
2. Industrial Processes and Product Use (IPPU) – Not Occurring in Tuvalu
3. Agriculture
4. Forestry and Other Land Use (FOLU) and
5. Waste

The present NI also estimates time series i.e. a sequence of annual greenhouse gas inventory estimates for the year baseline year 2010 and 2015 to 2023. It is to be noted that no manufacturing industry or industrial process emissions occur in the country. Moreover, Tuvalu doesn't import any solvents, refrigerants, or ODS directly; a small amount of refrigerant and ODS are used in equipment (Air Conditioning and Refrigeration) only. Hence, GHG emissions from this sector are not estimated for the inventory years 2010-2023.

For inventory years 2010-2023, energy sector GHG emissions were estimated using the reference and sectoral approaches. Further, International bunker emissions were also estimated and reported as memo items in the national GHG inventory; however, the GHG emissions from the international bunker are not included in Tuvalu's total national GHG emissions.

The GHGs estimated are (i) Carbon dioxide (CO<sub>2</sub>); (ii) Methane (CH<sub>4</sub>) and (iii) Nitrous oxide (N<sub>2</sub>O). The UNFCCC Reporting Guidelines encourage Parties to provide information on the following indirect GHGs: Oxides of Nitrogen (NO<sub>x</sub>), Carbon Monoxide (CO) and Sulphur dioxide (SO<sub>2</sub>), and Non-Methane Volatile Organic Compounds (NMVOC). To this end, an attempt is made to estimate emissions from these indirect gases from the Energy sector in this inventory for 2010-2023 using the emission factors provided in the IPCC Guidelines and EMEP/EEA Guidebook 2019<sup>2</sup>. A detailed discussion is provided in the later sections of this report.

The indirect GHG emissions are not accounted for in the aggregated national GHG emissions. The GHG emissions reported in Giga-grams (kt) and the aggregated GHG emissions and removals are expressed in CO<sub>2</sub> equivalent (CO<sub>2</sub>e) using the Global Warming Potential (GWP) defined by Fifth Assessment Report (AR5)<sup>3</sup> by the Intergovernmental Panel on Climate Change (IPCC).

**Table 5: Global Warming Potential of various gases**

<sup>2</sup> EMEP/EEA air pollutant emission inventory guidebook 2019 [https://www.eea.europa.eu/publications/emep-eea-guidebook-2019/at\\_download/file](https://www.eea.europa.eu/publications/emep-eea-guidebook-2019/at_download/file)

<sup>3</sup> IPCC Fifth Assessment report, Global Warming Potential (GWP) Values, [https://www.ipcc.ch/pdf/assessmentreport/ar5/wg1/WG1AR5\\_Chapter08\\_FINAL.pdf](https://www.ipcc.ch/pdf/assessmentreport/ar5/wg1/WG1AR5_Chapter08_FINAL.pdf) (p. 73-79)



| Gas              | GWP |
|------------------|-----|
| CO <sub>2</sub>  | 1   |
| CH <sub>4</sub>  | 28  |
| N <sub>2</sub> O | 265 |

This NIR also provides a description of the methodologies used and the quality assurance/quality control (QA/QC) measures applied, the results of the key category analysis, and Approach-I quantification of the uncertainties associated with the estimates. As a best practice, Tuvalu has carried out a key category analysis<sup>4</sup> which helped to identify the most relevant GHG inventory categories for Tuvalu. Furthermore, an uncertainty assessment<sup>5</sup> has been conducted on the estimates of emissions and removals, which identifies the potential for improvement in future inventory.

### 2.1.3 Key Category Analysis-2023

As per Decisions 17/CP.8 and 2/CP.17, the Non-Annex I Parties are encouraged, to the extent possible, to undertake any key category analysis (level/trend or both) to assist in developing inventories that better reflect their national circumstances. Key category Analysis (KCA) is prominent for the national GHG inventory development, and it provides a framework for identifying the most important categories in the GHG inventory. Key categories identified are emission or removal categories that contribute most to the total or trend in emissions level of the country. KCA aids the country in prioritizing efforts to improve the GHG inventory over time.

Tuvalu's National GHG Inventory key categories have been identified in terms of their contribution to the absolute level of national GHG emissions and removals. The basic Approach 1 has been adopted for quantitative analysis objectively, accounting for uncertainties and suggested aggregation level of analysis, as presented in the table below:

**Table 6: KCA: Aggression Level of Analysis for Approach-1**

| IPCC Category code                               | IPCC Category              | Greenhouse gas                                       | Remark                    |
|--------------------------------------------------|----------------------------|------------------------------------------------------|---------------------------|
| <b>Energy</b>                                    |                            |                                                      |                           |
| 1.A                                              | Fuel Combustion Activities | CO <sub>2</sub> , CH <sub>4</sub> , N <sub>2</sub> O | All fuel                  |
| <b>Agriculture, Forestry, and Other Land Use</b> |                            |                                                      |                           |
| 3.A                                              | Enteric Fermentation       | CH <sub>4</sub>                                      | All Category of Livestock |
| 3.B                                              | Manure Management          | CH <sub>4</sub> , N <sub>2</sub> O                   | All Category of Livestock |

<sup>4</sup> IPCC 2006 Guidelines, [http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/1\\_Volume1/V1\\_4\\_Ch4\\_MethodChoice.pdf](http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/1_Volume1/V1_4_Ch4_MethodChoice.pdf)

<sup>5</sup> IPCC 2006 Guidelines, [http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/1\\_Volume1/V1\\_3\\_Ch3\\_Uncertainties.pdf](http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/1_Volume1/V1_3_Ch3_Uncertainties.pdf)

|              |                                                            |                                    |                                    |
|--------------|------------------------------------------------------------|------------------------------------|------------------------------------|
| 3.D.1        | Direct N <sub>2</sub> O Emissions from managed soils       | N <sub>2</sub> O                   | All Category of Livestock          |
| 3.D.2        | Indirect N <sub>2</sub> O Emissions from managed soils     | N <sub>2</sub> O                   | All Category of Livestock          |
| 3.B.5        | Indirect N <sub>2</sub> O Emissions from manure management | N <sub>2</sub> O                   | All Category of Livestock          |
| <b>Waste</b> |                                                            |                                    |                                    |
| 5.A          | Solid Waste Disposal                                       | CH <sub>4</sub>                    | MSW Waste- Whole Country           |
| 5.D          | Wastewater Treatment and Discharge                         | CH <sub>4</sub> , N <sub>2</sub> O | Domestic Wastewater- Whole Country |

The tables below summarize the Key Category Analysis – Level Assessment Approach for the starting year i.e. base year (2010) and the latest inventory year (2023).

**Table 7: Key Category Analysis – Level Assessment Approach**

| <b>Key Category Analysis – Level Assessment for the starting year i.e. base year (2010)</b> |                                   |                           |              |                   |                                                                |
|---------------------------------------------------------------------------------------------|-----------------------------------|---------------------------|--------------|-------------------|----------------------------------------------------------------|
| <b>A</b>                                                                                    | <b>B</b>                          | <b>C</b>                  | <b>D</b>     | <b>E</b>          | <b>G</b>                                                       |
| <b>IPCC Category codes and Names</b>                                                        | <b>Greenhouse gas</b>             | <b>kt CO<sub>2</sub>e</b> | <b>Share</b> | <b>Cumulative</b> | <b>Rank of Absolute Value of Latest Year Estimate Column D</b> |
| 1.A.1: Energy Industries                                                                    | CARBON DIOXIDE (CO <sub>2</sub> ) | 7.33287                   | 31%          | 31%               | 1                                                              |
| 3.A: Manure Management                                                                      | METHANE (CH <sub>4</sub> )        | 7.11825                   | 30%          | 61%               | 2                                                              |
| 1.A.3.b: Road Transportation                                                                | CARBON DIOXIDE (CO <sub>2</sub> ) | 2.30224                   | 10%          | 71%               | 3                                                              |
| 1.A.3.d: Water-borne Navigation                                                             | CARBON DIOXIDE (CO <sub>2</sub> ) | 2.16958                   | 9%           | 80%               | 4                                                              |
| 1.A.4: Other Sectors                                                                        | CARBON DIOXIDE (CO <sub>2</sub> ) | 1.47717                   | 6%           | 86%               | 5                                                              |
| 5.A: Solid Waste Disposal                                                                   | METHANE (CH <sub>4</sub> )        | 1.03470                   | 4%           | 90%               | 6                                                              |
| 3.B Manure Management                                                                       | NITROUS OXIDE (N <sub>2</sub> O)  | 0.60624                   | 3%           | 93%               | 7                                                              |
| 3.B.5: Indirect N <sub>2</sub> O Emissions from manure management                           | NITROUS OXIDE (N <sub>2</sub> O)  | 0.44652                   | 2%           | 95%               | 8                                                              |
| <b>Key Category Analysis – Level Assessment for the latest inventory year (2023)</b>        |                                   |                           |              |                   |                                                                |
| <b>A</b>                                                                                    | <b>B</b>                          | <b>C</b>                  | <b>D</b>     | <b>E</b>          | <b>G</b>                                                       |
| <b>IPCC Category codes and Names</b>                                                        | <b>Greenhouse gas</b>             | <b>kt CO<sub>2</sub>e</b> | <b>Share</b> | <b>Cumulative</b> | <b>Rank of Absolute Value of Latest Year Estimate Column D</b> |
| 3.A: Manure Management                                                                      | METHANE (CH <sub>4</sub> )        | 7.22499                   | 28%          | 28%               | 1                                                              |
| 1.A.1: Energy Industries                                                                    | CARBON DIOXIDE (CO <sub>2</sub> ) | 7.11083                   | 27%          | 55%               | 2                                                              |
| 1.A.3.b: Road Transportation                                                                | CARBON DIOXIDE (CO <sub>2</sub> ) | 4.01194                   | 15%          | 71%               | 3                                                              |



|                                                                   |                                   |         |     |     |   |
|-------------------------------------------------------------------|-----------------------------------|---------|-----|-----|---|
| 1.A.3.d: Water-borne Navigation                                   | CARBON DIOXIDE (CO <sub>2</sub> ) | 2.81305 | 11% | 82% | 4 |
| 1.A.4: Other Sectors                                              | CARBON DIOXIDE (CO <sub>2</sub> ) | 1.72285 | 7%  | 88% | 5 |
| 5.A: Solid Waste Disposal                                         | METHANE (CH <sub>4</sub> )        | 1.14316 | 4%  | 93% | 6 |
| 3.B.5: Indirect N <sub>2</sub> O Emissions from manure management | NITROUS OXIDE (N <sub>2</sub> O)  | 0.44861 | 2%  | 95% | 7 |
| 3.D.1: Direct N <sub>2</sub> O Emissions from managed soils       | NITROUS OXIDE (N <sub>2</sub> O)  | 0.32247 | 1%  | 96% | 8 |

In Approach 1, key categories are identified using a pre-determined cumulative emissions threshold. Approach 1 identifies key categories and assesses the influence of various categories of sources and sinks on the level, and possibly the trend, of the national greenhouse gas inventory. Key categories are those that, when summed together in descending order of magnitude, add up to 95% of the total level; however, as per GPG key categories are identified between the threshold of 95% and 97%. The table below provides a summary of the key categories for the approach 1 level and trend assessment for the recent year i.e., 2023. The full calculations are annexed to the report.

The below table presents the summary of the conducted Key Category analysis – Trend Assessment Approach.

**Table 8: Key Category Analysis – Trend Assessment Approach**

| A                               | B                                 | C                                              | D                                              | E                                                | F                                | G                            | H                                 |
|---------------------------------|-----------------------------------|------------------------------------------------|------------------------------------------------|--------------------------------------------------|----------------------------------|------------------------------|-----------------------------------|
| IPCC Category Codes and Names   | Greenhouse gas                    | 2010 Year Estimate Ex0 (kt CO <sub>2</sub> Eq) | 2023 Year Estimate Ext (kt CO <sub>2</sub> Eq) | Trend Assessment Txt = [(Ext-Ex0) / (ΣEit-ΣEi0)] | Contribution to Trend (Txt/Σtit) | Cumulative Total of Column F | Rank of trend assessment Column E |
| 1.A.3.b: Road Transportation    | CARBON DIOXIDE (CO <sub>2</sub> ) | 2.302                                          | 4.01194                                        | 0.651                                            | 65%                              | 65%                          | 1                                 |
| 1.A.3.d: Water-borne Navigation | CARBON DIOXIDE (CO <sub>2</sub> ) | 2.170                                          | 2.81305                                        | 0.245                                            | 25%                              | 90%                          | 2                                 |
| 1.A.4: Other Sectors            | CARBON DIOXIDE (CO <sub>2</sub> ) | 1.477                                          | 1.72285                                        | 0.094                                            | 9%                               | 99%                          | 3                                 |

**Table 9: Summary of key category analysis Inventory year 2023**

| IPCC Category Codes and Names   | Greenhouse gas                    | 2023 Level KC | 2023 Trend KC |
|---------------------------------|-----------------------------------|---------------|---------------|
| 3.A: Manure Management          | METHANE (CH <sub>4</sub> )        | Yes           |               |
| 1.A.1: Energy Industries        | CARBON DIOXIDE (CO <sub>2</sub> ) | Yes           |               |
| 1.A.3.b: Road Transportation    | CARBON DIOXIDE (CO <sub>2</sub> ) | Yes           | Yes           |
| 1.A.3.d: Water-borne Navigation | CARBON DIOXIDE (CO <sub>2</sub> ) | Yes           | Yes           |
| 1.A.4: Other Sectors            | CARBON DIOXIDE (CO <sub>2</sub> ) | Yes           | Yes           |

|                                                                   |                                  |     |  |
|-------------------------------------------------------------------|----------------------------------|-----|--|
| 5.A: Solid Waste Disposal                                         | METHANE (CH <sub>4</sub> )       | Yes |  |
| 3.B.5: Indirect N <sub>2</sub> O Emissions from manure management | NITROUS OXIDE (N <sub>2</sub> O) | Yes |  |
| 3.D.1: Direct N <sub>2</sub> O Emissions from managed soils       | NITROUS OXIDE (N <sub>2</sub> O) | Yes |  |

## 2.1.4 Quality Assurance/Quality Control and Review Mechanism

Tuvalu's QA/QC and review mechanism for its National GHG Inventory is fully integrated with the institutional arrangements detailed in Chapter 1 of this report. As defined in Section 1.13 – Institutional Arrangements for Climate Change, the Climate Change Department (CCD) under the Ministry of Home Affairs, Climate Change and Environment (MHACCE) leads the overall climate reporting process, including the National GHG Inventory. This established structure provides clear roles and responsibilities that underpin the QA/QC mechanism, ensuring that all data and methodologies meet the highest standards of transparency, consistency, comparability, completeness, and accuracy.

In practical terms, the internal QA/QC plan assigns specific responsibilities to the GHG Inventory Team. The CCD (under the Ministry of Home Affairs, Climate Change and Environment (MHACCE)) carries out general quality control procedures in coordination with key institutions such as the Ministry of Finance and the Central Statistics Division (CSD), as outlined in Chapter 1. These entities are responsible for routinely checking the consistency, integrity, and completeness of data collected from government agencies, private sector participants, and non-governmental organizations. When discrepancies or data gaps arise, the team consults with the relevant stakeholders and technical experts to correct errors and reduce uncertainties, reflecting the flexibility provisions adopted due to current capacity constraints.

Category-specific quality control procedures are applied for key emission sectors—such as Energy, Agriculture, and Waste- if any significant methodological changes or data revisions occur. The thematic working group, comprised of representatives from the Department of Energy, Tuvalu Electricity Corporation, the Ministry of Natural Resources, the Ministry of Transport, Energy, Communication and Innovation, and others, conducts respective reviews of their collected data. These reviews assess activity data, emission factors, estimation methodologies, and calculation parameters to ensure that any deviations are promptly documented and addressed, in full accordance with IPCC guidelines.

Quality assurance is further reinforced by a basic expert peer review process. Draft inventory calculations and supporting documentation are submitted to independent technical reviewers, including external advisors from international organizations such as the UNDP Country Office and the UNDP Regional Technical Advisor. Their feedback is incorporated into the final inventory, ensuring that the QA/QC process not only verifies data accuracy but also enhances the credibility of the overall reporting system. This consultative process is consistent with the roles and responsibilities defined in Chapter 1 and helps maintain alignment with national climate policies and international reporting requirements.

Recognizing its current resource limitations, Tuvalu has adopted flexibility provisions in its QA/QC approach. While the present mechanism utilizes manual data verification and targeted expert reviews, plans are underway to develop a well-established, centralized, digitized QA/QC system. As mentioned in the National Inventory Improvement Plan (NIIP) in Section 2.7.1, future reporting versions will enhance inter-agency coordination, streamline data management, and expand QA/QC protocols. These



continuous improvement efforts will further solidify the robustness and reliability of Tuvalu's GHG inventory.

By aligning with the institutional arrangements described in Chapter 1 and adhering to UNFCCC MPGs Paragraph 35, Tuvalu's comprehensive QA/QC and review mechanism provides a solid foundation for credible inventory reporting, supports effective climate policymaking, and ensures sustained progress toward its NDC targets.

### 2.1.5 Uncertainty Analysis

Uncertainty estimates are an essential element of a complete emissions inventory. Uncertainty analysis has been carried out in accordance with the IPCC's general guidance on uncertainty assessment<sup>6</sup>. In accordance with the 2006 IPCC Guidelines, Approach 1 of uncertainty assessment is used. Approach 1 is based upon error propagation and is used to estimate uncertainty in individual categories, in the inventory, and trends between a year of interest and a base year.

Tuvalu selected 2010 as the starting year and 2023 as the latest year for uncertainty analysis, aligning with its NDC and MPGs. Trend uncertainty between 2010 and 2023 was estimated using IPCC Approach 1, ensuring transparency and alignment with MPGs.

The Uncertainties from disaggregated levels are combined by multiplying the default uncertainty values. The overall uncertainty in national emissions i.e., Percentage uncertainty in total inventory was estimated as 22%; and the trend in national emissions between the base year and the current year has been estimated as 2%. The major uncertainty contributed by the Energy sector and AFOLU sector followed by the Waste sector.

In Tuvalu, key uncertainties are associated with data availability, missing data, lack of comprehensive information, data archiving, and lack of country-specific emission factors. It is recognized that having country-specific emission factors and more detailed activity data will help reduce uncertainty in future inventory. For example, in the energy sector, there is good data available on fuel imports into the country but there is a lack of information on end usage.

**Table 10: Uncertainty range for key Sector emissions**

| IPCC Categories                  | Gas             | Activity data uncertainty | Emission factor / estimation parameter uncertainty | Combined uncertainty |
|----------------------------------|-----------------|---------------------------|----------------------------------------------------|----------------------|
|                                  |                 | Input data                | Input data                                         |                      |
|                                  |                 | %                         | %                                                  | %                    |
| 1 - Energy                       |                 |                           |                                                    |                      |
| 1.A - Fuel Combustion Activities | CO <sub>2</sub> | 0.25                      | 0.00                                               | 0.25                 |
| 3 - Agriculture                  |                 |                           |                                                    |                      |

<sup>6</sup> 2006 IPCC Guidelines, Volume 1, Chapter 3- Uncertainties

[http://www.ipccnggip.iges.or.jp/public/2006gl/pdf/1\\_Volume1/V1\\_3\\_Ch3\\_Uncertainties.pdf](http://www.ipccnggip.iges.or.jp/public/2006gl/pdf/1_Volume1/V1_3_Ch3_Uncertainties.pdf)

|                          |                                    |      |      |      |
|--------------------------|------------------------------------|------|------|------|
| 3.A & 3.B - Livestock    | CH <sub>4</sub> , N <sub>2</sub> O | 0.50 | 0.00 | 0.50 |
| 3.D - Agricultural Soils | N <sub>2</sub> O                   | 0.50 | 0.00 | 0.50 |
| <b>4 - Waste</b>         | CH <sub>4</sub> , N <sub>2</sub> O | 0.50 | 0.00 | 0.50 |

## 2.1.6 Flexibility Provision and Future Improvements

As a Small Island Developing State (SIDS) and a Least Developed Country (LDC), Tuvalu has applied flexibility provisions in accordance with Decision 4/CMA.1 under the Enhanced Transparency Framework (ETF) of the Paris Agreement. These flexibility measures account for data limitations, institutional constraints, and technical capacity challenges while ensuring transparency, accuracy, consistency, completeness, and comparability (TACCC) in reporting. The application of flexibility provisions is crucial for Tuvalu to effectively meet GHG inventory (GHGI) and BTR requirements within its national circumstances.

### Flexibility Provisions Applied in Tuvalu's GHGI

1. Use of Tier 1 Methodologies for Certain Sectors
  - Tier 1 methodologies have been applied in the Energy, AFOLU, and Waste sectors due to the absence of country-specific emission factors (EFs).
  - Default IPCC Emission Factors (EFs) are used where national data is lacking, particularly for CO<sub>2</sub>, CH<sub>4</sub>, and N<sub>2</sub>O emissions in the Energy, AFOLU, and Waste sectors.
  - Future improvements will focus on developing country-specific emission factors and transitioning to higher-tier methodologies where data availability improves.
2. Time Series Reporting Constraints
  - The GHGI reports emissions for 2010 and 2015 to 2023, relying on available post-2015 datasets where data gaps exist for 2011–2014.
  - In future reporting cycles, Tuvalu aims to improve historical data reconstruction for enhanced time-series consistency.
3. Uncertainty Analysis Using Simplified Approach
  - Approach 1 of the IPCC Guidelines is used to quantify uncertainty due to limitations in statistical capacity and data availability.
  - Estimated uncertainty in total national emissions is 22%, while trend uncertainty from 2010 to 2023 is 2%.
  - Efforts are underway to refine uncertainty analysis methodologies as national capacity improves.
4. Simplified Key Category Analysis (KCA)
  - The Key Category Analysis (KCA) was conducted using a 95% threshold for level and trend assessment.
  - A more detailed KCA will be developed in future inventories as higher-resolution activity data becomes available.
5. Data Gaps and Missing Categories
  - The Forestry and Other Land Use (FOLU) sector was not included in this inventory due to a lack of national land-use change data.
  - A National Inventory Improvement Plan (NIIP) is being developed to enhance data collection, archiving, and adoption of higher-tier methodologies.



- Future efforts will also focus on integrating FOLU emissions and removals using improved land-use data and geospatial mapping.

## 6. Institutional Capacity and MRV System Challenges

- A Greenhouse Gas Data Repository has been established with regional partner support to enhance national data collection and management.
- Strengthening institutional arrangements for data sharing between government ministries and agencies is a key priority for future inventories.
- Plans are in place to develop a formalized Measurement, Reporting, and Verification (MRV) system to improve data governance and inventory compilation.

Tuvalu remains committed to gradually reducing reliance on flexibility provisions by enhancing national capacity and technical expertise. Future improvements will focus on:

- Enhancing data quality through the development of country-specific emission factors.
- Expanding sectoral coverage to include land use, forestry, and additional sub-sectors.
- Strengthening MRV systems through improved institutional arrangements, quality assurance/quality control (QA/QC) protocols, and automated data tracking systems.
- Increasing technical capacity through training programs, regional cooperation, and technology transfer initiatives.

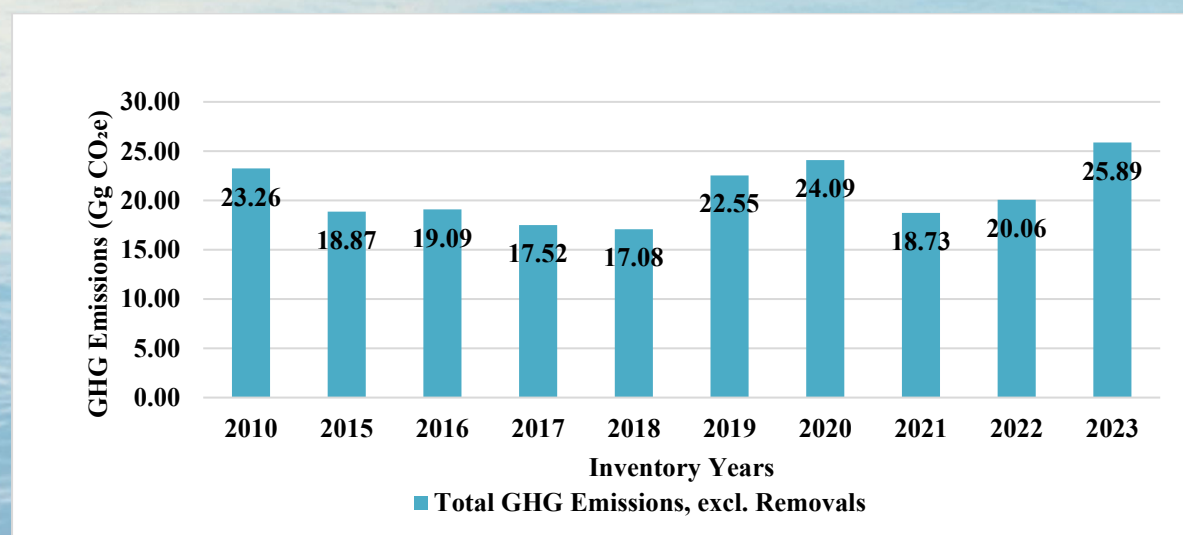
These improvements will help Tuvalu enhance its GHGI accuracy, completeness, and comparability while progressively minimizing reliance on flexibility provisions as national capacity and data availability improve.

## 2.2 GHG Emission Trend Analysis: 2010 – 2023

### 2.2.1 GHG Emission Trend: 2010 – 2023

This section presents the trend analysis for key emission-intensive sectors in Tuvalu (namely Energy, AFOLU, and Waste) for the inventory period 2010-2023.

**Figure 10. Tuvalu's Total GHG emissions (excluding removals) in kt CO<sub>2</sub>e: 2010-2023**



Tuvalu's total GHG emissions (excluding removals) reached 25.89 kt CO<sub>2</sub>e in 2023 rising from 23.26 kt CO<sub>2</sub>e in 2020, representing an increase in emission levels by about 11%. As can be seen in the above figure, there was a dip in emission level in the year 2018 which is mainly attributed to slower economic growth which led to a decrease in fuel imports. The 1994 GHG inventory covered emissions Energy

and Agriculture sectors. In the 2014 inventory, the sectoral coverage was increased and GHG emissions were estimated for all the key IPCC sectors i.e., Energy, AFOLU, and Waste sector. It is to be noted, that the current inventory for the period 2010-2023 covers emissions from Energy, Agriculture, and Waste sectors and does not include emissions from the Forestry and Other Land Use sector due to a lack of data on land use changes for the inventory period.

## 2.2.2 Sectoral GHG Emission Trend: 2010-2023

This section presents the GHG emission trends in Tuvalu's key GHG emission sectors i.e., Energy, Agriculture (Livestock and Aggregate sources and non-CO<sub>2</sub> emissions sources on land), and Waste (Solid waste- MSW and Domestic wastewater) for a more categoric review and analysis of GHG emission trends in Tuvalu.

**Figure 11. Tuvalu's total GHG emissions by sectors (excluding removals) in kt CO<sub>2</sub>e: 2010-2023**

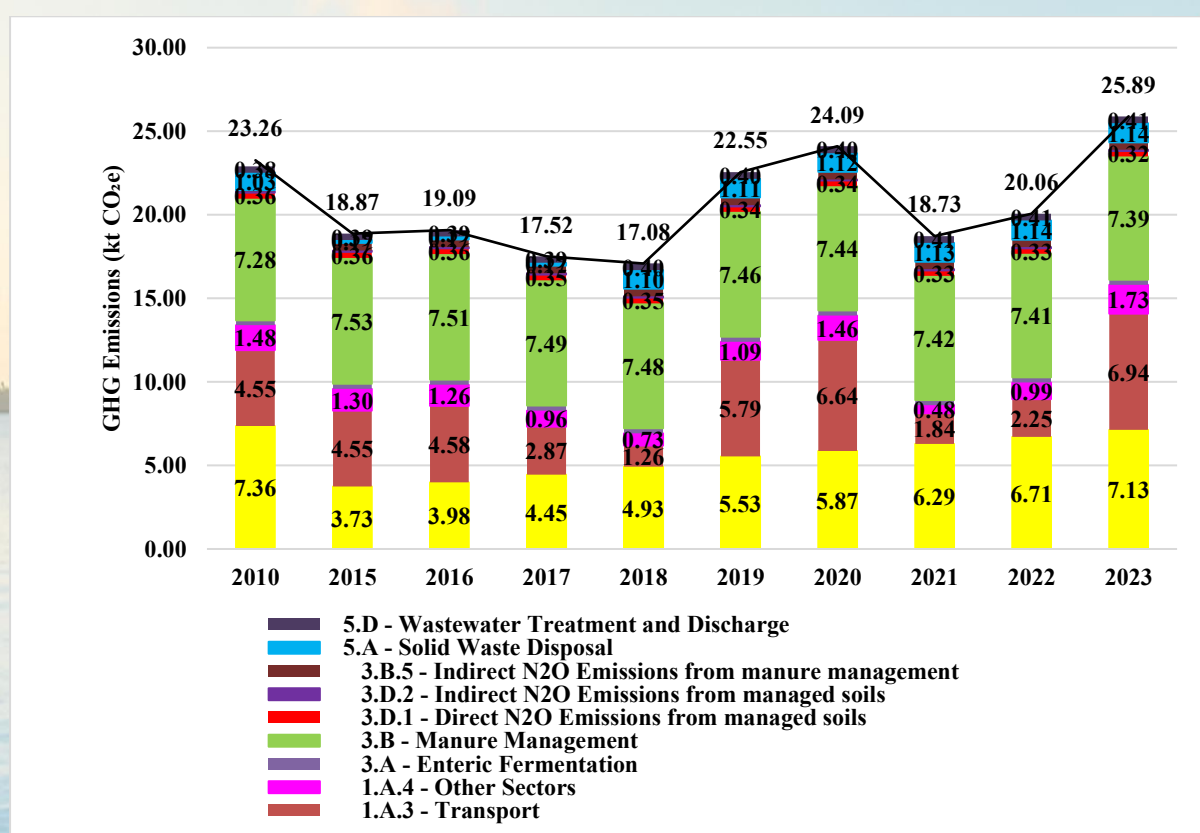
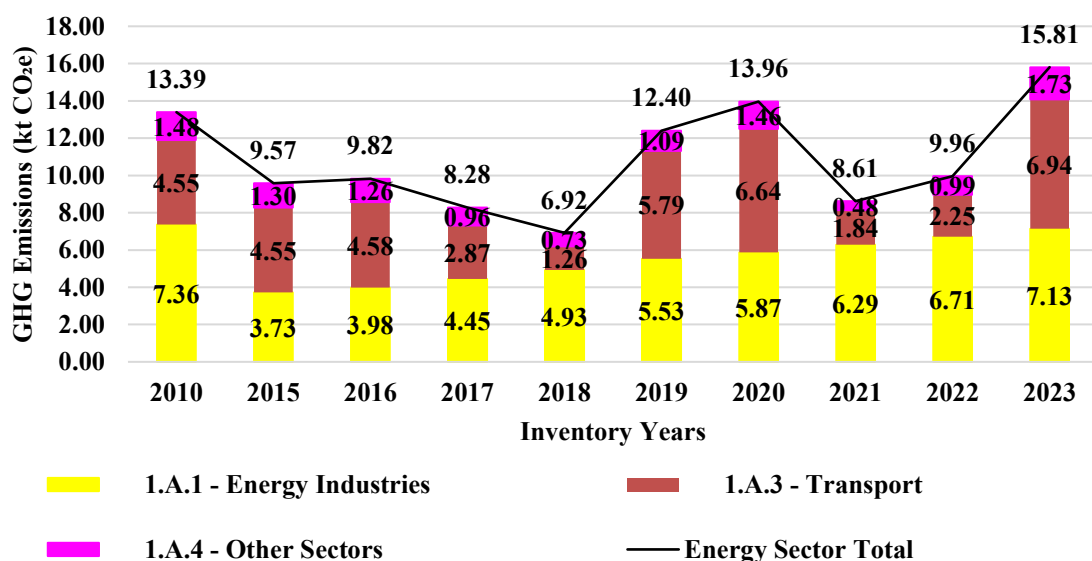


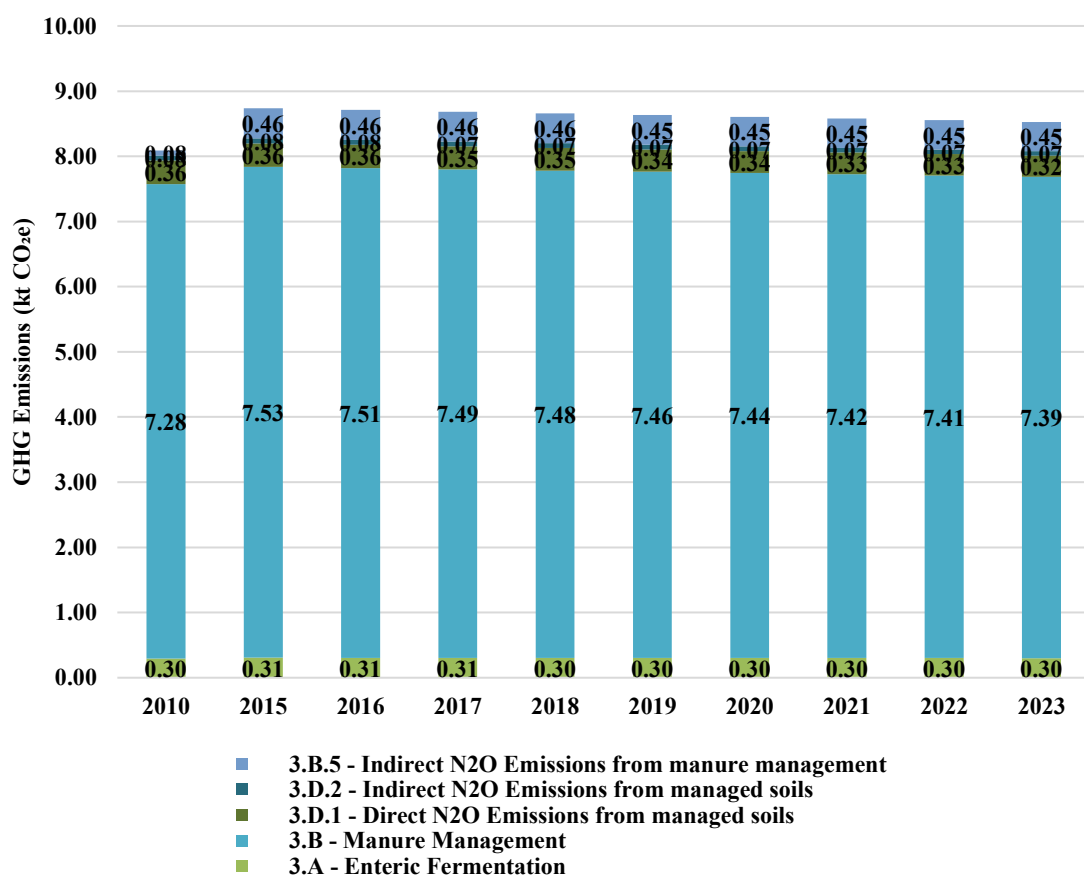
**Figure 12. Tuvalu's Energy sector total GHG emissions in kt CO<sub>2</sub>e: 2010-2023**





Tuvalu's estimated total energy sector GHG emission reached 15.81 kt CO<sub>2</sub>e in 2023 from 13.39 kt CO<sub>2</sub>e in 2010 representing an increase in emissions by about 18%. Energy sector emissions is analogous to the quantity of fuel imported into the country. Diesel used in electricity generation has grown more slowly (with the introduction of more renewables into the generation mix).

**Figure 13. Tuvalu's AFOLU sector total GHG emissions (excl. removals) in kt CO<sub>2</sub>e: 2010-2023**



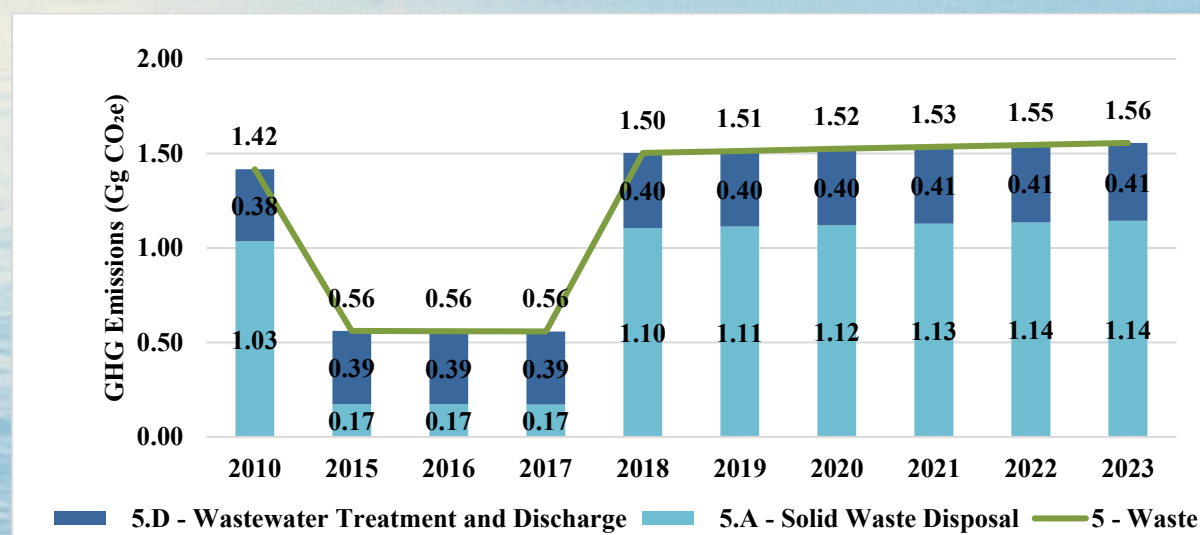
Tuvalu's total GHG emissions from the agriculture sector were estimated at 8.53 kt CO<sub>2</sub>e in 2023. The emissions from the 'Livestock (3.A-Enteric Fermentation and 3.B-Manure Management)' and 'Aggregate sources and non-CO<sub>2</sub> emissions sources on land (3.D.1 - Direct N<sub>2</sub>O Emissions from managed soils, 3.D.2 - Indirect N<sub>2</sub>O Emissions from managed soils, and 3.B.5 - Indirect N<sub>2</sub>O Emissions from manure management)' sub-sectors in Tuvalu show a decreasing trend and are mainly attributed to the estimated livestock population in the country. Livestock sector emissions reached 7.69 kt CO<sub>2</sub>e in 2023 from 7.57 kt CO<sub>2</sub>e in 2010.

Livestock raising is one of the most important agricultural activities in Tuvalu, playing a key role in supporting household livelihoods and providing income, particularly in rural areas. Pigs, chickens, and ducks are the livestock raised in the country with home consumption (subsistence) as the main purpose of raising livestock.

However, there is a lack of modern scientific manure management systems (composting of pig waste is practiced at some extent) and some of the livestock are free ranging due to which the emissions from both 'livestock' and 'Aggregate sources and non-CO<sub>2</sub> emissions sources on land' sub-sector has the significant share in the total GHG emissions from Tuvalu.

The Waste sector emissions were not estimated under the 1994 inventory. However, they are estimated in the 2014 inventory as well as under this inventory for the period 2010-2023. Tuvalu's emissions from the waste sector reached 1.56 kt CO<sub>2</sub>e in 2023. The waste sector emissions show an increasing trend during the inventory years 2010 to 2023 raising concerns. The increase in the waste sector emissions is attributed to the rising population of the country. All the disposal sites in the country are classified as open dumpsites and thus need physical improvements to upgrade to proper and safe disposal landfills. Whereas the wastewater generated is discharged into nearby water bodies untreated which is leading to contamination of groundwater and soil.

**Figure 14. Tuvalu's Waste Sector total GHG emissions in kt CO<sub>2</sub>e: 2010-2023**

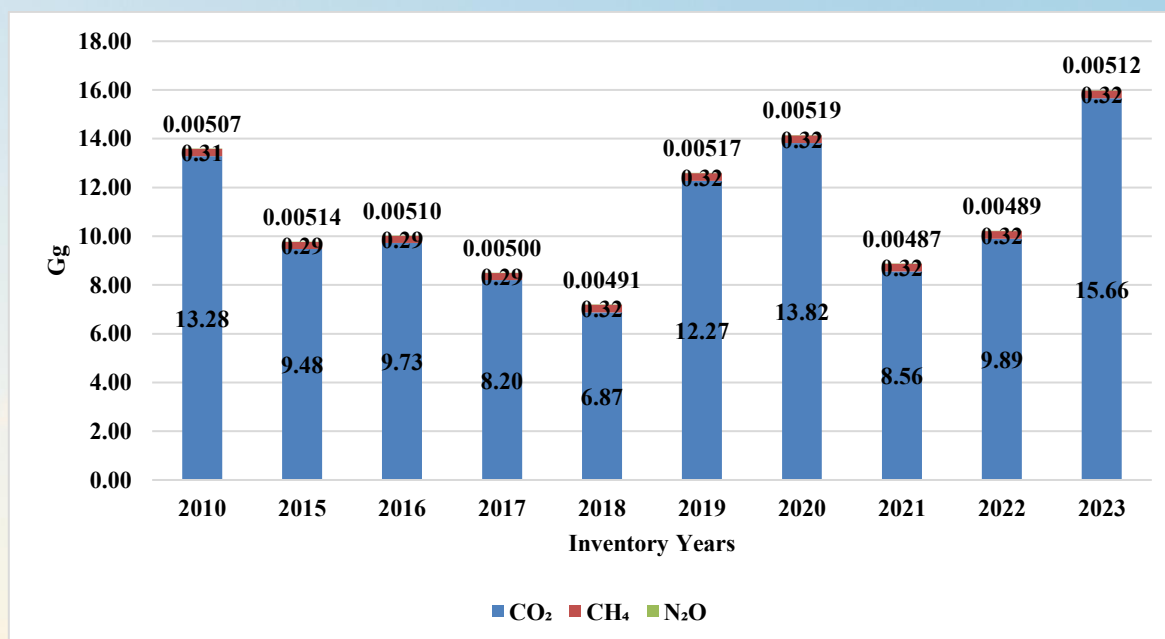


### 2.2.3 Gas-wise Emission Trend: 2010-2023

This section presents the Gas-wise emission trend in Tuvalu during the inventory years 2010 to 2023. The CO<sub>2</sub> emissions is mainly due to fuel combustion activities. While CH<sub>4</sub> and N<sub>2</sub>O emissions are contributed by the agriculture sector (Livestock and Aggregate sources and non-CO<sub>2</sub> emissions sources on land) and the Waste sector (Solid waste- MSW and Wastewater treatment- Domestic).



**Figure 15. Tuvalu's Gas-wise emissions in kt: 2010-2023**



As can be seen in the figure above, the CO<sub>2</sub> emissions trend indicates that the emission levels of CO<sub>2</sub> in Tuvalu have increased to 15.66 kt from 13.28 kt during the period 2010 to 2023, representing an increase of about 18% approximately. CH<sub>4</sub> emissions show an increase of over 3% during the period 2010-2023, increasing to 0.32 kt in 2023 from 0.31 kt in 2010. Whereas the N<sub>2</sub>O emissions are estimated to have reached 0.00512 kt in 2021 from 0.00507 kt in 2010.

## 2.3 Tuvalu's National GHG Inventory: 2010-2023

### 2.3.1 Overview

Tuvalu's total GHG emissions for the years 2010-2023 have been estimated based on the approach and methodologies discussed in the previous section of the report and are presented hereunder in the following section.

In 2023, Tuvalu's total GHG emissions (excluding removals) was 25.89 kt CO<sub>2</sub>e (in comparison to 25.26 kt CO<sub>2</sub>e estimated for the year baseline year 2010 and 18.47 kt CO<sub>2</sub>e estimated for the year 2014 under the second national communication). This comprises direct CO<sub>2</sub> emission of 15.66 kt, CH<sub>4</sub> emission of 0.317 kt, and N<sub>2</sub>O emissions of 0.005 kt during 2023. The emissions of other indirect GHGs like perfluorocarbons (PFCs), hydrofluorocarbons (HFCs), and Sulphur hexafluoride (SF<sub>6</sub>) are not estimated due to limited application and no manufacturing of the products containing these gases.

The total GHG emissions in Tuvalu for the year 2023, are presented in the Table below:

**Table 11: Tuvalu's GHG Emission and Removals kt CO<sub>2</sub>e: 2023**

| Inventory Year: 2023                                       | Emissions (kt)  |                 |                  |                            |                 |                |                |                 |
|------------------------------------------------------------|-----------------|-----------------|------------------|----------------------------|-----------------|----------------|----------------|-----------------|
| Categories                                                 | CO <sub>2</sub> | CH <sub>4</sub> | N <sub>2</sub> O | CO <sub>2</sub> Equivalent | NO <sub>x</sub> | CO             | NMVOCs         | SO <sub>2</sub> |
| <b>Total national emissions and removals</b>               | <b>15.65868</b> | <b>0.31688</b>  | <b>0.00512</b>   | <b>25.88840</b>            | <b>0.07011</b>  | <b>0.03730</b> | <b>0.00588</b> | <b>0.01868</b>  |
| <b>1. Energy</b>                                           | <b>15.65868</b> | <b>0.00074</b>  | <b>0.00047</b>   | <b>15.80516</b>            | <b>0.07011</b>  | <b>0.03730</b> | <b>0.00588</b> | <b>0.01868</b>  |
| 1.A. Fuel combustion                                       | <b>15.65868</b> | <b>0.00074</b>  | <b>0.00047</b>   | <b>15.80516</b>            | <b>0.07011</b>  | <b>0.03730</b> | <b>0.00588</b> | <b>0.01868</b>  |
| 1.A.1. Energy industries                                   | 7.11083         | 0.00029         | 0.00006          | <b>7.13415</b>             | 0.00643         | 0.00160        | 0.00008        | 0.00460         |
| 1.A.2. Manufacturing industries and construction           | 0.00000         | 0.00000         | 0.00000          | <b>NO</b>                  | 0.00000         | 0.00000        | 0.00000        | 0.00000         |
| 1.A.3. Transport                                           | 6.82499         | 0.00036         | 0.00040          | <b>6.94238</b>             | 0.06155         | 0.03496        | 0.00558        | 0.01362         |
| 1.A.4. Other sectors                                       | 1.72285         | 0.00009         | 0.00001          | <b>1.72863</b>             | 0.00213         | 0.00073        | 0.00022        | 0.00046         |
| 1.A.5. Other                                               | NO              | NO              | NO               | NO                         | NO              | NO             | NO             | NO              |
| <b>3. Agriculture</b>                                      | <b>0.0000</b>   | <b>0.2688</b>   | <b>0.0038</b>    | <b>8.52760</b>             | <b>NO</b>       | <b>NO</b>      | <b>NO</b>      | <b>NO</b>       |
| 3.A. Enteric fermentation                                  | 0.0000          | 0.0107          | 0.0000           | <b>0.30078</b>             | NO              | NO             | NO             | NO              |
| 3.B. Manure management                                     | 0.0000          | 0.2580          | 0.0023           | <b>7.83583</b>             | NO              | NO             | NO             | NO              |
| 3.D. Agricultural soils                                    | 0.0000          | NE              | 0.0015           | <b>0.39099</b>             | NO              | NO             | NO             | NO              |
| <b>5. Waste</b>                                            | <b>0.0000</b>   | <b>0.0474</b>   | <b>0.0009</b>    | <b>1.55563</b>             | <b>NO</b>       | <b>NO</b>      | <b>NO</b>      | <b>NO</b>       |
| 5.A. Solid waste disposal <sup>(6)</sup>                   | 0.0000          | 0.0408          | 0.0000           | 1.14316                    | NO              | NO             | NO             | NO              |
| 5.B. Biological treatment of solid waste                   | 0.0000          | NO              | NO               | NO                         | NO              | NO             | NO             | NO              |
| 5.C. Incineration and open burning of waste <sup>(6)</sup> | NO              | NO              | NO               | NO                         | NO              | NO             | NO             | NO              |
| 5.D. Wastewater treatment and discharge                    | 0.0000          | 0.0065          | 0.0009           | 0.41247                    | NO              | NO             | NO             | NO              |
| 5.E. Other <sup>(6)</sup>                                  | NO              | NO              | NO               | NO                         | NO              | NO             | NO             | NO              |
| <b>6. Other (please specify) <sup>(7)</sup></b>            | <b>NO</b>       | <b>NO</b>       | <b>NO</b>        | <b>NO</b>                  | <b>NO</b>       | <b>NO</b>      | <b>NO</b>      | <b>NO</b>       |
|                                                            | NO              | NO              | NO               | NO                         | NO              | NO             | NO             | NO              |



| Memo items: <sup>(8)</sup>          |      |          |         |                |        |        |        |      |
|-------------------------------------|------|----------|---------|----------------|--------|--------|--------|------|
| <b>1.D.1. International bunkers</b> | 0.69 | 0.00     | 0.00    | <b>0.69838</b> | 0.0024 | 0.0010 | 0.0005 | 0.00 |
| 1.D.1.a. Aviation                   | 0.69 | 0.000005 | 0.00002 | 0.69838        | 0.0024 | 0.0010 | 0.0005 | 0.00 |
| 1.D.1.b. Navigation                 | NO   | NO       | NO      | NO             | NO     | NO     | NO     | NO   |

### 2.3.2 Total GHG Emissions 2010-2023

Tuvalu's total GHG emissions in kt CO<sub>2</sub>e (excluding removals) for the inventory years 2010-2023 are presented as follows:

**Figure 16. Tuvalu's GHG Emission (excluding removals), kt CO<sub>2</sub>e: 2010 -2023**

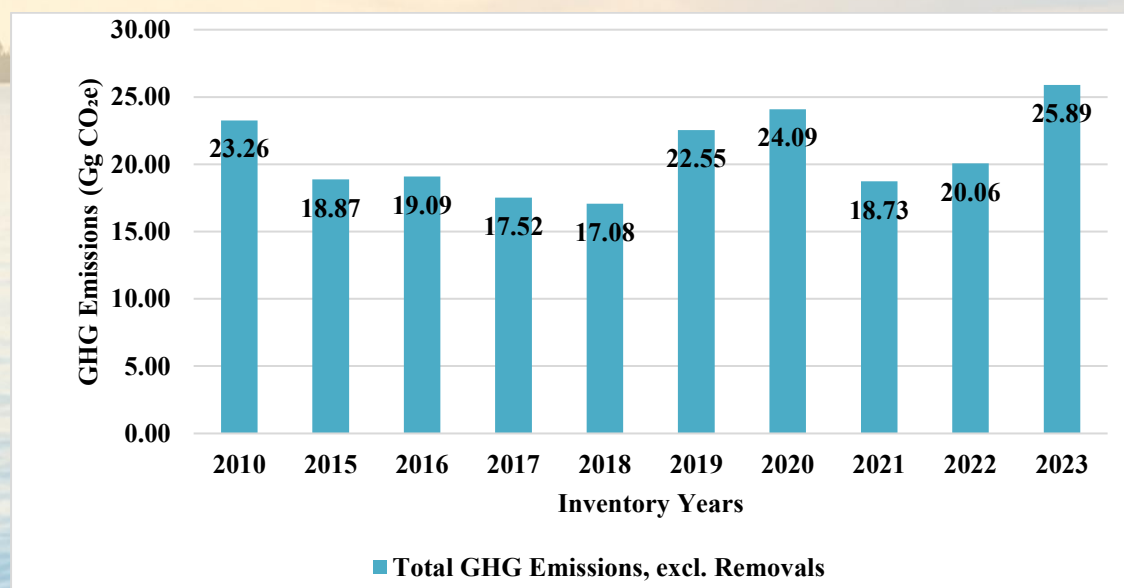


**Table 12: Tuvalu's GHG Emission (excluding removals), kt CO<sub>2</sub>e: 2010 -2023**

| Inventory Year: 2010-2023                  | Net CO <sub>2</sub> Emissions, (CO <sub>2</sub> Equivalents kt) |              |              |              |              |              |              |              |              |              |
|--------------------------------------------|-----------------------------------------------------------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|
| Categories                                 | 2010                                                            | 2015         | 2016         | 2017         | 2018         | 2019         | 2020         | 2021         | 2022         | 2023         |
| 1 - Energy                                 | 13.39                                                           | 9.57         | 9.82         | 8.28         | 6.92         | 12.40        | 13.96        | 8.61         | 9.96         | 15.81        |
| 2 - Industrial Processes and Product Use   | NO                                                              | NO           | NO           | NO           | NO           | NO           | NO           | NO           | NO           | NO           |
| 3 - Agriculture                            | 8.46                                                            | 8.74         | 8.71         | 8.68         | 8.66         | 8.63         | 8.61         | 8.58         | 8.55         | 8.53         |
| 4 - Land use, land-use change and forestry | NE                                                              | NE           | NE           | NE           | NE           | NE           | NE           | NE           | NE           | NE           |
| 5 - Waste                                  | 1.42                                                            | 0.56         | 0.56         | 0.56         | 1.50         | 1.51         | 1.52         | 1.53         | 1.55         | 1.56         |
| <b>Total GHG Emissions, excl. Removals</b> | <b>23.26</b>                                                    | <b>18.87</b> | <b>19.09</b> | <b>17.52</b> | <b>17.08</b> | <b>22.55</b> | <b>24.09</b> | <b>18.73</b> | <b>20.06</b> | <b>25.89</b> |

*Notation keys: NE= not estimated*

**Figure 17. Tuvalu's GHG Emission (excluding removals) by Gas (kt): 2010 -2023**

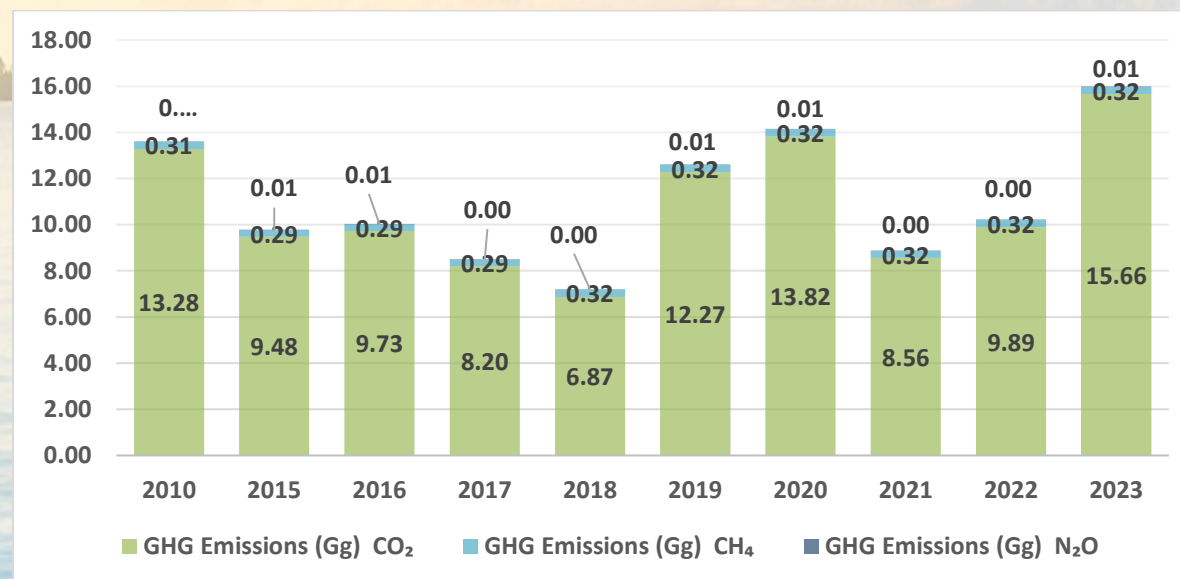
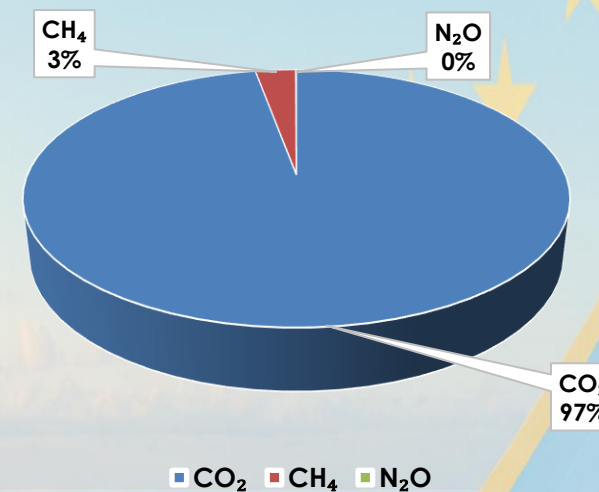




**Table 13: Tuvalu's GHG Emission (excluding removals) by Gas (kt): 2010 -2023**

| Tuvalu's GHG Emissions, (CO <sub>2</sub> Equivalents kt) |                 |                 |                  |                   |
|----------------------------------------------------------|-----------------|-----------------|------------------|-------------------|
| Year                                                     | CO <sub>2</sub> | CH <sub>4</sub> | N <sub>2</sub> O | CO <sub>2</sub> e |
| 2010                                                     | 13.28           | 0.31            | 0.01             | 23.26             |
| 2015                                                     | 9.48            | 0.29            | 0.01             | 18.87             |
| 2016                                                     | 9.73            | 0.29            | 0.01             | 19.09             |
| 2017                                                     | 8.20            | 0.29            | 0.00             | 17.52             |
| 2018                                                     | 6.87            | 0.32            | 0.00             | 17.08             |
| 2019                                                     | 12.27           | 0.32            | 0.01             | 22.55             |
| 2020                                                     | 13.82           | 0.32            | 0.01             | 24.09             |
| 2021                                                     | 8.56            | 0.32            | 0.00             | 18.73             |
| 2022                                                     | 9.89            | 0.32            | 0.00             | 20.06             |
| 2023                                                     | 15.66           | 0.32            | 0.01             | 25.89             |
| <b>Average</b>                                           | <b>10.78</b>    | <b>0.31</b>     | <b>0.01</b>      | <b>20.71</b>      |
| <b>%share</b>                                            | <b>97.18%</b>   | <b>2.77%</b>    | <b>0.05%</b>     |                   |
| <b>Percentage change between 2010-2023</b>               | <b>17.90%</b>   | <b>2.74%</b>    | <b>0.94%</b>     | <b>11.29%</b>     |

**Figure 18. Tuvalu's GHG Emission (excluding removals) by Gas (kt): Average of 2010 to 2023**



The total GHG emissions from Tuvalu is increasing during the inventory years 2010-2023, an indicative increase in the CO<sub>2</sub> emission followed by minimal variations in CH<sub>4</sub> and N<sub>2</sub>O emissions. CO<sub>2</sub> emissions are mainly attributed to fossil fuel combustion activities, while CH<sub>4</sub> and N<sub>2</sub>O emissions are from agriculture-livestock (Enteric fermentation, Manure management, and Aggregate sources and non-CO<sub>2</sub> emissions sources on land) and Waste Sector (Solid waste and wastewater) respectively.

### 2.3.3 GHG Emissions by Sector

The main GHG emission sectors and sub-sectors in Tuvalu are:

| Sector         | IPCC Category Code                                                  | Sub-sector/Activity                                        | Main GHG Emissions                                                                                  |
|----------------|---------------------------------------------------------------------|------------------------------------------------------------|-----------------------------------------------------------------------------------------------------|
| 1. Energy      | 1.A                                                                 | Fuel Combustion                                            | CO <sub>2</sub> , CH <sub>4</sub> , N <sub>2</sub> O, NO <sub>x</sub> , CO, NMVOCs, SO <sub>2</sub> |
|                | 1.A.1                                                               | Energy Industries (Electricity Generation)                 | CO <sub>2</sub> , CH <sub>4</sub> , N <sub>2</sub> O, NO <sub>x</sub> , CO, NMVOCs, SO <sub>2</sub> |
|                | 1.A.3                                                               | Transport                                                  | CO <sub>2</sub> , CH <sub>4</sub> , N <sub>2</sub> O, NO <sub>x</sub> , CO, NMVOCs, SO <sub>2</sub> |
|                | 1.A.3.b                                                             | Road Transportation                                        | CO <sub>2</sub> , CH <sub>4</sub> , N <sub>2</sub> O, NO <sub>x</sub> , CO, NMVOCs, SO <sub>2</sub> |
|                | 1.A.3.d                                                             | Water-borne Navigation (Domestic)                          | CO <sub>2</sub> , CH <sub>4</sub> , N <sub>2</sub> O, NO <sub>x</sub> , CO, NMVOCs, SO <sub>2</sub> |
|                | 1.A.4                                                               | Other Sectors                                              | CO <sub>2</sub> , CH <sub>4</sub> , N <sub>2</sub> O                                                |
|                | 1.A.4.b                                                             | Residential                                                | CO <sub>2</sub> , CH <sub>4</sub> , N <sub>2</sub> O                                                |
|                | 1.A.4.a                                                             | Commercial/Institutional                                   | CO <sub>2</sub> , CH <sub>4</sub> , N <sub>2</sub> O                                                |
|                | 1.A.4.c                                                             | Agriculture/Forestry/Fishing/Fish Farms                    | CO <sub>2</sub> , CH <sub>4</sub> , N <sub>2</sub> O                                                |
| 3. Agriculture | Livestock                                                           |                                                            |                                                                                                     |
|                | 3.A                                                                 | Enteric Fermentation                                       | CH <sub>4</sub>                                                                                     |
|                | 3.B                                                                 | Manure Management                                          | CH <sub>4</sub> , N <sub>2</sub> O                                                                  |
|                | Aggregate Sources and Non-CO <sub>2</sub> Emissions Sources on Land |                                                            |                                                                                                     |
|                | 3.D.1                                                               | Direct N <sub>2</sub> O Emissions from managed soils       | N <sub>2</sub> O                                                                                    |
|                | 3.D.2                                                               | Indirect N <sub>2</sub> O Emissions from managed soils     | N <sub>2</sub> O                                                                                    |
| 5. Waste       | 3.B.5                                                               | Indirect N <sub>2</sub> O Emissions from manure management | N <sub>2</sub> O                                                                                    |
|                | 5.A                                                                 | Solid Waste Disposal                                       | CH <sub>4</sub>                                                                                     |
|                | 5.D                                                                 | Wastewater Treatment and Discharge                         | CH <sub>4</sub> , N <sub>2</sub> O                                                                  |

**Note:** GHG emissions from international aviation have been calculated as a memo item and are not included in the total GHG emissions from Tuvalu. GHG emissions from international waterborne navigation have not been calculated due to a lack of fuel consumption/distribution for the said purpose.

The listed sector and sub-sectors are sources of direct CO<sub>2</sub> emission, CH<sub>4</sub> emission and N<sub>2</sub>O emissions and emissions of precursor gases (NO<sub>x</sub>, SO<sub>x</sub>, and NMVOC); further the other indirect GHGs like perfluorocarbons (PFCs), hydrofluorocarbons (HFCs), and Sulphur hexafluoride (SF<sub>6</sub>) are not estimated due to limited application and no manufacturing of the products containing these gases in Tuvalu.

The total GHG emissions for the year 201

0-2023 (excluding removals are summarized in the table below):

**Table 14: Tuvalu's Total GHG Emission (kt CO<sub>2</sub>e): 2010 -2023**

| Inventory Year: 2010-2023    | 2010                                | 2015         | 2016         | 2017         | 2018         | 2019         | 2020         | 2021         | 2022         | 2023         |
|------------------------------|-------------------------------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|
| Categories                   | kt CO <sub>2</sub> equivalents (kt) |              |              |              |              |              |              |              |              |              |
| <b>Total (net emissions)</b> | <b>23.26</b>                        | <b>18.87</b> | <b>19.09</b> | <b>17.52</b> | <b>17.08</b> | <b>22.55</b> | <b>24.09</b> | <b>18.73</b> | <b>20.06</b> | <b>25.89</b> |
| <b>1. Energy</b>             | <b>13.39</b>                        | <b>9.57</b>  | <b>9.82</b>  | <b>8.28</b>  | <b>6.92</b>  | <b>12.40</b> | <b>13.96</b> | <b>8.61</b>  | <b>9.96</b>  | <b>15.81</b> |
| 1.A. Fuel combustion         | 13.39                               | 9.57         | 9.82         | 8.28         | 6.92         | 12.40        | 13.96        | 8.61         | 9.96         | 15.81        |



|                                         |              |             |             |             |             |             |             |             |             |             |
|-----------------------------------------|--------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
| 1.A.1. Energy industries                | 7.36         | 3.73        | 3.98        | 4.45        | 4.93        | 5.53        | 5.87        | 6.29        | 6.71        | 7.13        |
| 1.A.3. Transport                        | 4.55         | 4.55        | 4.58        | 2.87        | 1.26        | 5.79        | 6.64        | 1.84        | 2.25        | 6.94        |
| 1.A.4. Other sectors                    | 1.48         | 1.30        | 1.26        | 0.96        | 0.73        | 1.09        | 1.46        | 0.48        | 0.99        | 1.73        |
| <b>3. Agriculture</b>                   | <b>8.458</b> | <b>8.74</b> | <b>8.71</b> | <b>8.68</b> | <b>8.66</b> | <b>8.63</b> | <b>8.61</b> | <b>8.58</b> | <b>8.55</b> | <b>8.53</b> |
| 3.A. Enteric fermentation               | 0.296        | 0.31        | 0.31        | 0.31        | 0.30        | 0.30        | 0.30        | 0.30        | 0.30        | 0.30078     |
| 3.B. Manure management                  | 7.724        | 7.99        | 7.97        | 7.95        | 7.93        | 7.91        | 7.89        | 7.87        | 7.86        | 7.83583     |
| 3.D. Agricultural soils                 | 0.437        | 0.44        | 0.43        | 0.43        | 0.42        | 0.41        | 0.41        | 0.40        | 0.40        | 0.39099     |
| <b>5. Waste</b>                         | <b>1.42</b>  | <b>0.56</b> | <b>0.56</b> | <b>0.56</b> | <b>1.50</b> | <b>1.51</b> | <b>1.52</b> | <b>1.53</b> | <b>1.55</b> | <b>1.56</b> |
| 5.A. Solid waste disposal               | 1.03         | 0.17        | 0.17        | 0.17        | 1.10        | 1.11        | 1.12        | 1.13        | 1.14        | 1.14316     |
| 5.D. Wastewater treatment and discharge | 0.38         | 0.39        | 0.39        | 0.39        | 0.40        | 0.40        | 0.40        | 0.41        | 0.41        | 0.41247     |

*Notation keys: NE= not estimated*

### 2.3.4 GHG Emissions by Sub-sector and Key Categories

Tuvalu's sub-sector-wise GHG emissions, focusing on key categories, indicate that the main contributions are from:

- 1.A - Fuel Combustion Activities (electricity generation, transport, and others),
- 3.A - Enteric Fermentation
- 3.B - Manure Management
- 3.D.1 - Direct N<sub>2</sub>O Emissions from managed soils,
- 3.D.2 - Indirect N<sub>2</sub>O Emissions from managed soils,
- 3.B.5 - Indirect N<sub>2</sub>O Emissions from manure management,
- 5.A - Solid Waste Disposal, and
- 5.D - Wastewater Treatment and Discharge.

These sub-sectors represent the *key categories* of GHG emissions for Tuvalu, identified as per the threshold used, i.e., the 95% cumulative contribution threshold, and refer section 2.2 key category analysis - 2023.

The sub-sector-wise GHG emissions show that the GHG emissions from enteric fermentation, manure management, and aggregate sources and non-CO<sub>2</sub> emissions sources on land (direct N<sub>2</sub>O emissions from managed soils and indirect N<sub>2</sub>O emissions from managed soils and manure management) activities are reducing year-on-year basis. This is mainly attributed to the decline in the livestock population.

A detailed analysis of each sub-sector is provided in the later sections of the report. Tuvalu's Sub-sectoral and key categories GHG emissions during the inventory years 2010-2023 are presented in below Figure and Table.

**Figure 19. Tuvalu's GHG emissions contributions by Sub-sectors (Key Categories, excluding removals) (kt CO<sub>2</sub>e): 2010-2023**

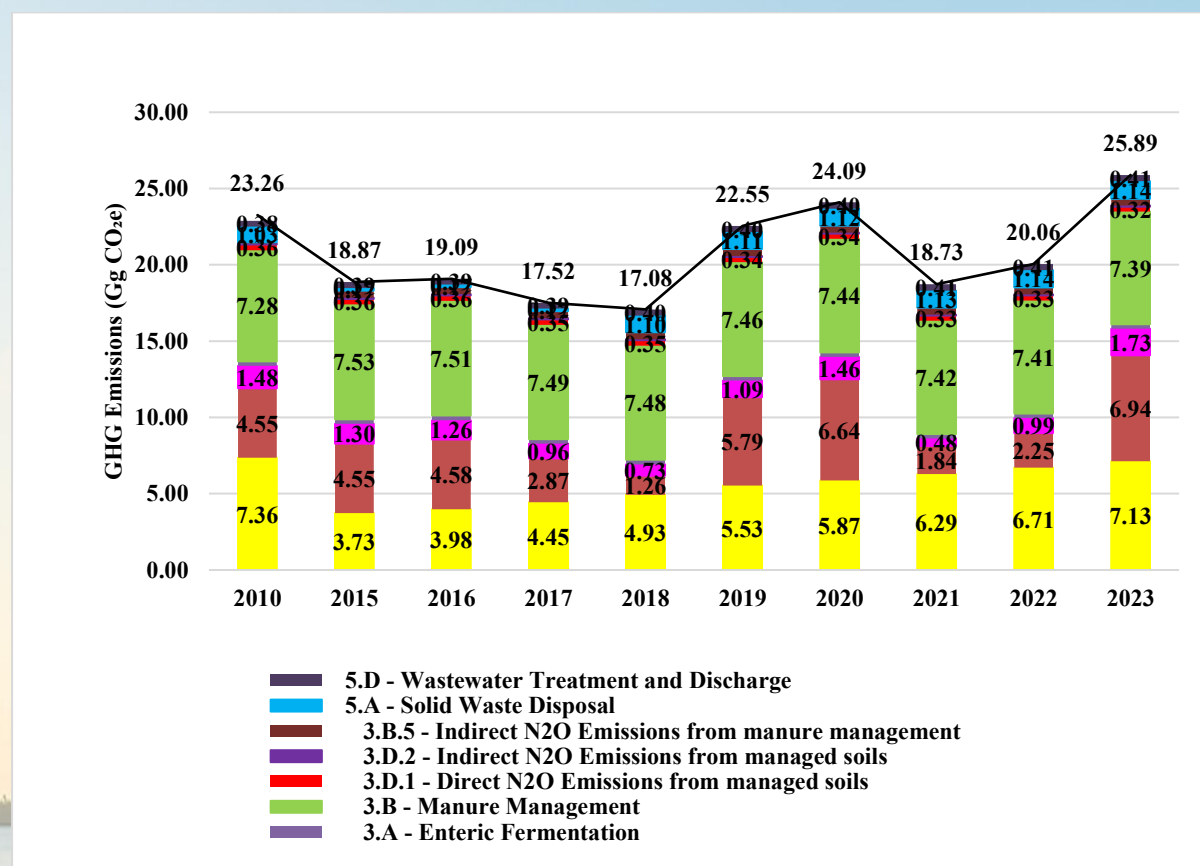


**Table 15: Tuvalu's GHG emissions contributions by Sub-sectors (Key Categories, excluding removals) (kt CO<sub>2</sub>e): 2010-2023**

| Inventory Year: 2010-2023                                          | Net CO <sub>2</sub> Emissions, (CO <sub>2</sub> Equivalents kt) |      |      |      |      |      |      |      |      |      |
|--------------------------------------------------------------------|-----------------------------------------------------------------|------|------|------|------|------|------|------|------|------|
| Categories                                                         | 2010                                                            | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 |
| 1.A.1 - Energy Industries                                          | 7.36                                                            | 3.73 | 3.98 | 4.45 | 4.93 | 5.53 | 5.87 | 6.29 | 6.71 | 7.13 |
| 1.A.3 - Transport                                                  | 4.55                                                            | 4.55 | 4.58 | 2.87 | 1.26 | 5.79 | 6.64 | 1.84 | 2.25 | 6.94 |
| 1.A.4 - Other Sectors                                              | 1.48                                                            | 1.30 | 1.26 | 0.96 | 0.73 | 1.09 | 1.46 | 0.48 | 0.99 | 1.73 |
| 3.A- Enteric Fermentation                                          | 0.38                                                            | 0.36 | 0.36 | 0.35 | 0.35 | 0.34 | 0.34 | 0.33 | 0.33 | 0.32 |
| 3.B - Manure Management                                            | 7.28                                                            | 7.53 | 7.51 | 7.49 | 7.48 | 7.46 | 7.44 | 7.42 | 7.41 | 7.39 |
| 3.D.1 - Direct N <sub>2</sub> O Emissions from managed soils       | 0.36                                                            | 0.36 | 0.36 | 0.35 | 0.35 | 0.34 | 0.34 | 0.33 | 0.33 | 0.32 |
| 3.D.2 - Indirect N <sub>2</sub> O Emissions from managed soils     | 0.00                                                            | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 3.B.5 - Indirect N <sub>2</sub> O Emissions from manure management | 0.00                                                            | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 5.A - Solid Waste Disposal                                         | 1.00                                                            | 0.36 | 0.36 | 0.35 | 0.35 | 0.34 | 0.34 | 0.33 | 0.33 | 0.32 |
| 5.D - Wastewater Treatment and Discharge                           | 0.38                                                            | 0.36 | 0.36 | 0.35 | 0.35 | 0.34 | 0.34 | 0.33 | 0.33 | 0.32 |



|                                            |            |            |            |            |            |            |            |            |            |            |
|--------------------------------------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| <b>Total GHG Emissions, excl. Removals</b> | <b>23.</b> | <b>18.</b> | <b>19.</b> | <b>17.</b> | <b>17.</b> | <b>22.</b> | <b>24.</b> | <b>18.</b> | <b>20.</b> | <b>25.</b> |
|                                            | <b>26</b>  | <b>87</b>  | <b>09</b>  | <b>52</b>  | <b>08</b>  | <b>55</b>  | <b>09</b>  | <b>73</b>  | <b>06</b>  | <b>89</b>  |

## 2.4 GHG Emission Sector Analysis: 2010– 2023

The following section presents the analysis of Tuvalu’s key GHG emission sectors i.e., Energy, AFOLU, and Waste Sector for the years 2010 to 2023.

### 2.4.1 Energy Sector

Tuvalu’s Energy sector is the major emission contributing sector to the total GHG emissions. Tuvalu is one of the Pacific countries that has achieved 100% access since 2017, in line with SDG 7.1 on access. Despite achieving universal access to electricity, Tuvalu is heavily reliant on imported petroleum products for transport, electricity generation, and household use such as cooking and lighting. The high fuel prices and fluctuations impact heavily on businesses and households and undermine growth and food security, especially the most isolated outer island.

The Pacific Energy Group became established in the Tuvalu in 2010, after to the acquisition of the BP assets and it is primary importer and distributor of petroleum products including LPG. Sulani Trading is the second-largest importer and wholesaler of petroleum products in the country. The company imports by container (tanktainers) and has no on the ground bulk storage. Sulani Trading sells all petroleum products including refilling LPG tanks and oil for 2 cycle engines. Mackenzie Trading imports fuel and LPG by container (tanktainer) and fills tanks for customers or ships barrels of fuel to distributors. The company also retails its products directly. The difficulty for estimating energy sector GHG for Tuvalu has been in terms of the sectoral breakdown of emissions, given that there were no energy balances for the country available; further the sectoral fuel sales forthcoming from the fuel suppliers/retailers are not available.

The data on fuel import quantity provided by the Department of Energy have been used to estimate CO<sub>2</sub> emissions from the Energy sector.

The sectoral GHG emissions have been estimated using data available from the stakeholders as well as expert judgment of the sectoral experts and is built on the assumption that the entire fuel quantity imported is consumed in the same year and is not stored. In a nutshell, the energy sector emissions have been estimated using both the IPCC reference approach and the sectoral approach for the years 2010 to 2023.

In Tuvalu's energy sector, the use of fuels is distributed across various sub-sectors based on government-department-provided data and assumptions to ensure alignment with activity patterns and previous trends.

**Table 16: Tuvalu Fuel Consumption Breakdown**

| <b>Fuel Type</b> | <b>Use/Sector</b>      | <b>Percentage/Amount</b>       | <b>Notes</b>                                |
|------------------|------------------------|--------------------------------|---------------------------------------------|
| Diesel           | Electricity Generation | Subtracted from total import   | Used first before other allocations.        |
|                  | Road Transport         | 35% of remaining diesel import | Remaining after electricity generation use. |

|                   |                                              |                                                       |                                                                                      |
|-------------------|----------------------------------------------|-------------------------------------------------------|--------------------------------------------------------------------------------------|
|                   | Domestic Sea Transport                       | 60% of remaining diesel import                        | Remaining after electricity generation use.                                          |
|                   | Commercial/Institutional Buildings           | 5% of remaining diesel import                         | Remaining after electricity generation use.                                          |
|                   | Domestic Marine Navigation                   | 60% of (Total Diesel Import - Electricity Generation) | Calculated separately; matches previous year's consumption and emission trends.      |
| Gasoline          | Road Transport                               | 70% of total petrol import                            |                                                                                      |
|                   | Fishing (under Agriculture/Forestry/Fishing) | 30% of total petrol import                            |                                                                                      |
| Kerosene          | Residential                                  | 50%                                                   | Assumed equal distribution between residential and commercial/institutional sectors. |
|                   | Commercial/Institutional                     | 50%                                                   | Assumed equal distribution between residential and commercial/institutional sectors. |
| Aviation Gasoline | International Aviation (Bunkers)             | 100% of Aviation Gasoline Imported                    | No domestic aviation in the country.                                                 |
| LPG               | Residential                                  | 50%                                                   | Assumed equal distribution between residential and commercial/institutional sectors. |
|                   | Commercial/Institutional                     | 50%                                                   | Assumed equal distribution between residential and commercial/institutional sectors. |

### Methodological Approach:

Tuvalu's GHG emissions inventory for its first BTR follows the 2006 IPCC Guidelines, using the Tier 1 methodology approach using defined formulas. Tier 1, uses readily available activity data and default IPCC emission factors, likely applied to sectors with limited data. This BTR covers data sources, acknowledges challenges faced by small island nations, and includes Key Category Analysis (KCA), uncertainty assessment, and QA/QC. It serves as the definitive source for Tuvalu's GHG inventory, detailing emissions by source, methodologies, data sources, emission factors, KCA, and uncertainty (explained in this report's respective sections). The methodological framework includes:

- **Activity Data:** Fuel consumption data was sourced from the Tuvalu Electricity Corporation (TEC), Ministry of Transport, Energy, Communication and Innovation (MTECI), and import records from the respective Departments. The following table presents a summary of total fuel imported and consumed in the energy sector during the inventory year 2010-2023.



**Table 17: Total fuel imported and consumed in the energy sector during 2010-2023**

| Year | Diesel Oil (Litres) | Gasoline/Petrol (Litres) | Aviation Gasoline (Litres) | Other Kerosene (Litres) | LPG (kg) |
|------|---------------------|--------------------------|----------------------------|-------------------------|----------|
| 2010 | 2695000             | 700000                   | 288000                     | 70000                   | 215605   |
| 2015 | 2766076             | 651000                   | 92000                      | 126000                  | 110400   |
| 2016 | 2993996             | 462000                   | 184000                     | 189000                  | 78400    |
| 2017 | 2294390             | 785750                   | 161000                     | 31430                   | 83880    |
| 2018 | 1926462             | 659748                   | 225288                     | 26390                   | 65750    |
| 2019 | 2858960             | 1123462                  | 289576                     | 25082                   | 48616    |
| 2020 | 3791457             | 1587175                  | 36157                      | 23773                   | 31483    |
| 2021 | 2784843             | 470204                   | 43479                      | 22465                   | 14349    |
| 2022 | 2792228             | 962562                   | 42767                      | 28233                   | 74938    |
| 2023 | 4450865             | 1454919                  | 42055                      | 34000                   | 135527   |

- **Emission Factors:** Default IPCC emission factors are used to calculate emissions from fuel combustion (stationary and mobile) in the energy sector. These factors represent the average amount of greenhouse gases emitted per unit of fuel burned i.e. kg of greenhouse gas per TJ.
- **Sectoral Breakdown:** Energy emissions are categorized into the following sub-sectors:

| IPCC Category                 | Sub-Category                         | Description                                            | Emission Factors                                                              |
|-------------------------------|--------------------------------------|--------------------------------------------------------|-------------------------------------------------------------------------------|
| 1A Fuel Combustion Activities | 1A1 Energy Industries                | Electricity generation from diesel power plants        | Default IPCC emission factors for diesel combustion                           |
|                               | 1A3 Transport                        |                                                        |                                                                               |
|                               | 1.A.3.b Road Transportation          | Emissions from vehicles (cars, motorcycles, trucks)    | Default IPCC emission factors for gasoline and diesel combustion              |
|                               | 1.A.3.d Domestic Navigation          | Emissions from ships and boats                         | Default IPCC emission factors for marine diesel oil combustion                |
|                               | 1A4 Other Sectors                    |                                                        |                                                                               |
|                               | 1.A.4.a Commercial/Institutional     | Emissions from businesses, government buildings, etc.  | Default IPCC emission factors for various fuel types (e.g., diesel, kerosene) |
|                               | 1.A.4.b Residential                  | Emissions from households (cooking, heating)           | Default IPCC emission factors for various fuel types (e.g., kerosene, LPG)    |
|                               | 1.A.4.c Agriculture/Forestry/Fishing | Emissions from agricultural machinery, fishing vessels | Default IPCC emission factors for various fuel types (e.g., diesel)           |

In 2023, the Energy sector emitted 61% of the total national GHG emissions. This was predominated by fossil fuel combustion activities, comprising energy industries (45%), transport (44%), and other sectors (11%) of total emissions from the energy sector. The emission levels have increased from 2010 to 2023. The following table gives the relative distribution of GHG emissions across the energy sector.

**Table 18: Tuvalu's Energy Sector GHG emissions kt CO<sub>2</sub>e: 2010-2023**

| Inventory Year: 2010-2023 | Net CO <sub>2</sub> Emissions, (CO <sub>2</sub> Equivalents kt) |             |             |             |             |              |              |             |             |              |
|---------------------------|-----------------------------------------------------------------|-------------|-------------|-------------|-------------|--------------|--------------|-------------|-------------|--------------|
| Categories                | 2010                                                            | 2015        | 2016        | 2017        | 2018        | 2019         | 2020         | 2021        | 2022        | 2023         |
| <b>1 - Energy</b>         | <b>13.39</b>                                                    | <b>9.57</b> | <b>9.82</b> | <b>8.28</b> | <b>6.92</b> | <b>12.40</b> | <b>13.96</b> | <b>8.61</b> | <b>9.96</b> | <b>15.81</b> |
| 1.A.1 - Energy Industries | 7.36                                                            | 3.73        | 3.98        | 4.45        | 4.93        | 5.53         | 5.87         | 6.29        | 6.71        | 7.13         |
| 1.A.3 - Transport         | 4.55                                                            | 4.55        | 4.58        | 2.87        | 1.26        | 5.79         | 6.64         | 1.84        | 2.25        | 6.94         |
| 1.A.4 - Other Sectors     | 1.48                                                            | 1.30        | 1.26        | 0.96        | 0.73        | 1.09         | 1.46         | 0.48        | 0.99        | 1.73         |

The below table presents the Gas-wise GHG emissions of the Energy sector in 2023.

**Table 19: Tuvalu's Energy Sector Gas-wise GHG emissions kt CO<sub>2</sub>e: 2023**

| Energy Sector Greenhouse Gas Source and Sink Categories | Net CO <sub>2</sub> emissions | CH <sub>4</sub>           | N <sub>2</sub> O          | NO <sub>x</sub>           | CO                        | NM VOC                    | SO <sub>x</sub>           | Total GHG emissions/removals     |
|---------------------------------------------------------|-------------------------------|---------------------------|---------------------------|---------------------------|---------------------------|---------------------------|---------------------------|----------------------------------|
|                                                         | (kt)                          |                           |                           |                           |                           |                           |                           | CO <sub>2</sub> equivalents (kt) |
| <b>Total national emissions and removals</b>            | <b>15.65</b><br><b>868</b>    | <b>0.31</b><br><b>688</b> | <b>0.00</b><br><b>512</b> | <b>0.07</b><br><b>011</b> | <b>0.03</b><br><b>730</b> | <b>0.005</b><br><b>88</b> | <b>0.01</b><br><b>868</b> | <b>26.88840</b>                  |
| <b>1. Energy</b>                                        | <b>15.65</b><br><b>868</b>    | <b>0.00</b><br><b>074</b> | <b>0.00</b><br><b>047</b> | <b>0.07</b><br><b>011</b> | <b>0.03</b><br><b>730</b> | <b>0.005</b><br><b>88</b> | <b>0.01</b><br><b>868</b> | <b>15.89775</b>                  |
| 1.A. Fuel combustion                                    | <b>15.65</b><br><b>868</b>    | <b>0.00</b><br><b>074</b> | <b>0.00</b><br><b>047</b> | <b>0.07</b><br><b>011</b> | <b>0.03</b><br><b>730</b> | <b>0.005</b><br><b>88</b> | <b>0.01</b><br><b>868</b> | <b>15.80516</b>                  |
| 1.A.1. Energy industries                                | 7.110<br>83                   | 0.00<br>029               | 0.00<br>006               | 0.00<br>643               | 0.00<br>160               | 0.000<br>08               | 0.00<br>460               | <b>7.13415</b>                   |
| 1.A.3. Transport                                        | 6.824<br>99                   | 0.00<br>036               | 0.00<br>040               | 0.06<br>155               | 0.03<br>496               | 0.005<br>58               | 0.01<br>362               | <b>6.94238</b>                   |
| 1.A.4. Other sectors                                    | 1.722<br>85                   | 0.00<br>009               | 0.00<br>001               | 0.00<br>213               | 0.00<br>073               | 0.000<br>22               | 0.00<br>046               | <b>1.72863</b>                   |

#### 2.4.1.1 Comparison of the sectoral approach with the reference approach

The GHG Emissions from the energy sector were estimated using reference and sectoral approaches using the IPCC Tier 1 analytical framework. Under the reference approach, GHG emissions were estimated using only the fuel consumption data for each type of fuel. The results of estimated CO<sub>2</sub> emissions for the GHG inventory year 2015-2021 using the reference approach have been estimated and compared with the CO<sub>2</sub> emissions estimated using the sectoral approach. The difference between the outputs from the two approaches is presented in the table below, the results are well below the thresholds recommended by IPCC. The table below presents the calculation results using reference and sectoral approach.

**Table 20: Energy Sector CO<sub>2</sub> Emissions using Reference and Sectoral Approach: 2010-2023**

| Inventory Year | Reference Approach        |                           |                                                       |                               | Sectoral Approach       |                               | Difference             |                            |
|----------------|---------------------------|---------------------------|-------------------------------------------------------|-------------------------------|-------------------------|-------------------------------|------------------------|----------------------------|
|                | Apparent Consumption (TJ) | Excluded Consumption (TJ) | Apparent Consumption - Excluding Non-energy uses (TJ) | CO <sub>2</sub> Emission (kt) | Energy Consumption (TJ) | CO <sub>2</sub> emission (kt) | Energy Consumption (%) | CO <sub>2</sub> emission % |
| <b>2010</b>    | 141.521                   | 9.454                     | 132.067                                               | 9.558                         | 182.249                 | 13.282                        | -38.00%                | -<br>38.96 %               |
| <b>2015</b>    | 133.025                   | 3.020                     | 130.005                                               | 9.464                         | 130.242                 | 9.481                         | -0.18%                 | -0.18%                     |
| <b>2016</b>    | 138.708                   | 6.040                     | 132.668                                               | 9.702                         | 133.024                 | 9.728                         | -0.27%                 | -0.26%                     |
| <b>2017</b>    | 118.241                   | 5.285                     | 112.956                                               | 8.200                         | 113.015                 | 8.204                         | -0.05%                 | -0.05%                     |
| <b>2018</b>    | 102.016                   | 7.395                     | 94.621                                                | 6.871                         | 94.671                  | 6.875                         | -0.05%                 | -0.05%                     |
| <b>2019</b>    | 151.853                   | 9.506                     | 142.347                                               | 10.344                        | 142.395                 | 10.347                        | -0.03%                 | -0.03%                     |
| <b>2020</b>    | 191.264                   | 1.190                     | 190.074                                               | 13.816                        | 190.118                 | 13.819                        | -0.02%                 | -0.02%                     |



|             |         |       |         |        |         |        |        |        |
|-------------|---------|-------|---------|--------|---------|--------|--------|--------|
| <b>2021</b> | 117.966 | 1.427 | 116.538 | 8.678  | 118.667 | 8.708  | -1.83% | -0.35% |
| <b>2022</b> | 137.438 | 1.404 | 136.035 | 9.887  | 136.088 | 9.891  | -0.04% | -0.04% |
| <b>2023</b> | 224.328 | 9.723 | 214.606 | 15.600 | 214.670 | 15.605 | -0.03% | -0.03% |

#### 2.4.1.2 International bunker fuels

In accordance with 2006 IPCC guidelines, CO<sub>2</sub> emissions from International Bunkers and burning of biomass are not included under the national items, only International Bunkers i.e., international aviation and international water-borne navigation have been estimated and reported separately as memo items in the inventory.

International bunkers include international aviation and international water-borne navigation. However, data on the fuel consumption for international waterborne navigation is not available and hence has not been estimated under this inventory for the period 2010-2023.

**Table 21: International Bunkers GHG emissions kt CO<sub>2</sub>e trend, 2010-2023**

| Inventory Year: 2010-2023                                               | Net CO <sub>2</sub> Emissions, (CO <sub>2</sub> Equivalents kt) |      |      |      |      |      |      |      |      |        |
|-------------------------------------------------------------------------|-----------------------------------------------------------------|------|------|------|------|------|------|------|------|--------|
| Categories                                                              | 2010                                                            | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2023   |
| <b>International Bunkers</b>                                            |                                                                 |      |      |      |      |      |      |      |      |        |
| 1.D.1.a. - International Aviation (International Bunkers)               | 0.67                                                            | 0.21 | 0.43 | 0.37 | 0.52 | 0.67 | 0.08 | 0.10 | 0.10 | 0.6984 |
| 1.D.1.b. - International water-borne navigation (International bunkers) | NE                                                              | NE   | NE   | NE   | NE   | NE   | NE   | NE   | NE   | NE     |

#### 2.4.1.3 1A Fuel Combustion Activities

##### 2.4.1.3.1 1A1 Energy Industries

In 2023, Electricity generation accounted for 7.134 kt CO<sub>2</sub>e, approximately 28% of the total national emissions and 45% of the energy sector emissions indicating that Electricity generation is the largest fossil fuel consumer and GHG emitter within the 'Energy Sector'.

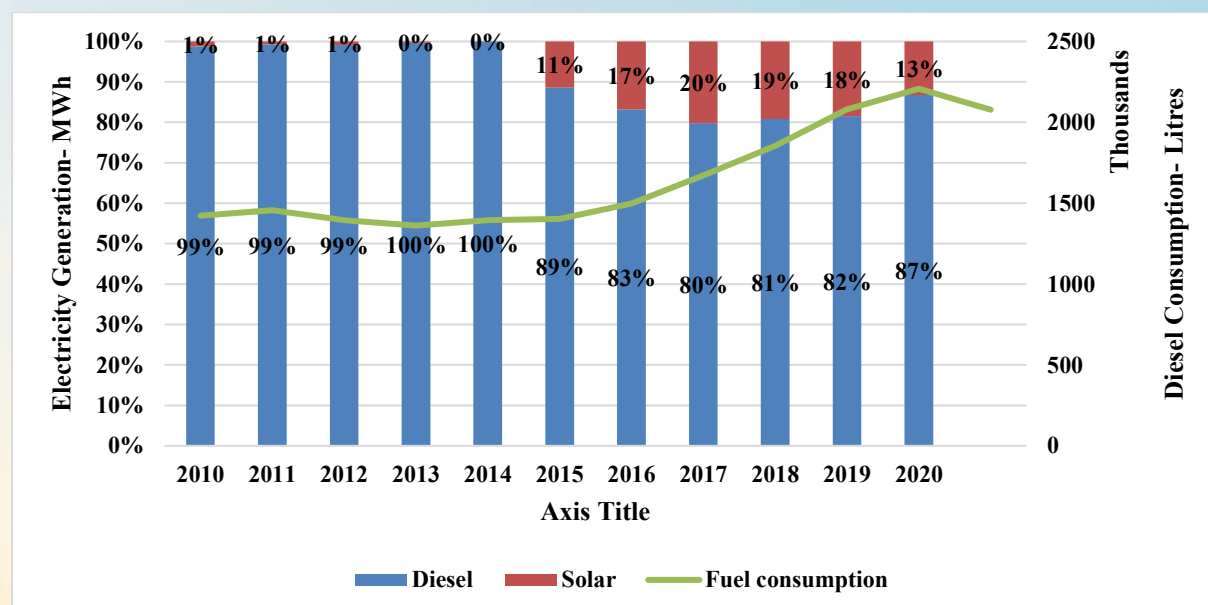
Tuvalu Electricity Corporation (TEC) is a state-owned enterprise, a vertically integrated electricity utility that owns and operates the generation and distribution assets in the capital of Funafuti and the outer islands of Nukulaelae, Nukufetau, Nui, Niutao, Vaitupu, Nanumaga and Nanumea. It was established by an Act of Parliament in 1990 and is mandated by the Act to be managed with prudent commercial principles to profit.

Electricity generation in Tuvalu is mainly based on diesel generators. The main island of Funafuti constitutes the majority of electrical demand for the country, with the outer islands already on the way towards 100% renewable energy. As can be seen in the below Figure, approximately 13% of the electricity in 2020 was generated from renewable sources (solar). Tuvalu is one of the Pacific countries that has achieved 100% access since 2017. Funafuti has an annual average increased demand forecast of 3.0%<sup>7</sup>. Resulting in a forecast demand increase of 200% from 2020 annual consumption of 7,281

<sup>7</sup> Tuvalu - Funafuti Road Map (2019), [https://www.tectuvalu.tv/wp-content/uploads/2021/09/Tuvalu-Road-Map\\_Entura-report-1.pdf](https://www.tectuvalu.tv/wp-content/uploads/2021/09/Tuvalu-Road-Map_Entura-report-1.pdf)

MWh to 14,562 MWh in 2045. Funafuti currently (as of 2020) has 3 x 600kW diesel generation and 735 kWp of installed solar PV capacity that is operational in Funafuti. To achieve a 100% renewable contribution for Funafuti by 2025 would require 7.6 MW of solar PV and 3 MW / 14 MWh of battery energy storage.

**Figure 20: Electricity Generation- Diesel v/s Solar and Diesel Consumption (Litres)**



Fuel consumption data for electricity generation were obtained from TEC for the inventory years 2010-2020.

#### 2.4.1.3.2 1A3 Transport—Road, Civil Aviation, and Water-borne Navigation

In 2023, GHG emissions from the transport sector are 6.94 kt CO<sub>2</sub>e which is about 44% of total CO<sub>2</sub>e emissions from the energy sector and 27% of total national GHG emissions (excluding removals). Road transport sector accounted for 59% of the total GHG emissions from the transport sector followed by water-borne navigation (41%).

The transport subsector is the second largest consumer of commercial fuel energy within the Energy sector in Tuvalu. Mainly two fuel types are used in road transport sectors i.e., petrol (gasoline) and diesel. In addition, lubricants are also used for two-stroke engines.

Tuvalu has only one airport, the Funafuti International Airport and there is no domestic civil aviation in the country. The emission estimates made for the combustion of AVG and DPK in international aviation is reported separately as a memo item under international bunkers. The Domestic Navigation sector emission estimates are based on fuel consumption (Gas / Diesel Oil). Emissions estimates made for international fleets are not estimated under this inventory due to a lack of data and are reported as memo items under marine bunkers separately.



**Figure 21: Tuvalu's total GHG Emissions Transport Sub-sector (kt CO<sub>2</sub>e): 2010-2023**

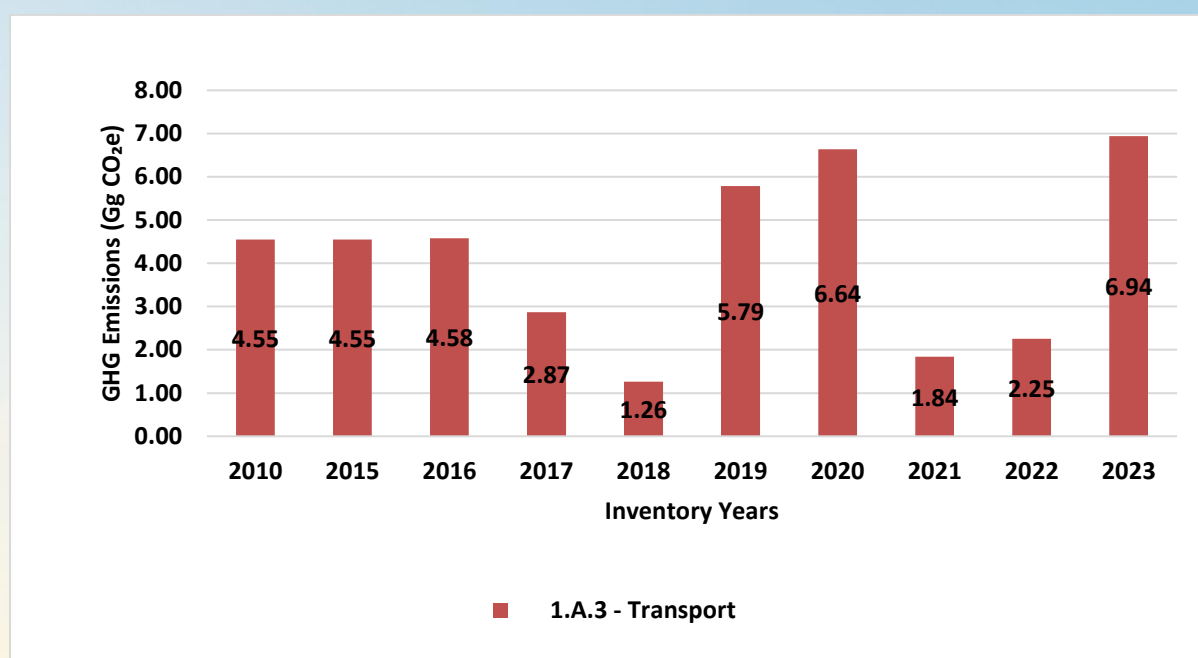


**Table 22: Gas-wise GHG emissions from Transport Sub-sector (kt) for 2023**

| Transport Sub-sector Greenhouse Gas Source and Sink Categories | Net CO <sub>2</sub> emissions | CH <sub>4</sub> | N <sub>2</sub> O | NO <sub>x</sub> | CO      | NMVOC  | SO <sub>x</sub> | Total GHG emissions/removals     |
|----------------------------------------------------------------|-------------------------------|-----------------|------------------|-----------------|---------|--------|-----------------|----------------------------------|
|                                                                | (kt)                          |                 |                  |                 |         |        |                 | CO <sub>2</sub> equivalents (kt) |
| <b>1.A.3. Transport</b>                                        | 6.8250                        | 0.0004          | 0.0004           | 0.00615         | 0.00350 | 0.0006 | 0.00136         | <b>6.94</b>                      |
| 1.A.3.b. Road transportation                                   | 4.0119                        | 0.0002          | 0.0003           | 0.00081         | 0.00299 | 0.0007 | 0.00000         | <b>4.09</b>                      |
| 1.A.3.d. Domestic navigation                                   | 2.8130                        | 0.0001          | 0.0001           | 0.00535         | 0.00050 | 0.0009 | 0.00136         | <b>2.86</b>                      |

In the absence of data on actual fuel distribution/consumption for transport subsector certain assumptions were made to determine the fuel consumption for this subsector. In case of Diesel oil, the total quantity of diesel oil used for electricity generation is deducted by the total quantity of diesel oil imported into the country and the resultant is distributed in the transportation and other subsector in proportions as described below:

- 35% of the remaining diesel import is used for road transportation.
- 60% of the remaining diesel import is used for sea transportation i.e., domestic water-borne navigation.
- And remaining 5% is used in Commercial and Institutional Buildings.

For Gasoline/ Petrol, it was assumed that 70% of the total petrol import is used for road transportation. While remaining quantity i.e., 30% of the total petrol is used for Fishing under Agriculture/Forestry/Fishing/Fish Farms subsector. For Lubricating Oil, it is assumed that 100% of the total Lubricant oils imported is used in road transportation.

#### 2.4.1.4 1A4 Other sectors

Other sectors include commercial/institutional sector, residential sector and agricultural/fisheries sector. The major fuel consumed in residential sector are LPG, Kerosene and Biomass. While diesel oil,

kerosene and LPG are used in commercial and institutional buildings for lighting and cooking purposes respectively. Further, gasoline is used for fishing boats and reported under the Agriculture/Forestry/Fishing under the Other sectors. The remaining diesel oil (viz about 5%) after electricity generation and transport is assumed to be used in this subsector. While kerosene and LPG imported are assumed to be distributed in equal proportions for residential, commercial and institutional buildings use.

In 2023, the other sectors together emitted 0.52 kt of CO<sub>2</sub>e, which is approximately 6% of total CO<sub>2</sub>e emissions from the energy sector and 3% of total national GHG emissions (excluding removals). The biomass consumption in the residential sector (mainly form cooking) is mostly renewable biomass, collect form the forest land, in the absence of data emission form the biomass combustion not included in the national inventory report.

**Figure 22. Tuvalu's Other Sectors Total GHG Emissions (kt CO<sub>2</sub>e): 2010-2023**

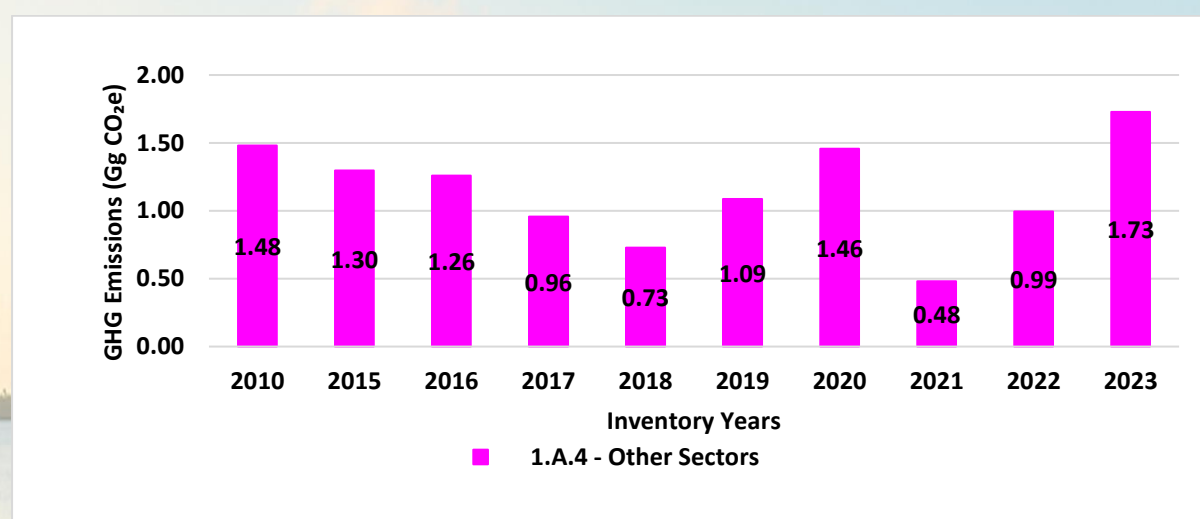


**Table 23: Gas-wise GHG emissions from Other Sub-sector (kt) for 2023**

| Other Sub-sector<br>Greenhouse Gas Source and<br>Sink Categories | Net<br>CO <sub>2</sub><br>emiss<br>ions  | CH <sub>4</sub>                         | N <sub>2</sub> O                         | NO <sub>x</sub>                          | CO                                       | NMV<br>OC                                | SO <sub>x</sub>                          | Total GHG<br>emissions/rem<br>ovals    |
|------------------------------------------------------------------|------------------------------------------|-----------------------------------------|------------------------------------------|------------------------------------------|------------------------------------------|------------------------------------------|------------------------------------------|----------------------------------------|
|                                                                  | (kt)                                     |                                         |                                          |                                          |                                          |                                          |                                          | CO <sub>2</sub><br>equivalents<br>(kt) |
| <b>1.A.4. Other sectors</b>                                      | <b>1.722</b><br><b>8534</b><br><b>31</b> | <b>9.368</b><br><b>8E-</b><br><b>05</b> | <b>1.189</b><br><b>54E-</b><br><b>05</b> | <b>0.002</b><br><b>1309</b><br><b>55</b> | <b>0.000</b><br><b>7321</b><br><b>02</b> | <b>0.000</b><br><b>2223</b><br><b>11</b> | <b>0.000</b><br><b>4614</b><br><b>81</b> | <b>1.73</b>                            |
| 1.A.4.a.<br>Commercial/Institutional                             | 0.482<br>1759<br>85                      | 4.117<br>E-05                           | 2.598<br>41E-<br>06                      | 0.001<br>4721<br>7                       | 0.000<br>4783<br>43                      | 0.000<br>1865<br>62                      | 0.000<br>3374<br>65                      | <b>0.48</b>                            |
| 1.A.4.b. Residential                                             | 0.247<br>7552<br>04                      | 9.534<br>31E-<br>06                     | 7.002<br>67E-<br>07                      | 0.000<br>6587<br>85                      | 0.000<br>2537<br>59                      | 3.574<br>92E-<br>05                      | 0.000<br>1240<br>16                      | <b>0.25</b>                            |
| 1.A.4.c.<br>Agriculture/forestry/fishing                         | 0.992<br>9222<br>41                      | 4.298<br>36E-<br>05                     | 8.596<br>73E-<br>06                      | NE                                       | NE                                       | NE                                       | NE                                       | <b>1.00</b>                            |



## 2.4.2 Industrial Processes and Product Use

Under the Industrial Processes and Product Use (IPPU), GHG emissions occurring from industrial processes, from the use of greenhouse gases in products, and from non-energy uses of fossil fuel carbon are estimated. In Tuvalu, the IPPU sector is non-existence in the absence of any major industry or industrial process emissions. Hence, GHG emissions from this sector are considered as not occurring estimated for the inventory years 2010 to 2023.

## 2.4.3 Agriculture, Forestry, and Other Land Use (AFOLU)

Tuvalu's Agriculture is dominated by subsistence agriculture and has traditionally been the preoccupation of Tuvaluan people and involves the cultivation of trees and crops and raising a limited number of pigs, chickens, and ducks. As reported in the 2017 Tuvalu Agriculture and Fisheries Report about 90 percent of households undertook some type of agricultural activity in 2017, including livestock raising (reported by 84 percent of all households), crop growing (69 percent), buying or selling fish (60 percent) and handicrafts (35 percent). Further, Agriculture continued to be the largest single sector in the Tuvalu economy in 2017, with a total value of Australian Dollars (AUD) 10.5 million. The agriculture sector is a major source of methane and nitrous oxide emissions in Tuvalu. Emissions from the Forestry and Other Land Use have not been estimated in this inventory.

The emissions from the following sub-sectors and categories are estimated under this inventory.

- Livestock (3.A)
  - Enteric Fermentation (3.A.1)
  - Manure Management (3.A.2)
- Aggregate sources and non-CO<sub>2</sub> emissions sources on land (3.C)

The Livestock population data used for estimating GHG emissions for the inventory period 2015-2021 is estimated based on the Tuvalu 2002 population and housing census<sup>8</sup> and the Tuvalu Agriculture and Fisheries Report<sup>9</sup>.

**Table 24: AFOLU Sector GHG Emission in kt CO<sub>2</sub>e (excluding Removal): 2010-2023**

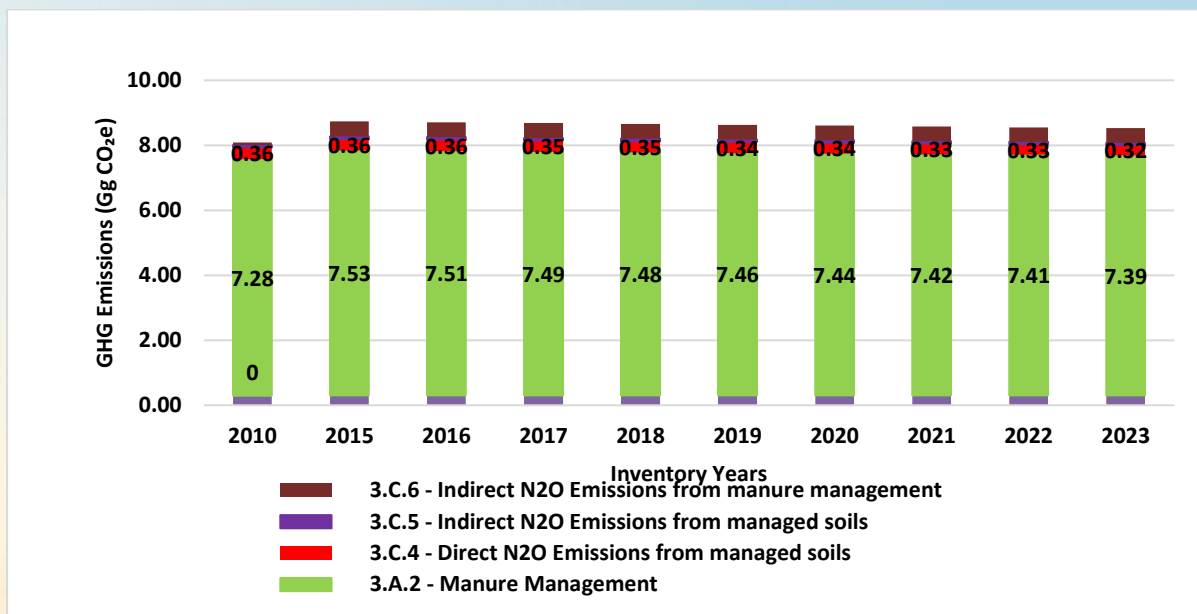
| Inventory Year: 2010-2023                                     | Net CO <sub>2</sub> Emissions, (CO <sub>2</sub> Equivalents kt) |      |      |      |      |      |      |      |      |      |
|---------------------------------------------------------------|-----------------------------------------------------------------|------|------|------|------|------|------|------|------|------|
| Categories                                                    | 2010                                                            | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 |
| 3 - Agriculture, Forestry, and Other Land Use                 | 8.09                                                            | 8.74 | 8.71 | 8.68 | 8.66 | 8.63 | 8.61 | 8.58 | 8.55 | 8.53 |
| 3.A - Livestock                                               | 7.57                                                            | 7.84 | 7.82 | 7.80 | 7.78 | 7.76 | 7.74 | 7.73 | 7.71 | 7.69 |
| 3.A.1 - Enteric Fermentation                                  | 0.30                                                            | 0.31 | 0.31 | 0.31 | 0.30 | 0.30 | 0.30 | 0.30 | 0.30 | 0.30 |
| 3.A.2 - Manure Management                                     | 7.28                                                            | 7.53 | 7.51 | 7.49 | 7.48 | 7.46 | 7.44 | 7.43 | 7.41 | 7.39 |
| 3.C - Aggregate sources and non-CO2 emissions sources on land | 0.51                                                            | 0.90 | 0.89 | 0.88 | 0.88 | 0.87 | 0.86 | 0.85 | 0.85 | 0.84 |
| 3.C.4 - Direct N2O Emissions from managed soils               | 0.36                                                            | 0.36 | 0.36 | 0.35 | 0.35 | 0.34 | 0.34 | 0.33 | 0.33 | 0.32 |

<sup>8</sup> 2002 data source: Tuvalu 2002 population and housing census. Volume 1 — analytical report/ Secretariat of the Pacific Community, [https://sdd.spc.int/digital\\_library/tuvalu-2002-census-vol-1-analytical-report](https://sdd.spc.int/digital_library/tuvalu-2002-census-vol-1-analytical-report)

<sup>9</sup> 2012 and 2014 data source: Tuvalu Agriculture and Fisheries Report: Based on the analysis of the 2017 Population and Housing Census, <https://stats.gov.tv/census/#>

|                                                                    |          |          |          |          |          |          |          |          |          |          |
|--------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
| 3.C.5 - Indirect N <sub>2</sub> O Emissions from managed soils     | 0.0<br>8 | 0.0<br>8 | 0.0<br>8 | 0.0<br>7 | 0.0<br>7 | 0.0<br>7 | 0.0<br>7 | 0.0<br>7 | 0.0<br>7 | 0.0<br>7 |
| 3.C.6 - Indirect N <sub>2</sub> O Emissions from manure management | 0.0<br>8 | 0.4<br>6 | 0.4<br>6 | 0.4<br>6 | 0.4<br>6 | 0.4<br>5 | 0.4<br>5 | 0.4<br>5 | 0.4<br>5 | 0.4<br>5 |

**Figure 23. Tuvalu's AFOLU Total CO<sub>2</sub> equivalent Emissions (kt): 2010-2023**



In 2023, Tuvalu's agriculture sector was the second largest GHG emitting sector and accounted for about 33% of the total GHG emissions (excluding removals). As can be seen from the following table and figure, the GHG emissions from the agriculture sector have declined from 2015 to 2023. This decrease is mainly attributed due to the decline in livestock population. Agriculture sector emissions (excluding removals) reached to 8.53 kt CO<sub>2</sub>e in 2023 from 8.46 kt CO<sub>2</sub>e in 2010, representing an increase in emissions of about 1% approximately.

As shown in the above figure, the major share of the average GHG emission of the agriculture sector during the period 2010-2023 is from Livestock farming –manure management (87%), and enteric fermentation (3.5%). The rest comes from Direct N<sub>2</sub>O emissions from managed soil (3.8%) and Indirect N<sub>2</sub>O emissions from managed soils and manure management (0.8% and 5.3% respectively). The sub-sector analysis in the subsequent sections entails a detailed discussion of these GHG emission-contributing sub-sectors and categories.

#### 2.4.3.1 Livestock

Livestock raising is one of the most important agricultural activities in Tuvalu, playing a key role in supporting household livelihoods and providing income, particularly in rural areas. Pigs, Chickens, and ducks are the livestock generally raised across the country with home consumption as the primary purpose. Tuvalu has recorded a decrease in households raising livestock as well as in several livestock in 2017 compared to 2002. The population of livestock estimated for the inventory period 2010-2023 was based on the 2002 population and housing census and Tuvalu Agriculture and Fisheries Report 2017. The following table presents the livestock population data used for estimating GHG emissions from the Livestock sub-sector.

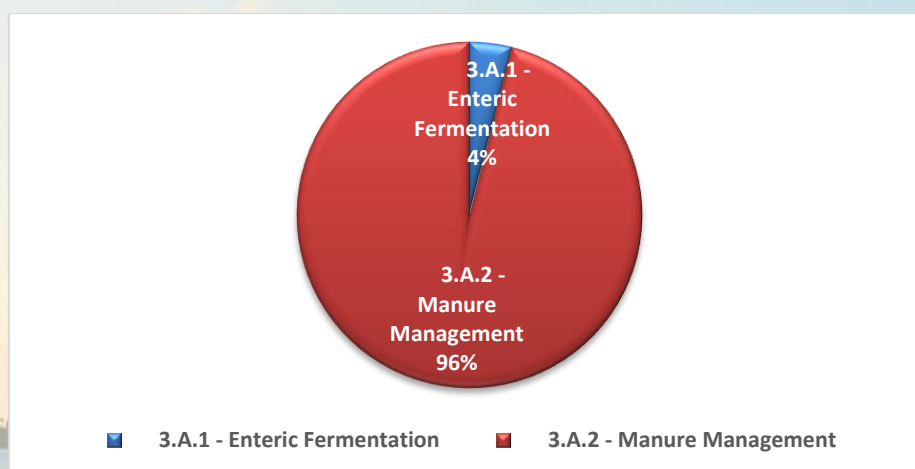


**Table 25: Livestock Population in Tuvalu: 2010-2023**

| Livestock Species/Category | 2010  | 2011  | 2012  | 2013  | 2014  | 2015  | 2016  | 2017  | 2018  | 2019  | 2020  | 2021  | 2022  | 2023  |
|----------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| Pigs                       | 10576 | 10799 | 11021 | 10996 | 10971 | 10945 | 10920 | 10894 | 10869 | 10844 | 10818 | 10793 | 10768 | 10742 |
| Chicken                    | 17902 | 18556 | 19209 | 18456 | 17703 | 16950 | 16197 | 15443 | 14690 | 13937 | 13184 | 12431 | 11678 | 10925 |
| Ducks                      | 2052  | 1947  | 1842  | 1715  | 1589  | 1462  | 1336  | 1209  | 1083  | 956   | 830   | 703   | 577   | 450   |

Source: Year 2017 & 2012- Tuvalu Agriculture and Fisheries Report: Based on the analysis of the 2017 Population and Housing Census; Year 2002-Tuvalu 2002 population and housing census. Volume 1— analytical report/ Secretariat of the Pacific Community.

**Figure 24. Tuvalu’s Livestock sub-sector GHG Emission Share (excluding Removal): 2023**

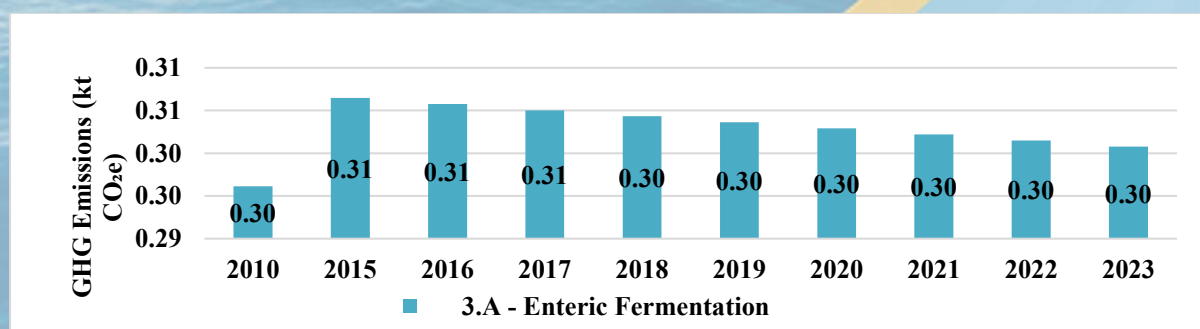


As can be seen in the above figure, approximately 96% of the Livestock sector emissions are contributed from manure management activities and 4% from enteric fermentation during the inventory period 2010-2023.

#### 2.4.3.1.1 Enteric Fermentation

Methane is produced in herbivorous animals as a by-product of enteric fermentation, a digestive process by which carbohydrates are broken down by micro-organisms into simple molecules for absorption into the bloodstream. Ruminant livestock (e.g., cattle, goat, sheep) are major sources of methane and moderate amounts produced from non-ruminant livestock (e.g., pigs, horses). This methane when released adds to GHG emissions in the atmosphere. The GHG emissions contributions from Enteric Fermentation have decreased from 0.296 kt CO<sub>2</sub>e in 2010 to 0.301 kt CO<sub>2</sub>e in 2023. This decrease is mainly attributed to the decreasing population of livestock.

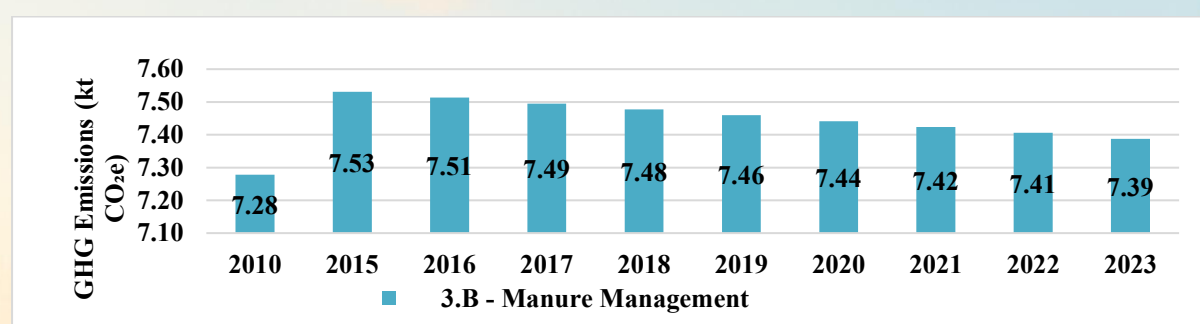
**Figure 25. GHG emissions from Enteric Fermentation in kt CO<sub>2</sub>e: 2010-2023**



### 2.4.3.1.2 Manure Management

Manure management contributes to about 96% of the GHG emissions from Livestock sub-sector in Tuvalu. GHG emissions contributions from Manure management has reduced from 7.278 kt CO<sub>2</sub>e in 2010 to 7.387 kt CO<sub>2</sub>e in 2023. This represents an average decrease in emission contributions of about 1% during the inventory years 2010-2023. Tuvalu's manure management system types include anaerobic lagoons, pit storage, composting and pasture/range/paddock. Pig wastes are largely managed in anaerobic lagoons (over 70%) followed by 10% each in pit storage, composting, and pasture/range/paddock. While chickens and ducks are free ranging. The emissions from pasture/range/paddock are estimated under the category 'Indirect N<sub>2</sub>O Emissions from manure management' under Aggregate sources and non-CO<sub>2</sub> emissions sources on land sector. Manure management system emissions can be further reduced if modern/ scientific manure management systems are introduced into the country.

**Figure 26. GHG emissions from Manure Management in kt CO<sub>2</sub>e: 2010-2023**



### 2.4.3.2 Aggregate sources and non-CO<sub>2</sub> emissions sources on land

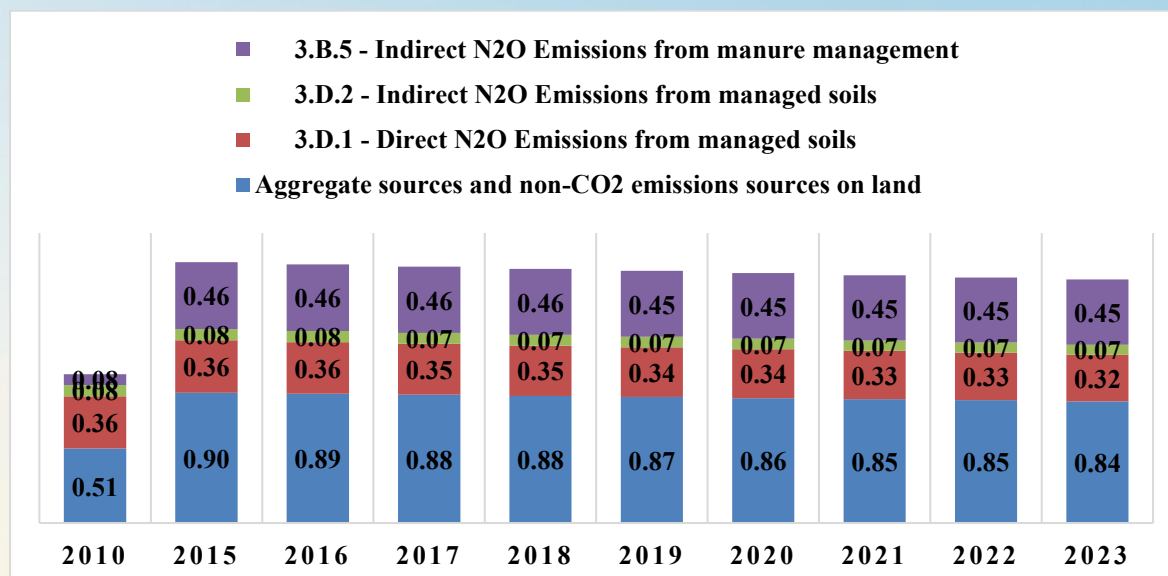
The N<sub>2</sub>O emissions from soils mainly occur from two pathways- direct and indirect. Direct N<sub>2</sub>O emissions to estimated using net N additions to soils (synthetic or organic fertilizers, deposited manure, crop residues, etc.) and mineralization of N in soil due to cultivation/land-use change on mineral soils. Indirect N<sub>2</sub>O emissions occur from two pathways. The first of these pathways is through the volatilization of N as NH<sub>3</sub> and oxides of N (NO<sub>x</sub>), and the deposition of these gases and their products NH<sub>4</sub><sup>+</sup> and NO<sub>3</sub><sup>-</sup> onto soils and the surface of lakes and other waters. The second pathway is the leaching and runoff from land of N from synthetic and organic fertilizer additions, crop residues, mineralization of N associated with loss of soil C in mineral and drained/managed organic soils through land-use change or management practices, and urine and dung deposition from grazing animals. Due to limited data availability on usage of fertilizers in Tuvalu, only emissions from animal manure are considered. This sub-sector contributes about 10% of the total GHG emissions from the AFOLU sector.

**Table 26: Aggregate sources and non-CO<sub>2</sub> emissions sources on land GHG Emission in kt CO<sub>2</sub>e (excluding Removal): 2010-2023**

| Inventory Year: 2010-2023                                           | Net CO <sub>2</sub> Emissions, (CO <sub>2</sub> Equivalents kt) |      |      |      |      |      |      |      |      |      |
|---------------------------------------------------------------------|-----------------------------------------------------------------|------|------|------|------|------|------|------|------|------|
| Categories                                                          | 2010                                                            | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 |
| Aggregate sources and non-CO <sub>2</sub> emissions sources on land | 0.51                                                            | 0.90 | 0.89 | 0.88 | 0.88 | 0.87 | 0.86 | 0.85 | 0.85 | 0.84 |
| 3.D.1 - Direct N <sub>2</sub> O Emissions from managed soils        | 0.36                                                            | 0.36 | 0.36 | 0.35 | 0.35 | 0.34 | 0.34 | 0.33 | 0.33 | 0.32 |
| 3.D.2 - Indirect N <sub>2</sub> O Emissions from managed soils      | 0.08                                                            | 0.08 | 0.08 | 0.07 | 0.07 | 0.07 | 0.07 | 0.07 | 0.07 | 0.07 |
| 3.B.5 - Indirect N <sub>2</sub> O Emissions from manure management  | 0.08                                                            | 0.46 | 0.44 | 0.44 | 0.44 | 0.44 | 0.44 | 0.44 | 0.44 | 0.44 |



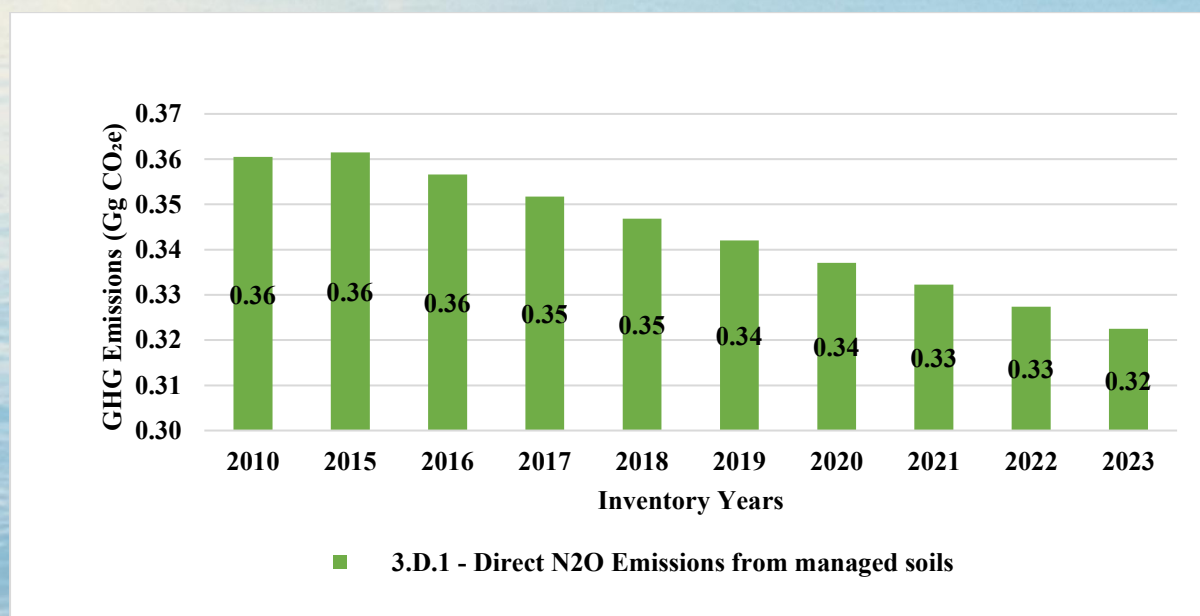
**Figure 27. Aggregate sources and non-CO<sub>2</sub> emissions sources on land GHG Emission in kt CO<sub>2</sub>e (excluding Removal): 2010-2023**



#### 2.4.3.3 Direct N<sub>2</sub>O Emissions from managed soils

The Direct N<sub>2</sub>O emissions from managed soils occurring due to urine and dung N deposited on pasture, range, and paddock by grazing animals ( $F_{PRP}$ ) have been estimated for the inventory years 2010-2023. The emissions from this category reached to 0.32 kt CO<sub>2</sub>e in 2023 decreasing from 0.36 kt CO<sub>2</sub>e in 2010.

**Figure 28. GHG emissions from Direct N<sub>2</sub>O Emissions from managed soils in kt CO<sub>2</sub>e: 2010-2023**

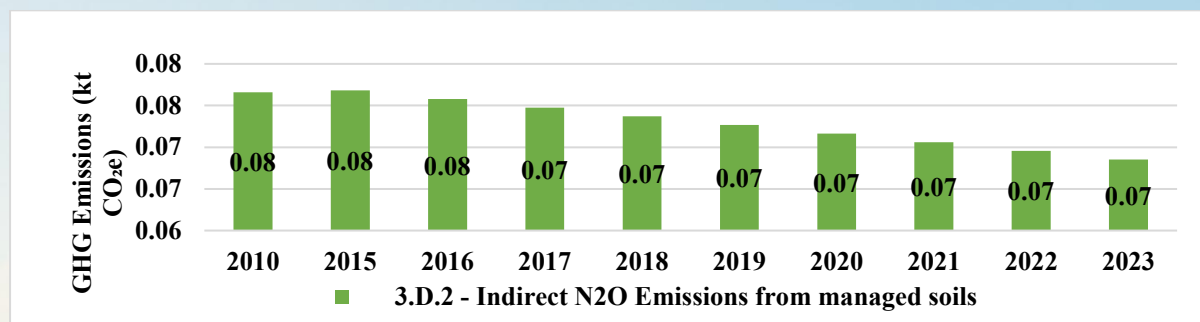


#### 2.4.3.4 Indirect N<sub>2</sub>O Emissions from Managed Soils

Under this category emissions due to the volatilization of N as NH<sub>3</sub> and oxides of N (NO<sub>x</sub>), and the deposition of these gases and their products NH<sub>4</sub><sup>+</sup> and NO<sub>3</sub><sup>-</sup> onto soils and the surface of lakes and other

waters are estimated. The GHG emissions from this category decreased to 0.07 kt CO<sub>2</sub>e in 2023 from 0.08 kt CO<sub>2</sub>e in 2010.

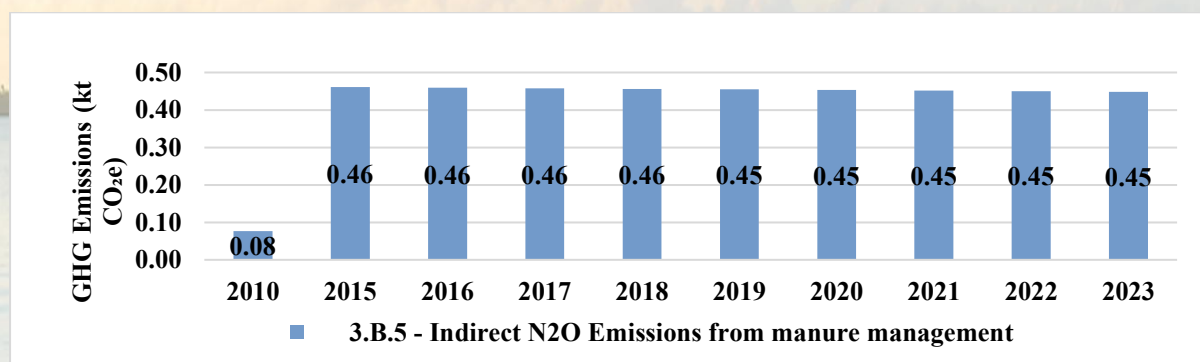
**Figure 29. GHG emissions from Indirect N<sub>2</sub>O Emissions from managed soils in kt CO<sub>2</sub>e: 2010-2023**



#### 2.4.3.5 Indirect N<sub>2</sub>O Emissions from Manure Management

Under this category indirect N<sub>2</sub>O emissions from manure management occurring through NH<sub>3</sub> volatilization and leaching of N during storage and handling of animal manure are estimated. The GHG emissions from this category decrease to 0.449 kt CO<sub>2</sub>e in 2023 from 0.461 kt CO<sub>2</sub>e in 2015.

**Figure 30. GHG emissions from Indirect N<sub>2</sub>O Emissions from Manure management in kt CO<sub>2</sub>e: 2010-2023**



#### 2.4.4 Waste sector

Tuvalu's waste sector includes the estimation of GHG emissions, mainly Methane (CH<sub>4</sub>) and Nitrous oxide (N<sub>2</sub>O) emission estimates from the following key categories:

- Solid Waste Management and Disposal (excluding biological waste)
- Domestic and Commercial wastewater handling (there is no industrial wastewater generation)

In the year 2023, the waste sector emitted 1.56 kt CO<sub>2</sub>e, which is 6% of total national GHG emissions. The total methane emissions from the waste sector were 0.043 kt and nitrous oxide emissions were 0.001 kt. Methane (CH<sub>4</sub>) emissions occur from solid and wastewater disposal and N<sub>2</sub>O is mainly emitted from wastewater discharge. The following table illustrates the waste sector emissions:

**Table 27: Waste Sector GHG Emissions (kt): 2010- 2023**

| Inventory Year: 2010-2023                | 2010        | 2015        | 2016        | 2017        | 2018        | 2019        | 2020        | 2021        | 2022        | 2023        |
|------------------------------------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
| <b>5 - Waste Total</b>                   | <b>1.42</b> | <b>0.56</b> | <b>0.56</b> | <b>0.56</b> | <b>1.50</b> | <b>1.51</b> | <b>1.52</b> | <b>1.53</b> | <b>1.55</b> | <b>1.56</b> |
| 5.A - Solid Waste Disposal               | 1.03        | 0.17        | 0.17        | 0.17        | 1.10        | 1.11        | 1.12        | 1.13        | 1.14        | 1.14        |
| 5.D - Wastewater Treatment and Discharge | 0.38        | 0.39        | 0.39        | 0.39        | 0.40        | 0.40        | 0.40        | 0.41        | 0.41        | 0.41        |



Figure 31. Tuvalu's Waste Sector Emissions in kt CO<sub>2</sub>e: 2010-2023

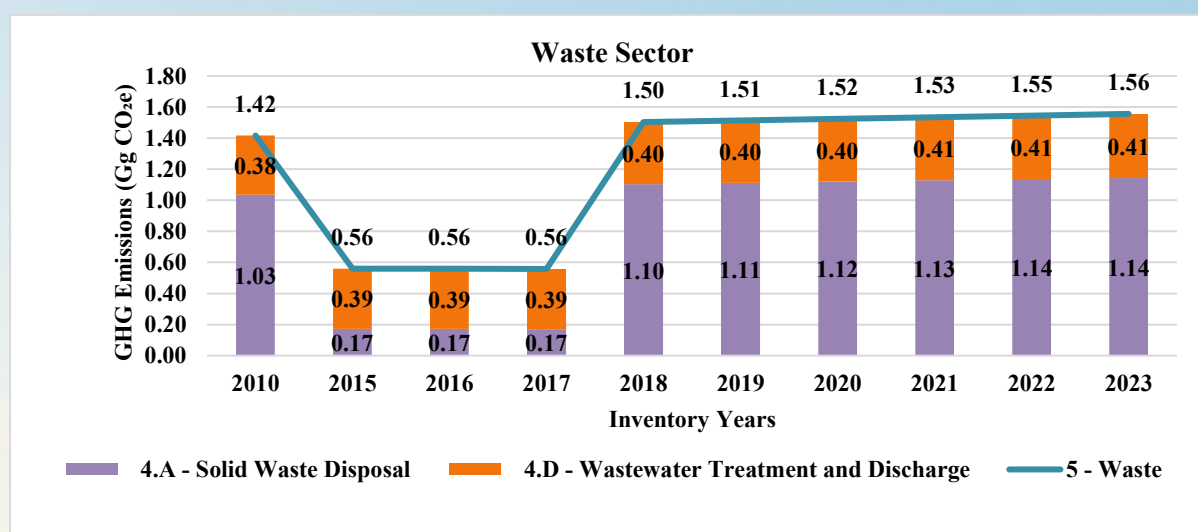


Table 28: Gas-wise Waste Sector GHG Emissions (kt):2023

| Waste Sector Greenhouse Gas Source and Sink Categories | C O <sub>2</sub> | CH <sub>4</sub> | N <sub>2</sub> O | N O <sub>x</sub> | C O | NMV OC | SO <sub>x</sub> | Total GHG emissions              |
|--------------------------------------------------------|------------------|-----------------|------------------|------------------|-----|--------|-----------------|----------------------------------|
|                                                        | (kt)             |                 |                  |                  |     |        |                 | CO <sub>2</sub> equivalents (kt) |
| 5. Total waste sector                                  | N O              | 0.047           | 0.001            | N O              | N O | NO     | N O             | 1.5556                           |
| 5.A. Solid waste disposal                              |                  | 0.041           |                  | N O              | N O | NO     | N O             | 1.1432                           |
| 5.A.2. Unmanaged waste disposal sites                  |                  | 0.04            |                  | NO               | N O | NO     | NO              | 1.1432                           |
| 5.D. Wastewater treatment and discharge                |                  | 0.00653         | 0.00087          | NO               | N O | NO     | NO              | 0.4125                           |
| 5.D.1. Domestic wastewater                             |                  | 0.007           | 0.001            | NO               | N O | NO     | NO              | 0.4125                           |

#### 2.4.4.1 Solid Waste Disposal - Municipal Solid Waste (MSW)

The key source of methane emissions from solid waste management and disposal includes emissions from anaerobic decomposition of waste disposed at 8 major open dump sites located on Nanumea, Nanumaga, Niutao, Nui, Vaitupu, Nukufetau, Funafuti, Nukulaelae islands. All the disposal sites in the country are classified as open dumpsites and thus need physical improvements to upgrade to proper and safe disposal landfills.

First Order Decay (FOD) model has been applied for the calculation of methane emission from landfill sites. In a FOD model, the decay rate of carbon in the waste is governed by a first-order reaction. Thus, the rate of decay is directly proportional to the amount of carbon remaining in the disposal site. This model is built on an exponential factor that describes the fraction of degradable material that each year is degraded into CH<sub>4</sub> and CO<sub>2</sub>. One key input in the model is the amount of degradable organic matter in the waste disposed at the solid waste disposal site. Degradable Organic Carbon (DOC) is the organic carbon in the waste that is amenable to biochemical decomposition. The basis for the calculation is the amount of Decomposable Degradable Organic Carbon (part of the organic carbon that will be degradable under an anaerobic condition) at the disposal site of solid waste after initial decomposition under aerobic conditions. The spreadsheet model estimates the amount of decomposable DOC in the

disposal site, considering the amount deposited each year and the amount remaining after decomposition.

In the absence of actual monitored data, the MSW generation in Tuvalu is estimated from the total population of the country and using MSW waste generation rate of 0.42 kg/capita/day as provided in the latest waste survey report titled 'Tuvalu Waste Survey Report' implemented by Department of Waste Management in December 2017<sup>10</sup>. Since 2018, a per capita waste generation rate of 0.43 kg/capita/day has been assumed, based on the Tuvalu State of Environment Report 2022. This report indicates an increase in Tuvalu's per capita waste generation compared to the previous waste survey report from 2017. The waste composition was also taken from the 2017 survey report as the Weight of waste component (wt%) in Tuvalu as presented in the figure below.

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<sup>10</sup> Tuvalu Waste Survey Report, 2017, <https://tuvalu-data.sprep.org/dataset/tuvalu-waste-survey-report-2017>



Figure 32. MSW Characterization (wt%) – Tuvalu Waste Survey Report (2017)

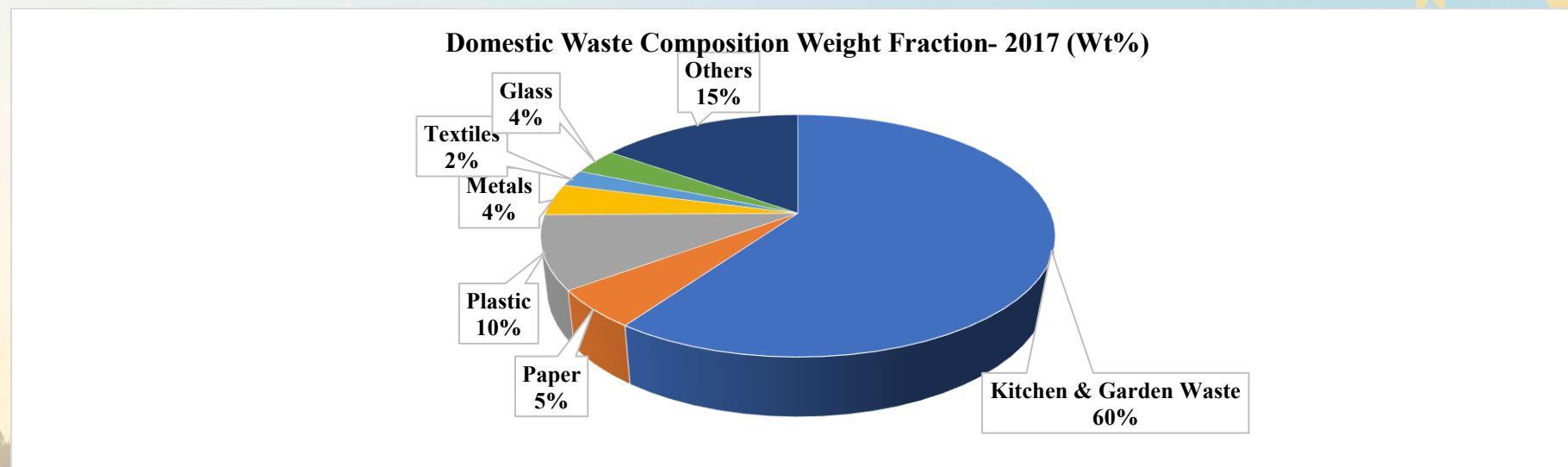


Table 29: Activity data for solid waste disposal: 2010-2023

| Population                                                           | 2010        | 2011        | 2012        | 2013        | 2014        | 2015        | 2016        | 2017        | 2018        | 2019        | 2020        | 2021        | 2022        | 2023        |
|----------------------------------------------------------------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
| Total Population                                                     | 10526       | 10653       | 10782       | 10754       | 10727       | 10700       | 10673       | 10645       | 10975       | 11052       | 11129       | 11206       | 11283       | 11359       |
| Urban population (Funafuti)                                          | 5231        | 5332        | 5434        | 5669        | 5914        | 6170        | 6437        | 6716        | 6206        | 6304        | 6401        | 6498        | 6596        | 6693        |
| Rural population (Outer Islands)                                     | 5291        | 5319        | 5347.9      | 5028        | 4727        | 4444        | 4178        | 3929        | 4928        | 4932        | 4935        | 4938        | 4941        | 4945        |
| MSW Generation Rate (kg/capita/day)                                  | 0.42        | 0.42        | 0.42        | 0.42        | 0.42        | 0.42        | 0.42        | 0.42        | 0.43        | 0.43        | 0.43        | 0.43        | 0.43        | 0.43        |
| Total Solid Waste (MSW) generated Tonnes                             | 1613.6<br>4 | 1633.1<br>0 | 1652.8<br>8 | 1648.5<br>9 | 1644.4<br>5 | 1640.3<br>1 | 1636.1<br>7 | 1631.8<br>8 | 1722.5<br>3 | 1734.6<br>1 | 1746.7<br>0 | 1758.7<br>8 | 1770.8<br>7 | 1782.8<br>0 |
| Waste disposed at managed sites (landfill) -Tonnes                   | 0           | 0           | 0           | 0           | 0           | 0           | 0           | 0           | 0           | 0           | 0           | 0           | 0           | 0           |
| Waste disposed at un-managed sites (landfill, open dumping) - Tonnes | 1613.6<br>4 | 1633.1<br>0 | 1652.8<br>8 | 1648.5<br>9 | 1644.4<br>5 | 1640.3<br>1 | 1636.1<br>7 | 1631.8<br>8 | 1722.5<br>3 | 1734.6<br>1 | 1746.7<br>0 | 1758.7<br>8 | 1770.8<br>7 | 1782.8<br>0 |
| No of landfill                                                       | 8           | 8           | 8           | 8           | 8           | 8           | 8           | 8           | 8           | 8           | 8           | 8           | 8           | 8           |
| Uncontrolled waste dumps                                             | 8           | 8           | 8           | 8           | 8           | 8           | 8           | 8           | 8           | 8           | 8           | 8           | 8           | 8           |

In 2023, GHG emissions from municipal solid waste disposal were 1.14 kt CO<sub>2</sub>e, up from 1.03 kt CO<sub>2</sub>e in 2010. This indicates an increase of about 10% during the inventory period 2010-2023, which is attributed to the increase in the country's total population.

#### *2.4.4.2 Wastewater Treatment and Discharge*

Wastewater treatment and Sanitation system is a major concern in Tuvalu just like other Pacific Island countries (PICs). All the islands are low-lying, with an average elevation of 3 meters (m) above sea level. The groundwater table is just 1–1.3 m below the surface and shallower in some parts of Funafuti. Only in limited areas groundwater can be found at depths greater than 2 m. As a result, any surface pollutants, or pollutants from leaking underground septic pits easily move into the groundwater, and from the groundwater system into lagoons<sup>11</sup>. Contamination of groundwater resources and coastal lagoons poses threat to the human health as well the environment and hampers socio-economic development of the country. In Tuvalu houses are connected to piped sewers and septic tanks are the most common form of sanitation. There was no wastewater treatment facility operational in the country during the inventory period and the wastewater generated is discharged to the nearby water bodies without treatment leading to methane and nitrous oxide emissions.

In 2023, the GHG emissions contribution from the wastewater treatment and discharge subsector was 0.41 kt CO<sub>2</sub>e viz about 2% of the total GHG emissions of the country and about 27% of total GHG emissions from the waste sector. The quantity of wastewater generated and the IPCC default parameter for the Oceania region has been used for estimating GHG emissions due to a lack of monitored data. The Tier1 method has been applied to estimate GHG emissions from the sub-sector, which uses the default values for the emission factor and activity parameters (such as specific per capita BOD in the inventory year, maximum methane producing capacity (Bo), methane correction factor (MCFi), fraction of nitrogen in protein, factor to adjust for non-consumed protein, etc.) and is considered good practice for countries with limited data. The following table presents the parameters used for the estimation of GHG emissions from this sub-sector.

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<sup>11</sup> Economics of liquid waste management in Funafuti, Tuvalu / by Padma Lal, Kalesoma Saloa and Falealili Uila. – Apia, Samoa : SPREP, 2006.



**Table 30: Activity data for wastewater disposal: 2010-2023**

| Data/Parameters                                             | Unit         | 2010    | 2015     | 2016       | 2017       | 2018       | 2019     | 2020       | 2021      | 2022    | 2023    | Source                                                                                           |
|-------------------------------------------------------------|--------------|---------|----------|------------|------------|------------|----------|------------|-----------|---------|---------|--------------------------------------------------------------------------------------------------|
| Population                                                  | Number       | 10526   | 10700    | 10673      | 10645      | 10975      | 11052    | 11129      | 11206     | 11283   | 11359   | Based on Census 2017                                                                             |
| Wastewater's source                                         |              |         |          |            |            |            |          |            |           |         |         | Domestic                                                                                         |
| Organic content in the wastewater - in inventory year, TOWi | kg BOD/yr    | 288,149 | 292912.5 | 292173.375 | 291406.875 | 300440.625 | 302548.5 | 304656.375 | 306764.25 | 308,872 | 310,953 | Estimated using IPCC Guidelines                                                                  |
| Wastewater treated                                          | MLD          | 0       | 0        | 0          | 0          | 0          | 0        | 0          | 0         | 0       | 0       |                                                                                                  |
| Specific per capita BOD in inventory year, BOD              | g/person/day | 60      | 60       | 60         | 60         | 60         | 60       | 60         | 60        | 60      | 60      | IPCC Default value- 60 g/person/day                                                              |
| Annual per capita protein consumption,                      | kg/person/yr | 34.68   | 34.68    | 34.68      | 34.68      | 34.68      | 34.68    | 34.68      | 34.68     | 34.68   | 34.68   | Average protein consumption= 95 grams/person/day based on Tuvalu Food Security Profile 2017, FAO |

## 2.5 GHG Emissions by Gases

The gas-by-gas emissions for Tuvalu's inventory years 2010-2023 include three main Greenhouse gases viz Carbon dioxide (CO<sub>2</sub>), Methane (CH<sub>4</sub>), and Nitrous-oxide (N<sub>2</sub>O). The emissions of other GHGs like hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and Sulphur hexafluoride (SF<sub>6</sub>) have not been estimated due to the reasons and limitations discussed in the previous section. are reported in greenhouse gas inventories. Further, an effort has been made to estimate emissions of indirect gases such as carbon monoxide (CO), oxides of nitrogen (NO<sub>x</sub>), non-methane volatile organic compounds (NMVOC), and Sulphur dioxide (SO<sub>2</sub>) from the Energy Sector (Energy Industries, Transport, Other sectors- Commercial, Institutional and Residential). However, they are not the main source of the GHGs and have very negligible quantum. These emissions are not counted under national total GHG emissions.

The dominant GHG emission in Tuvalu is carbon dioxide (CO<sub>2</sub>) which is emitted mainly from fossil fuel combustion activities for electricity generation, transportation, and other sectors such as Residential/Commercial/Institutional and Agriculture/Forestry/Fishing/Fish Farms.

The next main GHG is methane (CH<sub>4</sub>), mainly from livestock, aggregate sources, non-CO<sub>2</sub> emissions sources on land, solid waste, and wastewater disposal and treatment activities. This is followed by N<sub>2</sub>O emissions mainly from livestock, aggregate sources, and non-CO<sub>2</sub> emissions sources on land and wastewater sub-sector.

Gas-wise GHG emissions in Tuvalu during the inventory years 2010-2023 are presented in the table below and discussed in detail in the following section:

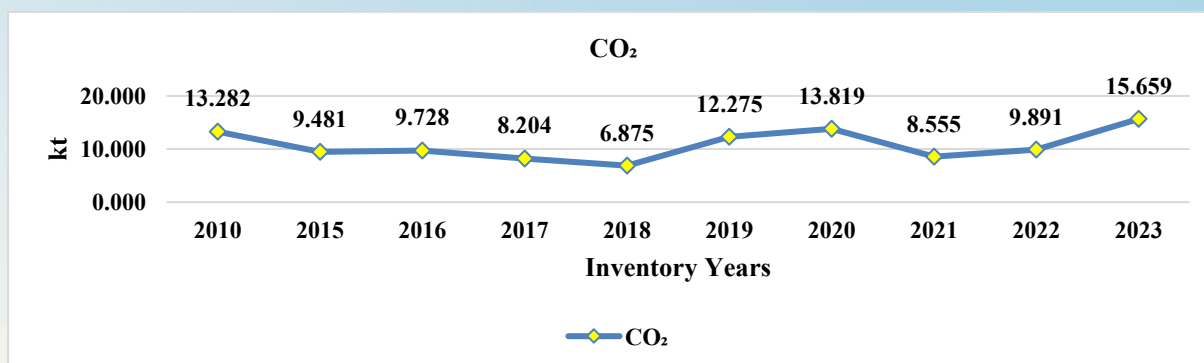
**Table 31: Tuvalu's Gas-wise GHG Emission (excluding removals), Kt: 2010-2023**

| Tuvalu's GHG Emissions, (kt)        |                 |                 |                  |                   |
|-------------------------------------|-----------------|-----------------|------------------|-------------------|
| Year                                | CO <sub>2</sub> | CH <sub>4</sub> | N <sub>2</sub> O | CO <sub>2</sub> e |
| 2010                                | 13.28           | 0.31            | 0.01             | 23.26             |
| 2015                                | 9.48            | 0.29            | 0.01             | 18.87             |
| 2016                                | 9.73            | 0.29            | 0.01             | 19.09             |
| 2017                                | 8.20            | 0.29            | 0.00             | 17.52             |
| 2018                                | 6.87            | 0.32            | 0.00             | 17.08             |
| 2019                                | 12.27           | 0.32            | 0.01             | 22.55             |
| 2020                                | 13.82           | 0.32            | 0.01             | 24.09             |
| 2021                                | 8.56            | 0.32            | 0.00             | 18.73             |
| 2022                                | 9.89            | 0.32            | 0.00             | 20.06             |
| 2023                                | 15.66           | 0.32            | 0.01             | 25.89             |
| Average                             | 10.78           | 0.31            | 0.01             | 20.71             |
| %share                              | 97.18%          | 2.77%           | 0.05%            |                   |
| Percentage change between 2010-2023 | 17.90%          | 2.74%           | 0.94%            | 11.29%            |



### 2.5.1.1 Carbon dioxide (CO<sub>2</sub>)

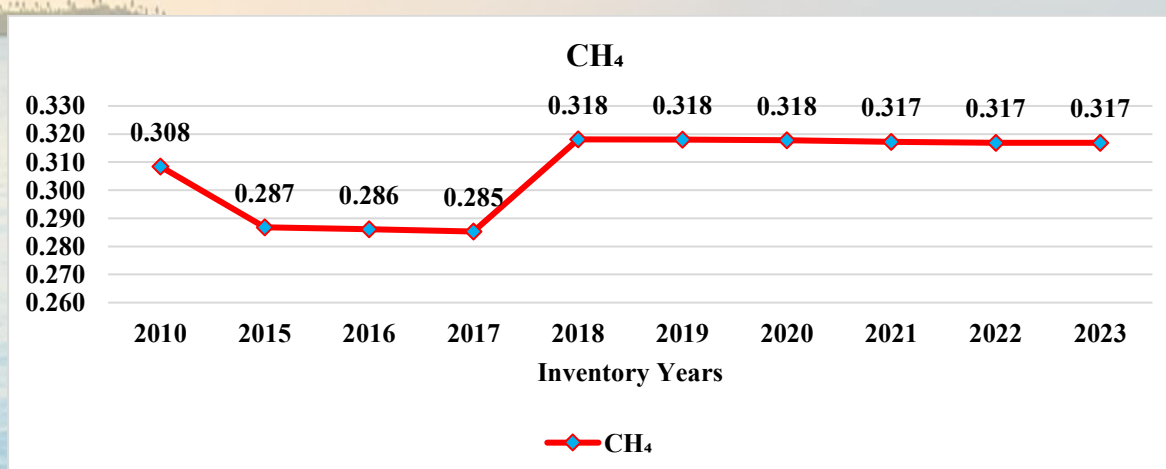
Figure 33. Tuvalu's Total CO<sub>2</sub> emissions in Kt: 2010-2023



The net CO<sub>2</sub> emissions in Tuvalu are estimated for the period 2010-2023 and presented in the above Figure. The energy sector and sub-sectors are the main sources of CO<sub>2</sub> emissions and account for the entire CO<sub>2</sub> emissions in Tuvalu. The net CO<sub>2</sub> emissions show an increasing trend over the inventory period. It has increased from 13.28 kt in 2010 to 15.66 kt in 2023. This decline in 2021 is attributed to a decline in the import of fuels and a slowdown of the economy due to the global Covid-19 pandemic.

### 2.5.1.2 Methane (CH<sub>4</sub>)

Figure 34. Tuvalu's total Methane (CH<sub>4</sub>) emissions in kt – 2010-2023



The CH<sub>4</sub> emission trend shows a slightly declining trend, and it is mainly attributed to the decrease in the population of livestock in the inventory years. The CH<sub>4</sub> emissions in Tuvalu declined from 2010 to 0.285 in 2017 then increased to 0.318 in 2018 and then declined to 0.317 in 2023. The majority of the CH<sub>4</sub> emissions viz around 85% are contributed from the agriculture sector mainly Livestock-enteric fermentation and manure management. While the remaining 15% is contributed from the waste sector (Solid waste disposal- MSW and Domestic wastewater discharge).

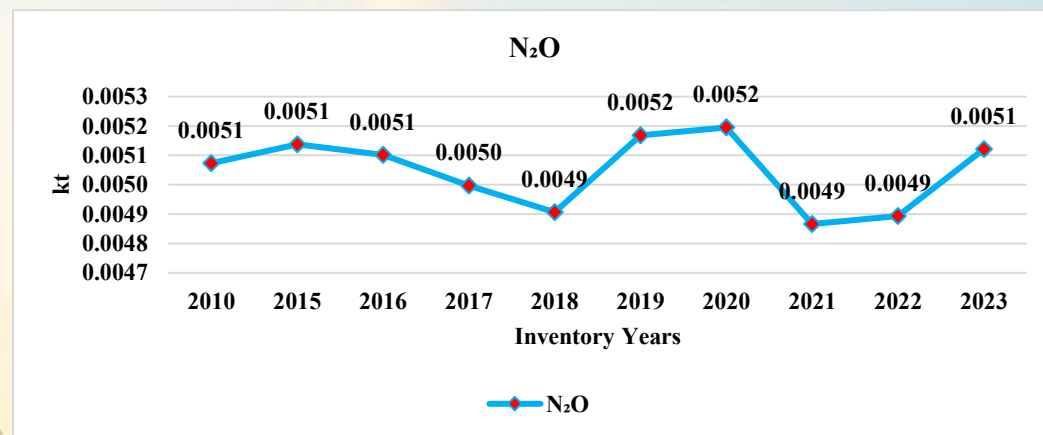
**Table 32: Tuvalu's Sub-sector wise CH<sub>4</sub> Emission Kt: 2010-2023**

| Years                                                     | 2010                 | 2015    | 2016    | 2017    | 2018    | 2019    | 2020    | 2021    | 2022    | 2023    |
|-----------------------------------------------------------|----------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
| CH <sub>4</sub> Greenhouse Gas Source and Sink Categories | CH <sub>4</sub> (kt) |         |         |         |         |         |         |         |         |         |
| <b>Total CH<sub>4</sub> emissions</b>                     | <b>0.30842</b>       | 0.28678 | 0.28614 | 0.28530 | 0.31810 | 0.31806 | 0.31780 | 0.31719 | 0.31692 | 0.31688 |
| <b>1. Energy</b>                                          | <b>0.00061</b>       | 0.00048 | 0.00051 | 0.00038 | 0.00030 | 0.00059 | 0.00067 | 0.00038 | 0.00044 | 0.00074 |
| 1.A. Fuel combustion                                      | <b>0.00061</b>       | 0.00048 | 0.00051 | 0.00038 | 0.00030 | 0.00059 | 0.00067 | 0.00038 | 0.00044 | 0.00074 |
| 1.A.1. Energy industries                                  | <b>0.00030</b>       | 0.00015 | 0.00016 | 0.00018 | 0.00020 | 0.00022 | 0.00024 | 0.00025 | 0.00027 | 0.00029 |
| 1.A.3. Transport                                          | <b>0.00024</b>       | 0.00024 | 0.00024 | 0.00015 | 0.00007 | 0.00030 | 0.00035 | 0.00010 | 0.00012 | 0.00036 |
| 1.A.4. Other sectors                                      | <b>0.00008</b>       | 0.00010 | 0.00011 | 0.00005 | 0.00003 | 0.00006 | 0.00009 | 0.00003 | 0.00005 | 0.00009 |
| <b>3. Agriculture</b>                                     | <b>0.26480</b>       | 0.27399 | 0.27335 | 0.27268 | 0.27204 | 0.27140 | 0.27073 | 0.27009 | 0.26945 | 0.26878 |
| 3.A. Enteric fermentation                                 | <b>0.01058</b>       | 0.01095 | 0.01092 | 0.01089 | 0.01087 | 0.01084 | 0.01082 | 0.01079 | 0.01077 | 0.01074 |
| 3.B. Manure management                                    | <b>0.25422</b>       | 0.26305 | 0.26243 | 0.26179 | 0.26117 | 0.26055 | 0.25991 | 0.25929 | 0.25868 | 0.25804 |
| <b>5. Waste</b>                                           | <b>0.04300</b>       | 0.01230 | 0.01227 | 0.01224 | 0.04576 | 0.04608 | 0.04640 | 0.04672 | 0.04704 | 0.04736 |
| 5.A. Solid waste disposal <sup>(6)</sup>                  | <b>0.03695</b>       | 0.00615 | 0.00614 | 0.00612 | 0.03945 | 0.03972 | 0.04000 | 0.04028 | 0.04055 | 0.04083 |
| 5.D. Wastewater treatment and discharge                   | <b>0.00605</b>       | 0.00615 | 0.00614 | 0.00612 | 0.00631 | 0.00635 | 0.00640 | 0.00644 | 0.00649 | 0.00653 |



### 2.5.1.3 Nitrous Oxide (N<sub>2</sub>O)

Figure 35. Tuvalu's total Nitrous Oxide (N<sub>2</sub>O) emissions in kt – 2010-2023



The net N<sub>2</sub>O emissions in Tuvalu were estimated at 0.0051 kt in 2023. From 2010 to 2023, emissions have had increasing and decreasing trends. The average contribution of N<sub>2</sub>O emissions to the total GHG emissions of Tuvalu is minimal, about 0.05%. Approximately 74% of Tuvalu's total N<sub>2</sub>O emissions come from the agriculture sector (Aggregate sources and non-CO<sub>2</sub> emissions sources on land). The remaining 17% and 9% of N<sub>2</sub>O emissions come from the waste sector (Domestic wastewater Treatment and Discharge) and the Energy sector (Energy Industries, Transport, and Other sectors) respectively. The rationale behind the decreasing N<sub>2</sub>O emission trend is the same as that of the CH<sub>4</sub> emissions.

Table 33: Tuvalu's subsector-wise N<sub>2</sub>O Emission Kt: 2010 -2023

| Years                                                      | 2010                  | 2015       | 2016     | 2017     | 2018     | 2019     | 2020     | 2021     | 2022     | 2023     |
|------------------------------------------------------------|-----------------------|------------|----------|----------|----------|----------|----------|----------|----------|----------|
| N <sub>2</sub> O Greenhouse Gas Source and Sink Categories | N <sub>2</sub> O (kt) |            |          |          |          |          |          |          |          |          |
| <b>Total N<sub>2</sub>O emissions</b>                      | <b>0.00507</b>        | 0.00513772 | 0.005101 | 0.004997 | 0.004906 | 0.005169 | 0.005195 | 0.004866 | 0.004894 | 0.005121 |
| <b>1. Energy</b>                                           | <b>0.00033</b>        | 0.00030481 | 0.0003   | 0.000228 | 0.000141 | 0.000427 | 0.000477 | 0.000172 | 0.000223 | 0.000474 |
| 1.A. Fuel combustion                                       | <b>0.00033</b>        | 0.00030481 | 0.0003   | 0.000228 | 0.000141 | 0.000427 | 0.000477 | 0.000172 | 0.000223 | 0.000474 |
| 1.A.1. Energy industries                                   | <b>0.00006</b>        | 3.0096E-05 | 3.22E-05 | 3.59E-05 | 3.98E-05 | 4.46E-05 | 4.74E-05 | 5.08E-05 | 5.42E-05 | 5.76E-05 |
| 1.A.3. Transport                                           | <b>0.00027</b>        | 0.00026606 | 0.000259 | 0.000185 | 9.6E-05  | 0.000374 | 0.000418 | 0.000117 | 0.000162 | 0.000405 |
| 1.A.4. Other sectors                                       | <b>0.00001</b>        | 8.6473E-06 | 8.93E-06 | 6.41E-06 | 4.88E-06 | 8.27E-06 | 1.18E-05 | 3.8E-06  | 6.96E-06 | 1.19E-05 |
| <b>3. Agriculture</b>                                      | <b>0.00394</b>        | 0.00401666 | 0.003987 | 0.003958 | 0.003928 | 0.003899 | 0.003869 | 0.00384  | 0.00381  | 0.003781 |
| 3.B. Manure management                                     | <b>0.00229</b>        | 0.00236261 | 0.002355 | 0.002348 | 0.002341 | 0.002334 | 0.002327 | 0.002319 | 0.002312 | 0.002305 |
| 3.D. Agricultural soils                                    | <b>0.00165</b>        | 0.00165406 | 0.001632 | 0.001609 | 0.001587 | 0.001565 | 0.001542 | 0.00152  | 0.001498 | 0.001475 |
| <b>5. Waste</b>                                            | <b>0.00080</b>        | 0.00081625 | 0.000814 | 0.000812 | 0.000837 | 0.000843 | 0.000849 | 0.000855 | 0.000861 | 0.000867 |
| 5.D. Wastewater treatment and discharge                    | <b>0.00080</b>        | 0.00081625 | 0.000814 | 0.000812 | 0.000837 | 0.000843 | 0.000849 | 0.000855 | 0.000861 | 0.000867 |

### 2.5.1.4 Other GHGs (PFCs, HFCs and SF<sub>6</sub>)

Emissions from Other indirect GHGs like Perfluorocarbons (PFCs), hydrofluorocarbons (HFCs), and Sulphur hexafluoride (SF<sub>6</sub>) are not estimated and reported under this inventory due to data and capacity limitations. Reliable activity data on their consumption is unavailable, and higher-tier methodology expertise requires capacity building. Consistent with flexibilities for developing countries (particularly SIDS/LDCs) under MPGs relevant reporting guidelines, Tuvalu has not reported these gases. This reflects the challenge of balancing comprehensive reporting with limited resources. Tuvalu is committed to improving data and capacity, intending to include these gases in future BTRs, demonstrating its commitment to continuous improvement.

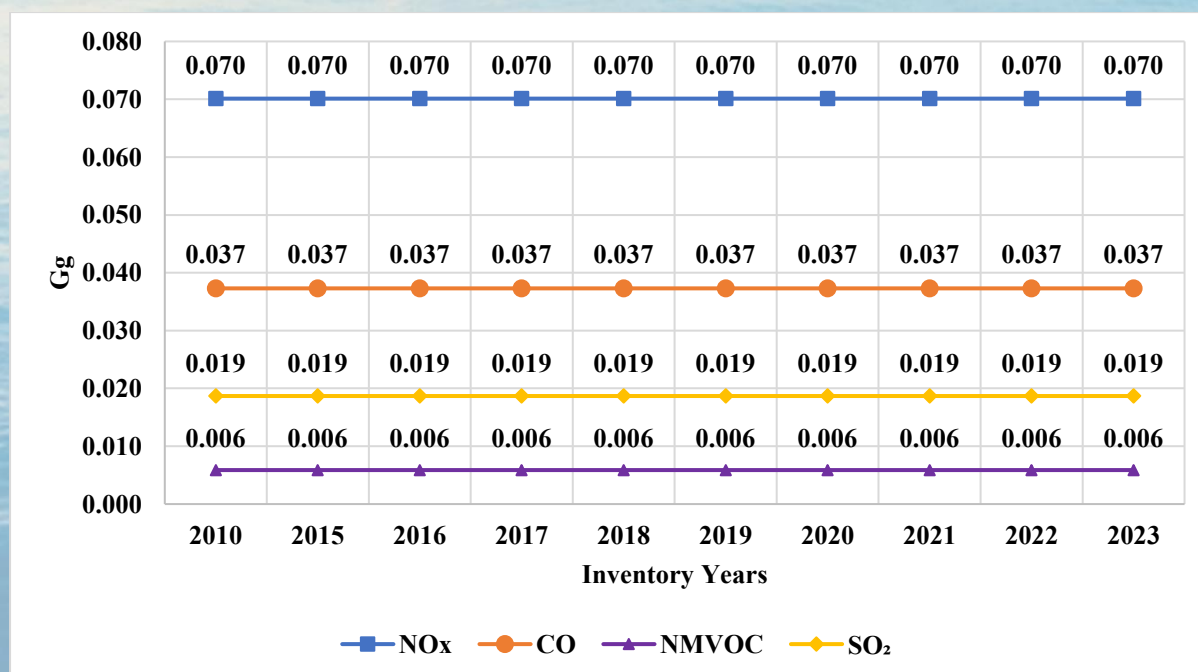
### 2.5.1.5 Precursor and Indirect Emission (NO<sub>x</sub>, CO, NMVOC, and SO<sub>2</sub>)

The following table and figure present reporting of the following precursors: nitrogen oxides (NO<sub>x</sub>), non-methane volatile organic compounds (NMVOC), carbon monoxide (CO) and sulphur dioxide (SO<sub>2</sub>) emissions and emission trends in Tuvalu for the year 2010-2023.

**Table 34: Tuvalu's net Indirect GHG emission (kt) during 2010-2023**

| Precursor and Indirect Emission (NO <sub>x</sub> , CO, NMVOC, and SO <sub>2</sub> ) in kt |                 |      |       |                 |
|-------------------------------------------------------------------------------------------|-----------------|------|-------|-----------------|
| Year                                                                                      | NO <sub>x</sub> | CO   | NMVOC | SO <sub>2</sub> |
| 2010                                                                                      | 0.07            | 0.04 | 0.01  | 0.02            |
| 2015                                                                                      | 0.07            | 0.04 | 0.01  | 0.02            |
| 2016                                                                                      | 0.07            | 0.04 | 0.01  | 0.02            |
| 2017                                                                                      | 0.07            | 0.04 | 0.01  | 0.02            |
| 2018                                                                                      | 0.07            | 0.04 | 0.01  | 0.02            |
| 2019                                                                                      | 0.07            | 0.04 | 0.01  | 0.02            |
| 2020                                                                                      | 0.07            | 0.04 | 0.01  | 0.02            |
| 2021                                                                                      | 0.07            | 0.04 | 0.01  | 0.02            |
| 2022                                                                                      | 0.07            | 0.04 | 0.01  | 0.02            |
| 2023                                                                                      | 0.07            | 0.04 | 0.01  | 0.02            |

**Figure 36. Tuvalu's net Indirect GHG emission trend during 2010-2023**





The above table and figure represent the indirect GHG emission in Tuvalu for the inventory years 2010-2023 showing that the emissions of these gases follow the same trend as that of the energy sector- fuel combustion activities as they are directly dependent on fossil fuel combustion.

## 2.6 GHG Inventory Conclusion

The preparation of this inventory has been another opportunity to strengthen the credibility of the results, and the rigor of the national system used to produce the inventory estimates. This inventory serves as a key source of evidence on Tuvalu's National greenhouse gas emissions trends and aids in monitoring progress made towards the reduction of GHG emissions. It also acts as an important tool for Tuvalu's policy recommendations on climate change and enables to measure success of such policies. The current GHG inventory provides comprehensive information on GHG emissions for the years 2010 to 2023. The GHG emissions results for the inventory period 2010-2023 reveal a varying trend over the reporting period with the annual variation dominated by fuel consumption in the energy sector.

The compilation of the GHG inventory continues to remain a major challenge, especially in terms of the availability of activity data for the estimation of GHG emissions. The key findings and recommendations of this inventory development exercise have been identified during and highlighted in previous sections of the report. However, data collection, monitoring, and verification for the GHG emission sector is a key takeaway of this exercise. For the future GHG inventory, Tuvalu shall minimize the data gaps and uncertainty specifically in the Energy, Livestock, and Waste sectors.

## 2.7 Recalculations, Consistency, Improvements, and Capacity-Building

**Recalculations and Consistency in the National GHG Inventory:** Tuvalu's First Biennial Transparency Report (BTR) confirms no recalculations of previously submitted greenhouse gas (GHG) inventories. This BTR presents new GHG calculations for the years following the last inventory submission, utilizing the most recent activity data. Consequently, historical emission trends remain unchanged, and no modifications were necessary due to technical review. Maintaining alignment with the IPCC 2006 Guidelines, the reporting adheres to the principles of transparency, accuracy, completeness, consistency, and comparability (TACCC). Therefore, previously reported emission and removal levels and trends are unchanged, ensuring time-series consistency. While no recalculations were performed, ongoing efforts focus on enhancing historical data reconstruction to address existing gaps. Future BTR submissions will prioritize improving the accuracy and completeness of emission trends.

**Improvements in the National GHG Inventory:** Tuvalu's greenhouse gas (GHG) inventory improvements are guided by the National GHG Inventory Improvement Plan (NIIP) (Section 2.7.1) and QA/QC mechanisms (Sections 1.13.6 and 2.1.4) of this BTR. Significant enhancements are being implemented across key sectors:

- **Energy Sector:** Improvements include the introduction of disaggregated fuel consumption data for key sub-categories, adoption of IPCC-based emission factors, and planned development of country-specific emission factors. Further enhancements include exploring potential automated fuel tracking by the Tuvalu Electricity Corporation (TEC) and integrating solar photovoltaic (PV) adoption rates into emissions calculations for a more accurate representation of energy-related emissions.
- **AFOLU Sector:** Data quality will be improved through strengthened livestock data collection, GIS-based land-use monitoring, and piloting of manure management improvements. These efforts



aim to provide a more robust and spatially explicit understanding of emissions and removals within the AFOLU sector.

- **Waste Sector:** The waste sector inventory will be enhanced through more comprehensive waste characterization studies, tracking of landfill gas emissions, and planning for future improvements to methane recovery systems. These enhancements will improve the accuracy of waste-related emissions estimates.

**Areas of Improvement in Response to the Review Process:** Tuvalu has identified several key priorities to further enhance the quality of its GHG inventory, specifically addressing areas highlighted during the review process:

- **Country-Specific Emission Factors:** A key focus is the development of country-specific emission factors for the Energy, AFOLU, and Waste sectors. This will improve the accuracy of emission estimates by reflecting Tuvalu's unique circumstances.
- **Expanded Data Collection:** Tuvalu aims to expand data collection efforts, particularly for land-use changes and industrial processes, which are currently identified as data gaps. More comprehensive data will contribute to a complete and more accurate inventory.
- **Strengthened Institutional Arrangements:** Strengthening institutional arrangements for data collection and verification is crucial. Tuvalu is committed to working with regional partners to improve data management and ensure data quality.
- **Enhanced MRV System:** Enhancing the Measurement, Reporting, and Verification (MRV) system is a priority, including formalizing data-sharing frameworks between government agencies. This will improve transparency and facilitate consistent and reliable reporting.

**Capacity-Building and Future Reductions in Flexibility Provisions:** As a SIDS and LDC, Tuvalu has applied flexibility provisions under MPGs due to capacity constraints. To progressively reduce reliance on these provisions, Tuvalu aims to:

- Adopt higher-tier methodologies and reduce reliance on IPCC default factors.
- Strengthen technical expertise through training programs.
- Expand QA/QC mechanisms to improve data validation and verification.
- Implement automated data tracking for improved inventory management.

Future National Inventory Improvement Plans (NIIPs) will outline estimated timeframes for improvements, subject to available funding and resources. Tuvalu remains committed to enhancing GHGI accuracy, completeness, and comparability, ensuring alignment with ETF and MPGs requirements as national capacity develops. Below Section 2.7.1 NIIP expands further details.

## 2.7.1 National GHG Inventory Improvement Plan (NIIP)

### Procedural arrangements:

- **Data Collection:** The activity data collection from the Public and private sectors including government agencies, ministries, industry, public and private sector, institutions, etc. will be formalized via suitable instruments e.g., legal contracts/ MoUs, MoAs, or other legal documents. **Data Collection Format:** The activity data collection format will be designed and to be shared with the respective data providers and key stakeholders.
- The Climate Change Department (CCD) will initiate the regulation to formalize the database management, archives, and institutional setup for data collection and archiving.
- Climate Change Department (CCD) will establish arrangements for implementing improved QA/QC procedures, manage and operate the inventory database, and document and archive inventory information and the operation of the inventory.



- CCD will also identify the efforts required to establish procedures and arrangements to make data collection and archiving a continuous process. Also, identify the constraints and gaps that need to be overcome for future GHG Inventories.
- **Energy sector data:** Data on fuel distribution and their consumption in different fuel combustion activities like electricity generation, transportation, etc., will be obtained from the energy department and national statistics department for computing emissions using the sectoral approach in the future inventory. Further, data on international waterborne navigation was not available for this inventory but will be collected for the next inventory by the Energy Department in coordination with the Marine Department.
- **Livestock Data:** Livestock population data has not been collected regularly in the country, which poses a challenge for estimating GHG emissions from the agriculture sector. The Department of Agriculture will establish mechanisms and provisions to collect more detailed and granular data on livestock species and their population for the future inventory.
- **Forestry and Other Land Use:** Data on land use change and forestry were not available for this inventory period; hence, emissions/removals from this sub-sector are not estimated in this inventory. Data will be collected by the Lands and Survey department for the future inventory.
- **Waste Sector Data:** The waste (Solid waste and wastewater) sector activity data monitoring and reporting needs to be initiated in urban centres.
- **Higher Tier Approach:** The CCD will improve the overall data collection, archiving, and verification process for the applicable sector and shall improve the quality of data; further improve the calculation approach to higher tier for the key sectors.
- **Capacity building and training activities:** will be conducted for the stakeholders involved mainly for monitoring and data collection. Further the stakeholders will be sensitizing on accuracy, traceability and transparency of data, QA/QC and reporting aspects of national GHG inventory.
- **Key Category Analysis:** The activity data collection and review process will be improved and higher tier analysis of GHG from the key categories and sub-categories identified for Tuvalu proposed for the next inventory. The activity data collection, review process and QA/QC procedure will be developed and implemented for all the key categories and sub-categories.
- **Trend Analysis:** The GHG emissions from the previous year will be recalculated for trend analysis if there is a change in the methodologies used during the reporting period.
- **Implementation Integrated Monitoring, Reporting and Verification (MRV Tool) for National GHG Inventory:** CCD will develop, implement, and operationalize the web-based integrated monitoring, reporting, and verification system for national GHG inventory.

### 3 Chapter 3: Tracking Progress Made in Implementation and Achievement of NDC Under Article 4

Tuvalu's national circumstances, as comprehensively detailed in Chapter 1, provide the essential foundation for tracking progress toward its NDC under Article 4 of the Paris Agreement and collectively shape the nation's GHG emissions and removals over time. National circumstances factors not only highlight the inherent vulnerabilities and opportunities within Tuvalu but also underscore the impact of unique circumstances on climate outcomes. Furthermore, legal, administrative, and procedural institutional arrangements (Sections 1.13 and 1.14) provide robust mechanisms for monitoring and reporting progress, including tracking internationally transferred mitigation outcomes where applicable. This cohesive framework, consistent with previous reports, ensures that domestic implementation, stakeholder engagement, and data archiving are effectively managed, thereby meeting the UNFCCC MPGs requirements (Paragraphs 59–63) and providing a basis for informed climate policy and ongoing NDC implementation.

#### 3.1 Tuvalu's national circumstances affect GHG emissions and removals over time

Tuvalu's distinctive national context fundamentally shapes its greenhouse gas (GHG) emissions and the capacity for carbon removals. As a small island nation composed of low-lying atolls and reef islands, Tuvalu is extraordinarily vulnerable to the impacts of climate change. Rising sea levels, coastal erosion, and more frequent extreme weather events significantly threaten its delicate ecosystems and infrastructure. These vulnerabilities, combined with the nation's limited land area, restrict the expansion of land-based mitigation options—such as afforestation and reforestation—that might be feasible in larger, more resource-abundant countries.

Moreover, Tuvalu's heavy reliance on imported diesel for electricity generation, transportation, and other critical sectors has resulted in a fossil fuel-dependent energy system. This dependency is the primary contributor to its GHG emissions. While substantial progress has been made in deploying renewable energy in the outer islands—where solar photovoltaic (PV) systems and battery storage now deliver 80–90% renewable electricity—the capital, Funafuti, continues to rely largely on diesel generators. This uneven energy mix contributes to higher per capita emissions in urbanized areas, while remote islands face challenges in ensuring reliable and efficient energy access.

The following factors, explain how these national circumstances impact emissions and removals over time:

##### 1. Geographic and Climate Vulnerability:

- **Rising Sea Levels & Extreme Weather:** Tuvalu is highly susceptible to sea level rise, coastal erosion, and saltwater intrusion, all of which compromise land use and food security. These factors severely limit the potential for large-scale land-based mitigation options.
- **Isolation & Transport Emissions:** Geographic isolation increases dependency on imported fossil fuels, particularly affecting the transportation sector. Limited local alternatives result in elevated emissions from long-distance transport.

##### 2. Energy Dependency and Limited Renewable Resources:

- **Fossil Fuel Reliance:** The nation relies heavily on imported diesel for electricity and transportation, making the energy sector the largest source of GHG emissions.



- **Renewable Energy Challenges:** Despite successful renewable energy initiatives in the outer islands, challenges remain—especially in Funafuti—due to high initial costs, technical integration issues, and dispersed island geography. Tuvalu’s NDC targets a transition to 100% renewable electricity by 2030 yet achieving this requires overcoming significant financial and technical barriers.
- 3. Population Distribution and Urbanization:**
- **Urban Concentration in Funafuti:** Most of the population is concentrated in Funafuti, where urban density results in higher per capita emissions from energy consumption, transportation, and waste generation.
  - **Disparity Across Islands:** In contrast, outer islands exhibit low overall emissions but struggle with ensuring continuous energy access and operational efficiency. This disparity complicates national policy implementation and resource allocation.
- 4. Agricultural Limitations and Food Security:**
- **Limited Arable Land:** Poor soil quality and limited arable land restrict agricultural activities, resulting in low direct agricultural emissions and limited opportunities for carbon sequestration through sustainable practices.
  - **Import Dependency:** Reliance on imported food increases indirect emissions via long supply chains and extensive transportation, further contributing to Tuvalu’s overall carbon footprint.
- 5. Waste Management and Limited Disposal Infrastructure:**
- **Inadequate Waste Systems:** In Funafuti, constrained landfill space and inefficient waste separation practices lead to significant methane emissions. Although the Tuvalu Integrated Waste Policy and Action Plan are in place to address these issues, infrastructural deficiencies and low public awareness continue to hamper progress.
- 6. Socioeconomic Constraints and Capacity Limitations:**
- **Resource and Technical Capacity:** Limited economic resources and technical capacity slow the deployment of advanced GHG mitigation and waste management technologies. This is further compounded by its heavy reliance on international climate finance and technical expertise, underscoring the need for increased domestic investment and capacity-building to accelerate climate action.
- 7. Forest and Land Use Constraints:**
- **Minimal Forest Cover:** Tuvalu’s scarce forest cover and limited land availability inhibit the potential for afforestation or reforestation as a means of carbon sequestration.
  - **Threatened Coastal Vegetation:** Although coastal vegetation such as mangroves plays an essential role in carbon sequestration, these areas are vulnerable to sea level rise and extreme weather, limiting their long-term effectiveness as carbon sinks.

In conclusion, Tuvalu’s unique geographic, economic, and environmental realities exert a profound influence on its GHG emissions and removals over time. These national circumstances are integral to the country’s NDC, shaping its climate action strategies by underscoring the need for a tailored approach. By aligning mitigation efforts with these challenges—through a focus on renewable energy deployment, energy efficiency improvements, and targeted waste management measures—Tuvalu aims to achieve feasible and sustainable emissions reductions despite its inherent limitations. This contextual understanding ensures that Tuvalu’s climate action strategies remain realistic, effective, and aligned with both national needs and global climate commitments.

## 3.2 Changes since the most recent biennial transparency report

Since this is Tuvalu’s first Biennial Transparency Report (BTR), there is no prior report for comparison. However, future BTR submissions will document any methodological updates driven by enhanced data availability, analytical improvements, or changes in international best practices. Areas identified for methodological refinement include sectoral data accuracy across islands and sector-specific emissions factors, enhanced stakeholder engagement, integration of new technologies, and capacity-building initiatives



- **Enhanced Stakeholder Engagement:** Tuvalu will implement a more inclusive approach to stakeholder engagement, incorporating feedback from local communities, NGOs, and the private sector into the planning and implementation processes.
- **Integration of New Technologies:** The CCD will adopt advanced data management systems to improve the accuracy and efficiency of data collection and reporting.
- **Capacity Building Initiatives:** Ongoing training programs will be established to enhance the skills of personnel involved in climate data management, enabling them to utilize new tools and methodologies.

### 3.3 Description of Tuvalu's NDC

#### 3.3.1 Overview of Tuvalu's Updated NDC (2022)

The Government of Tuvalu developed its Intended Nationally Determined Contribution (INDC) and submitted it to the United Nations Framework Convention on Climate Change (UNFCCC) in 2015 and ratified the Paris Agreement on 22 April 2016. When the Paris Agreement came into force on 04 November 2016, Tuvalu's INDC submitted in 2015 automatically became Tuvalu's First NDC.

In accordance with decision 1/CP.21, Tuvalu hereby communicated Tuvalu's Updated Nationally Determined Contribution (NDC) in November 2022 under Article 4 of the Paris Agreement.

In this Updated NDC, Tuvalu hereby communicates to the UNFCCC:

An update to its existing NDC pursuant to Article 4.11 of the Paris Agreement that includes:

- Tuvalu commits to the reduction of greenhouse gas (GHG) emissions from the electricity (power) sector by 100%, i.e., almost zero emissions by 2030.
- Increase energy efficiency in Funafuti by 30%.
- Tuvalu's indicative quantified economy-wide target to reduce total GHG emissions from the entire energy sector to 60% below 2010 levels by 2030.
- Zero carbon development pathway by 2050

Tuvalu's Updated NDC, submitted in 2022, underscores its commitment to climate action and resilience. This NDC reflects Tuvalu's urgent need to address the climate crisis, with specific targets designed to reduce greenhouse gas (GHG) emissions, enhance climate resilience, and promote sustainable development.

#### 1. Targets and Description

Tuvalu's Updated NDC sets forth several ambitious targets for the period **2022-2030**: Target relative to the reference indicator, expressed numerically, for example in percentage or amount of reduction:

- Tuvalu commits to reduction of emissions of GHGs from the electricity generation (power) sector, by 100%, i.e., almost zero emissions by 2030.
- Increase energy efficiency in Funafuti by 30%.
- Tuvalu's indicative quantified economy-wide target for a reduction in total GHGs emissions from the entire energy sector 60% below 2010 levels by 2030.
- Zero carbon development pathway by 2050.

GHG emissions will be further reduced from the other key sectors, agriculture, and waste, conditional upon necessary technology and finance.

Tuvalu's Updated Nationally Determined Contribution (NDC) includes unconditional, conditional, and aspirational targets for emissions reduction. Unconditionally, Tuvalu commits to 100% renewable energy electricity generation by 2030 and a 30% increase in energy efficiency in Funafuti, building



upon existing renewable energy programs to reduce reliance on imported fossil fuels. Indicatively, Tuvalu aims for a 60% reduction in total GHG emissions from the entire energy sector below 2010 levels by 2030. Aspirationally, Tuvalu will pursue a zero-carbon development pathway by 2050. Further GHG emission reductions from the agriculture and waste sectors are targeted conditionally, dependent on international financial and technological support. While the NDC prioritizes mitigation, Tuvalu's adaptation actions, recognizing its extreme vulnerability to climate change impacts, are detailed in other national plans and communications, including initiatives focused on energy conservation, education, and efficiency.

## **2. Target Year(s) and Period(s)**

The targets outlined in Tuvalu's NDC have specific timelines for achievement, with the overall implementation period spanning from **2022 to 2030**. This timeframe is essential for mobilizing resources and implementing climate action projects.

## **3. Reference Points and Baselines**

The reference point for Tuvalu's GHG emissions is set at **2010**, which serves as the baseline year for measuring progress. This baseline is vital for tracking the effectiveness of implemented measures over the NDC period.

## **4. Time Frame for Implementation**

Implementation of Tuvalu's NDC commenced in **2022** and will continue until **2030**. The government has outlined an NDC implementation roadmap and investment plan that includes regular assessments and adjustments to ensure targets are met.

## **5. Scope and Coverage**

Tuvalu has set ambitious targets to achieve zero emissions in the electricity sector by 2030 and a zero-carbon development pathway by 2050. The sectors covered by Tuvalu's nationally determined contribution (NDC) include electricity, land transport, maritime transport, and AFOLU (agriculture, forestry, and other land use) - livestock and agricultural soil, and Waste. The target applies to all major greenhouse gases, including carbon dioxide (CO<sub>2</sub>), methane (CH<sub>4</sub>), nitrous oxide (N<sub>2</sub>O), carbon monoxide (CO), sulfur dioxide (SO<sub>2</sub>), non-volatile organic compounds (NMVOC), and nitrogen oxides (NO<sub>x</sub>), with all emissions expressed in CO<sub>2</sub> equivalent (CO<sub>2</sub>e).

Tuvalu has endeavoured to include all categories of anthropogenic emissions and removals in its NDC, consistent with paragraphs 31(c) and (d) of decision 1/CP.21 and will maintain this approach once a source or activity is included. A specific target for the industrial processes and product use (IPPU) sector was not developed due to its negligible impact on the NDC.

No mitigation co-benefits from adaptation actions or economic diversification plans are applicable at this time.

## **6. Intention for Cooperative Approaches**

Tuvalu could finance GHG emissions reduction projects by taking part in international carbon markets. Given the early stages of Article 6 negotiations, possible financing arrangements under Article 6 have not been included in the NDC Roadmap and Plan. However, this could be considered as a possible financing solution for Tuvalu in the future.

### 3.4 Information Necessary to Track Progress in Implementing and Achieving Tuvalu's NDC under Article 4

The NDC Roadmap and Plan sets out practical steps for the GoT to successfully implement the projects in the pipeline and is also intended to help generate interest from potential implementation partners, including donors and private investors, for implementing the pipeline of projects.

This NDC Roadmap and Plan identifies six GHG mitigation opportunities—two in the land transport sector, two in the maritime transport sector, and two in the electricity energy efficiency sector. Implementation of GHG mitigation projects in the pipeline will occur between 2022 and 2030. The two projects in each sector can be implemented at the same time.

The NDC Roadmap and Plan comprises two key strategic documents:

- An Implementation Roadmap, including information about Tuvalu's specific context, such as Tuvalu's GHG emissions profile, targets in Tuvalu's First NDC, as well as information about the priority sectors and institutional capacity. The roadmap also includes an implementation plan, which details a strategy for preparing and procuring projects and monitoring implementation.
- An Investment Plan, which includes a project pipeline of promising GHG mitigation projects across Tuvalu's priority sectors, outlining potential emissions reductions, costs, co-benefits, capacity requirements, and potential to attract funding. It also shows funding and financing requirements for projects, supporting measures that may need to be put in place to attract finance and environmental and social considerations.

The NDC Roadmap and Plan sets out practical steps for the GoT to successfully implement the projects in the pipeline and is also intended to help generate interest from potential implementation partners, including donors and private investors, for implementing the pipeline of projects. The details of the GHG mitigation pipeline projects for each sector, along with indicative investment needs to 2030, the annual GHG mitigation potential in 2030, and the cumulative GHG mitigation potential by 2030 are discussed in detail in the following sections of the report.

To effectively monitor and report progress on the implementation of the NDC, Tuvalu employs the Common Tabular Formats (CTFs) as per UNFCCC guidelines. These tables present indicators and progress assessments in a standardized manner.

#### 3.4.1 Selected Indicators for Tracking the Progress of Tuvalu's NDC

Tuvalu's progress toward achieving its NDC targets is tracked using three key indicators focused on renewable electricity, energy efficiency, and overall GHG emission reductions in the energy sector. These indicators provide a quantitative basis for monitoring Tuvalu's NDC implementation progress and align with UNFCCC MPGs requirements for IPCC. Progress is measured relative to the 2010 base year, with status updates for 2023 and targets set for 2030.

##### 3.4.1.1 Key Indicators and Targets:

Tuvalu's NDC base year (2010) serves as the reference for its emissions reduction targets and renewable energy transitions. By 2023, significant progress has been made, particularly in the energy sector, with the implementation of several renewable energy and energy efficiency projects, which are expected to drastically reduce reliance on fossil fuels by 2030. The following are the duly assessed and defined NDC progress tracking indicators, aligned with the NDC targets.



### **100% Renewable Electricity by 2030:**

- **Indicator:** Percentage of electricity generated from renewable sources
- **Unit:** Percentage (%)
- **Sector Considered:** Energy (Electricity generation).
- **Area/Region Considered:** Nationwide, including Funafuti and Outer Islands.
- **Base Year (2010):** Tuvalu relied almost entirely on diesel generators, with renewable energy contributing less than 1% to the total electricity supply.
- **2023 Status:**
  - Renewable energy penetration is 6% in Funafuti and 41% in the Outer Islands, primarily through solar PV and battery storage. In other words, Tuvalu's overall renewable energy penetration is 14%.
- **2030 Target:**
  - Achieve 100% renewable electricity nationwide by phasing out diesel generators.
  - Expand solar PV, battery storage, and potential wind/ocean energy solutions.
- **Data Collection & Tracking:**
  - Electricity generation data will be sourced from Tuvalu Electricity Corporation (TEC), and solar and battery storage capacity expansion will be monitored annually.
  - Renewable energy penetration will be tracked through installed capacity (MW), energy generation (MWh), and emissions reductions (tCO<sub>2</sub>eq).
- **Barriers & Challenges:**
  - Grid stability issues, requiring investment in advanced storage solutions.
  - Limited technical capacity to maintain renewable infrastructure.
  - High investment costs for further expansion.

### **30% Energy Efficiency Improvement in Funafuti:**

- **Indicator:** Per capita electricity consumption in Funafuti.
- **Unit:** Kilowatt-hours per capita per year (kWh/capita/year).
- **Sector Considered:** Energy (Demand-side management, efficiency improvements).
- **Area/Region Considered:** Funafuti, with potential future expansion to outer islands.
- **Base Year (2010):**
  - High energy intensity, with inefficient diesel-based electricity generation.
  - Lack of energy efficiency programs and widespread reliance on inefficient appliances.
  - In 2010, the per capita electricity consumption in Funafuti Island was 969 kWh per capita per year. The table below presents the 2010 electricity demand and supply for Tuvalu's nine atolls and islands, sourced from the Enetise Tutumau 2012-2020 Master Plan for Renewable Electricity and Energy Efficiency in Tuvalu.

| Atoll        | Population      | Land area (km <sup>2</sup> ) | Population density (persons/km <sup>2</sup> ) | Peak Generation (kW) | Annual Generation (kWh) | Electricity use per person (kWh) |
|--------------|-----------------|------------------------------|-----------------------------------------------|----------------------|-------------------------|----------------------------------|
| Funafuti     | 5,156           | 2.79                         | 1,848                                         | 1000                 | 4,997,501               | 969                              |
| Nanumea      | 779             | 3.87                         | 201                                           | 37                   | 110,280                 | 142                              |
| Nanumaga     | 687             | 2.78                         | 247                                           | 37                   | 115,000                 | 167                              |
| Niutao       | 773             | 2.53                         | 305                                           | 39                   | 110,000                 | 142                              |
| Nui          | 618             | 2.83                         | 218                                           | 31                   | 120,000                 | 194                              |
| Vaitupu      | 1863            | 5.60                         | 332                                           | 95                   | 293,876                 | 158                              |
| Nukufetau    | 688             | 2.99                         | 230                                           | 38                   | 120,000                 | 174                              |
| Nukulaelae   | 457             | 1.28                         | 357                                           | 20                   | 70,000                  | 153                              |
| Niulakita    | 41              | 0.42                         | 98                                            |                      |                         |                                  |
| <b>TOTAL</b> | <b>11,062**</b> | <b>25</b>                    | <b>442</b>                                    | <b>1,297</b>         | <b>5,936,657</b>        |                                  |

**\*\* 2007 population**

**Source: Tuvalu Electricity Corporation**

- **2023 Status:**
  - Early-stage efficiency improvements, including retrofits for public buildings and introduction of efficient cooling systems.
  - Awareness campaigns on demand-side energy management is being initiated.
  - Public-sector pilot projects for efficient appliances are being launched.
- **2030 Target:**
  - Achieve a 30% improvement in energy efficiency by reducing per capita electricity consumption.
  - Implement identified energy efficiency measures, demand-side management strategies, energy audits, and appliance efficiency standards.
  - Establish financial incentives and regulatory measures for energy-efficient buildings.
- **Data Collection & Tracking:**
  - TEC billing records and national energy statistics will provide tracking of annual electricity consumption per capita.
  - Energy audits and surveys will assess efficiency gains and areas for improvement.
- **Barriers & Challenges:**
  - Lack of regulatory incentives for energy efficiency investments.
  - Limited public awareness of energy-saving measures.
  - Financial constraints affecting large-scale implementation.

#### **60% Reduction in GHG Emissions from the Energy Sector by 2030:**

- **Indicator:** Reduction in total GHG emissions from the entire energy sector.
- **Unit:** Percentage (%) reduction from 2010 levels.
- **Sector Considered:** Energy (Power generation, transport, and other sectors).
- **Area/Region Considered:** Nationwide, including Funafuti and Outer Islands.
- **Base Year (2010):**
  - The energy sector accounted for over 70% of Tuvalu's total GHG emissions.
  - Fossil fuel dependence was high, with emissions primarily from diesel power plants and fuel-based transport.
- **2023 Status:**
  - Initial mitigation strategies implemented, including renewable energy expansion, transport electrification initiatives, and fuel efficiency programs.
  - Small-scale electric vehicle adoption pilot projects are being initiated.
  - Public-sector programs encouraging the use of energy-efficient appliances is being initiated.
- **2030 Target:**
  - Reduce GHG emissions from the energy sector by 60% below 2010 levels.
  - Transition the transport sector towards low-emission and electric mobility solutions.
  - Enhance fuel efficiency in maritime and aviation sectors.
- **Data Collection & Tracking:**
  - Emissions data estimated using IPCC 2006 Guidelines and national energy balance statistics.
  - Sector-specific emissions breakdowns (electricity, transport, and other sectors) will be tracked annually.
  - Progress will be measured using energy consumption reports, emission inventories, and monitoring frameworks.
- **Barriers & Challenges:**
  - Heavy reliance on imported fossil fuels, making transition challenging.
  - High capital costs for electric transport infrastructure.
  - Technical capacity constraints in maintaining advanced energy systems.



The table below compares the progress from 2010 to 2023 and outlines the 2030 targets across key sectors as per the defined key indicators:

| Sector | Category                                    | Indicator                                                                                  | Base Year (2010)                                                                         | Status (2023)                                                                                                                             | 2030 Target                                                             |
|--------|---------------------------------------------|--------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------|
| Energy | Electricity                                 | Percentage of electricity generated from renewable sources. (%)                            | 1% Renewable Energy (Diesel-dependent)                                                   | 6%% Renewable Energy in Funafuti, 41% in Outer Islands                                                                                    | 100% Renewable Energy Nationwide                                        |
| Energy | Energy Efficiency in Funafuti               | Per capita electricity consumption in Funafuti (kWh/capita/year)                           | 969 kWh/capita/year : Baseline electricity consumption.                                  | 1006 kWh/capita/year : Early-stage improvements and energy-efficient retrofits are being initiated.                                       | 678 kWh/capita/year : 30% improvement in energy efficiency              |
| Energy | GHG Emission Reduction in the Energy Sector | Reduction in total GHG emissions from the entire energy sector (ktCO <sub>2</sub> eq or %) | 13.39 KtCO <sub>2</sub> eq emissions from the energy sector: High fossil fuel dependency | 15.81 KtCO <sub>2</sub> eq: Ongoing mitigation measures including RE power, EV pilots, and improved efficiency on the energy demand side. | 5.36 KtCO <sub>2</sub> eq: 60% reduction in energy sector GHG emissions |

### 3.4.2 Assessment of Indicators:

**100% Renewable Electricity by 2030:** Tuvalu has made substantial progress in transitioning towards a renewable-based electricity system, particularly in the outer islands where 80-90% of electricity generation now comes from solar PV and battery storage. However, in Funafuti, renewable energy penetration is only at 6%, with continued reliance on diesel generators. Achieving 100% renewable electricity nationwide by 2030 will require accelerated investment in solar PV expansion, battery storage solutions, and potential offshore wind/ocean energy integration. Tuvalu has identified renewable energy areas, including grid modernization, enhanced energy storage systems, and feasibility assessments for offshore renewable projects. Additional financing, technical expertise, and policy support will be critical to completing the transition. While progress has been encouraging, further institutional coordination, capacity-building efforts, and stronger regulatory frameworks are necessary to ensure Tuvalu reaches its renewable energy target within the given timeframe.

**30% Energy Efficiency Improvement in Funafuti:** Tuvalu's energy efficiency efforts in Funafuti have begun, with early-stage measures including retrofitting public buildings, improving cooling systems, and promoting efficient appliances. However, despite these initiatives, per capita electricity consumption has increased from 969 kWh in 2010 to 1006 kWh in 2023, indicating that energy demand

continues to rise. Achieving the 30% reduction target by 2030 (bringing per capita consumption down to 678 kWh) will require a more comprehensive and aggressive implementation of demand-side management strategies, expansion of efficiency standards, and the establishment of financial incentives for energy-efficient buildings, retrofits and appliances. The lack of regulatory incentives, limited public awareness, and financial constraints remain key barriers. Strengthening policy measures for energy efficiency, expanding programs to commercial and residential sectors, and enhancing enforcement of efficiency standards will be critical to reversing the current consumption trend and achieving the NDC target.

**60% Reduction in GHG Emissions from the Energy Sector:** Tuvalu's energy sector accounted for 13.39 KtCO<sub>2</sub>eq in 2010, with emissions increasing to 15.81 KtCO<sub>2</sub>eq by 2023, despite ongoing mitigation measures such as renewable energy expansion, electric vehicle (EV) pilot projects, and improved energy efficiency efforts. Achieving the target of a 60% reduction in emissions (5.36 KtCO<sub>2</sub>eq by 2030) requires a more aggressive transition towards low-carbon energy solutions. While renewable energy deployment is progressing, challenges remain in reducing fossil fuel use in transport and maritime sectors, which continue to be heavily diesel-dependent. The NDC Implementation Roadmap prioritizes electrification of transport, expansion of EV infrastructure, and improved fuel efficiency in maritime transport, but implementation must be scaled up rapidly. Financial and technical barriers continue to hinder progress, and additional policy support, funding mechanisms, and institutional coordination will be necessary to meet the ambitious 2030 target.

In summary, Tuvalu has made notable advancements in all three key indicators, with significant progress in renewable electricity deployment and early-stage energy efficiency measures. However, the rate of improvement in energy efficiency and emissions reductions must accelerate to stay on track for the 2030 targets. The heavy reliance on diesel in transport and maritime sectors remains a significant challenge, requiring urgent intervention through policy enforcement, financial incentives, and large-scale infrastructure improvements. Strengthening institutional capacity, securing international climate finance, and expanding public-private partnerships will be crucial to maintaining momentum and ensuring the successful implementation of Tuvalu's NDC commitments under the Paris Agreement.

### 3.4.3 Accounting Approach and Reporting Consistency

#### 3.4.3.1 Overview of Accounting Approach

Tuvalu's first and second Nationally Determined Contributions (NDCs), submitted in 2015 and 2022, reflect the country's strong commitment to climate change mitigation and sustainable development, in line with Article 4 of the Paris Agreement. The established accounting approach for Tuvalu's NDCs ensures emissions reductions are quantitatively measured, transparently reported, and consistently tracked over time. This approach adheres to Article 4, paragraphs 13-14 of the Paris Agreement by employing the 2006 IPCC Guidelines and its 2019 Refinement for systematic GHG emissions quantification across key sectors, emphasizing transparency, accuracy, completeness, and consistency.

It includes meticulous documentation of methodologies, data sources, and assumptions to prevent double counting, thereby ensuring the integrity of reported figures. By covering all significant GHG sources and applying standardized methodologies, Tuvalu enhances comparability with other countries while fulfilling the transparency requirements of Decision 4/CMA.1, reinforcing its commitment to measurable and verifiable climate action.

#### 1. Methodological Framework:

- Tuvalu adopts the 2006 IPCC Guidelines for National GHG Inventories and the 2019 Refinement to the 2006 IPCC Guidelines for National GHG Inventories to prepare its national greenhouse gas (GHG) inventories. These guidelines provide a systematic, standardized method for estimating emissions across various sectors, ensuring consistency



and reliability in emissions reporting. Utilizing these internationally recognized methodologies enables Tuvalu to maintain comparability with global emissions data and best practices.

## 2. Key Principles of Accounting:

- The accounting approach is governed by several key principles that align with the Paris Agreement's objectives, particularly emphasizing the need for robust and transparent accounting systems:
  - **Transparency:** All methodologies, data sources, and assumptions are meticulously documented to facilitate understanding and independent verification of the reported data. This transparency fosters trust among stakeholders and the international community.
  - **Accuracy:** High-quality data collection methodologies are employed to minimize uncertainties and enhance the reliability of the reported emissions figures. Regular calibration of measurement tools and techniques ensures data precision.
  - **Completeness:** The accounting framework covers all relevant sectors and sources of emissions, ensuring that no significant omissions occur. Comprehensive data collection efforts encompass both direct and indirect emissions across all relevant activities.
  - **Comparability:** Consistent application of methodologies over time is paramount to allow for meaningful comparisons and assessments of progress. Tuvalu is committed to employing standardized indicators that align with international frameworks.
  - **Consistency:** The accounting methods utilized are designed to be consistent with previous reports and will be maintained in future reporting cycles to facilitate longitudinal studies and assessments.

### 3.4.3.2 Sector-Specific Accounting Approaches

Tuvalu's NDC targets several key sectors, each incorporating tailored methodologies for tracking progress and reporting emissions reductions. The following table provides a detailed overview of the sectors, methodologies applied, key assumptions made, and data sources utilized:

| Sector | Category    | Indicator                                                      | Definitions                                                                                                                                                                               | Methodology                                                                                                                              | Key Assumptions                                                                                                                                                              | Data Source                                                                                       |
|--------|-------------|----------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------|
| Energy | Electricity | Percentage of electricity generated from renewable sources (%) | Proportion of total electricity generated using renewable sources (e.g., solar PV, battery storage, potential wind/ocean energy) from the total National electricity generation including | Application of IPCC 2006 Guidelines (with regional/national/sector adjustments as available) and project-specific monitoring techniques. | The transition to renewables is predicated on scaling up solar PV and battery storage capacity, grid modernization, Wind/and the availability of international financing and | Tuvalu Electricity Corporation (TEC) reports.<br>Government energy reports.<br>IPCC publications. |

|        |                                               |                                                                                                                       |                                                                                                                                                                            |                                                                                                                                              |                                                                                                                                                                                                                       |                                                                                                                                                       |
|--------|-----------------------------------------------|-----------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------|
|        |                                               |                                                                                                                       | fossil-fuel based.                                                                                                                                                         |                                                                                                                                              | technical support.                                                                                                                                                                                                    |                                                                                                                                                       |
| Energy | Energy Efficiency in Funafuti                 | Per capita electricity consumption in Funafuti (kWh/capita/year)                                                      | Measurement of average annual electricity consumption per person in Funafuti, reflecting improvements in efficiency through demand-side management and appliance upgrades. | Energy consumption audits, efficiency standards, and baseline comparisons using national energy statistics.                                  | Energy efficiency improvement is assumed achievable through comprehensive retrofits, efficient appliance adoption, enhanced energy audits, and supportive financial incentives.                                       | TEC billing records, National Energy Statistics, Energy audits, and Local government reports.                                                         |
| Energy | GHG Emission Reduction from the Energy Sector | Reduction in total GHG emissions from the entire energy sector (ktCO <sub>2</sub> eq or % reduction from 2010 levels) | Overall decrease in emissions from power generation, transport, and other energy-related activities relative to the 2010 baseline.                                         | Estimation using IPCC 2006 Guidelines combined with national energy balance statistics and IPCC default or sector-specific emission factors. | Reduction is achievable by simultaneously implementing renewable energy projects, energy efficiency measures, and low-carbon transport initiatives as outlined in the NDC Implementation Roadmap and Investment Plan. | National GHG Inventory, TEC reports, Ministry of Transport, Energy, Communication and Innovation (MTECI) reports, National Energy Balance statistics. |

#### 3.4.4 Consistency with Decision 4/CMA.1

Tuvalu's Nationally Determined Contribution (NDC) accounting approach is consistent with the requirements of Decision 4/CMA.1, which establishes the guidelines for the implementation of the Paris Agreement's transparency framework. Decision 4/CMA.1 outlines the modalities, procedures, and



guidelines (MPGs) for ensuring the accuracy, transparency, consistency, comparability, and completeness of the information countries provide on their progress toward climate targets.

#### 3.4.4.1 Key Areas of Consistency with Decision 4/CMA.1:

**1. Accuracy and Transparency:** Tuvalu's accounting approach emphasizes transparency and accuracy in line with Decision 4/CMA.1, which requires parties to provide a clear, consistent, and accurate report of their greenhouse gas (GHG) emissions and progress towards their NDC targets. Tuvalu uses methodologies aligned with the Intergovernmental Panel on Climate Change (IPCC) guidelines to ensure precision in emissions measurement and reduction tracking. All methodologies, assumptions, data sources, and calculations are thoroughly documented, providing transparency for stakeholders, including national authorities, international bodies, and local communities. This ensures that all involved parties can trace how emissions estimates are made and how progress is measured.

**2. Consistency and Comparability:** As per Decision 4/CMA.1, consistency across time and comparability with other countries' NDC reporting is essential. Tuvalu ensures that the same methodologies are applied across different reporting periods, and any changes in methodologies are clearly documented and justified. This allows for comparability between the current and future NDC implementation cycles. Moreover, Tuvalu's consistent use of the IPCC's Guidelines for National GHG Inventories ensures that its reporting aligns with global standards, facilitating international comparison and enhancing the credibility of its data.

**3. Avoidance of Double Counting:** Tuvalu adheres to the principle of avoiding double counting as required under Article 4, paragraphs 13 and 14 of the Paris Agreement and Decision 4/CMA.1. The accounting framework ensures that any GHG emission reductions are counted only once, and mechanisms are in place to prevent double issuance or double claiming of reductions. For instance, robust data management systems are implemented to ensure that emission reductions in sectors such as energy and transportation are tracked and reported accurately without being claimed by multiple entities or projects.

**4. Completeness:** In compliance with Decision 4/CMA.1, Tuvalu's accounting approach ensures the inclusion of all significant sources of GHG emissions within its economy. This includes emissions from key sectors such as energy, transportation, waste management, and agriculture. By covering all major sectors, Tuvalu ensures that its NDC reporting framework is comprehensive and leaves no major emission sources unaccounted for. Furthermore, the reporting framework includes detailed justifications and explanations for any data gaps or omissions, ensuring a full and complete disclosure of emissions information.

**5. Adjustments and Justifications:** In accordance with the flexibility mechanisms embedded in Decision 4/CMA.1 for developing countries, Tuvalu provides clear documentation and justification for any adjustments to baseline emissions, data, or methodologies. Tuvalu has chosen 2010 as its base year for its first BTR, ensuring consistency with its already submitted updated NDC in 2022 to the UNFCCC. These adjustments are necessary to reflect base year/reference year/reference period, national circumstances, or new data availability. This flexibility helps Tuvalu to better represent its national context while maintaining the integrity of its NDC accounting.

**6. Sector-Specific Accounting:** Decision 4/CMA.1 calls for the use of appropriate methodologies for different sectors, ensuring that countries report GHG emissions reductions for each sector consistently and reliably. Tuvalu has used IPCC 2006 guidelines and 2019 refinement for its accounting methods for specific sectors, such as energy, transportation, waste management, and agriculture, ensuring that each sector's contributions to GHG reductions are measurable and verifiable. By doing so, Tuvalu meets the decision's requirements for ensuring sectoral transparency in its reporting.



**7. Tracking Mitigation Co-benefits of Adaptation:** Tuvalu considers that the focus of the Updated NDC should primarily be mitigation. In terms of adaptation, Tuvalu's adaptation actions are comprehensively articulated in the Environmental and Social Management Plan 2021, the Second National Communication 2015, National Strategic Action Plan for Climate Change and Disaster Risk Management 2012-2016, the National Climate Change Policy 2021-2030, and the Recovery and Vulnerability Reduction Plan. Hence, no adaptation actions are included in this Updated NDC 2022.

While the Updated NDC focuses on mitigation, Tuvalu's efforts to track progress in adaptation and economic diversification remain crucial for long-term resilience building, especially regarding the social and economic consequences of response measures. Below is a detailed response to Paragraph 79 of the MPGs, which addresses the sectors and activities associated with these response measures, their consequences, and actions taken to address challenges:

**(a) Sectors and Activities Associated with the Response Measures:**

The key sectors and activities associated with the response measures in Tuvalu include:

**1. Energy Sector: Renewable Energy and Energy Efficiency**

- **Activities:** Transition to 100% renewable energy by 2030 through solar photovoltaic (PV) installations, battery storage systems, and energy-efficient measures.
- **Mitigation:** The transition to renewable energy reduces reliance on imported diesel for electricity generation, lowering greenhouse gas emissions while promoting energy security and job creation in green sectors.

**2. Agriculture and Fisheries Sector**

- **Activities:** Promotion of climate-resilient agricultural practices, including agroforestry, organic farming, the use of drought-resistant crops, and livestock management. Sustainable fisheries management is also a priority.
- **Mitigation Co-benefit:** Reduced emissions from agricultural practices through sustainable land management techniques that increase carbon sequestration, and Livestock management that reduces the emissions. Enhancing food security reduces the need for food imports, fostering local economic diversification.

**3. Water Management and Coastal Protection**

- **Activities:** Implementation of water conservation measures and enhanced rainwater harvesting systems to cope with freshwater scarcity. Coastal protection measures include sea walls and mangrove restoration. In addition, Tuvalu could initiate ocean-based carbon sequestration activities, especially for nearshore ecosystems such as blue carbon.
- **Mitigation Co-benefit:** Tuvalu's water management and coastal protection efforts yield notable mitigation co-benefits by reducing energy-intensive desalination needs through enhanced rainwater harvesting and conservation. Additionally, coastal measures like mangrove restoration and blue carbon initiatives sequester carbon, protecting shorelines and contributing to long-term carbon storage while enhancing ecosystem resilience.

**4. Waste Management**

- **Activities:** Investments in improving implementation of modern waste management practices, landfill rehabilitation & improvisation, including wastes eliminated from the raising site and converted to energy or compost, and improved recycling.
- **Mitigation Co-benefit:** Waste management practices help mitigate methane emissions while creating employment opportunities in the recycling and waste treatment sectors.

**(b) Social and Economic Consequences of the Response Measures:**

The social and economic consequences of the measures taken by Tuvalu to transition toward a low-carbon, climate-resilient economy are as follows:



1. **Job Creation:** The shift to renewable energy, sustainable agricultural practices, and waste management has led to the creation of new jobs, particularly in green sectors such as solar energy installation, sustainable farming, sustainable agriculture, livestock management, waste management, and fisheries management.
2. **Energy Security:** The reduction in dependence on imported fossil fuels has increased Tuvalu's energy security, lowering the vulnerability to fluctuating global energy prices. This has a positive impact on household energy costs and the national budget.
3. **Food Security:** Sustainable agriculture and fisheries management have improved food security by promoting self-reliance, reducing the need for food imports, and strengthening local economies. This contributes to long-term social stability.
4. **Health and Well-being:** Improved water management and waste management systems help reduce pollution and health risks associated with contaminated water and improper waste disposal. This contributes to better public health outcomes.

#### **(c) Challenges and Barriers to Addressing the Consequences:**

Despite the progress, Tuvalu faces several challenges and barriers in addressing the social and economic consequences of its climate response measures:

1. **Financial Constraints:** Limited financial resources make it challenging to implement large-scale renewable energy projects, sustainable agriculture practices, waste management, transportation initiatives, and other climate-resilient infrastructure. This barrier also affects the ability to scale up adaptation measures.
2. **Technical Capacity:** Tuvalu lacks sufficient technical capacity to fully implement and maintain renewable energy, water management and other projects. The need for skilled technicians and capacity-building programs is critical for ensuring long-term sustainability.
3. **Geographical Isolation:** Tuvalu's remoteness and small size make it difficult to access markets, technology, and funding. This isolation hinders economic diversification efforts and makes it harder to attract investment in green technologies.
4. **Climate Vulnerabilities:** The nation remains highly vulnerable to the impacts of climate change, such as sea-level rise, extreme weather events, and saltwater intrusion, which threaten the success of its adaptation and diversification strategies.

#### **(d) Actions to Address the Consequences:**

In response to these challenges, Tuvalu is taking the following actions:

1. **International Financial Support:** Tuvalu is actively seeking international financial support through mechanisms such as the Green Climate Fund (GCF) and the Adaptation Fund to finance renewable energy projects, other sectoral projects, and climate-resilient infrastructure. The Tuvalu NDC Implementation Roadmap and Investment Plan identifies key areas for investment and prioritizes access to global climate finance.
2. **Capacity Building and Training:** Efforts are being made to strengthen local capacity through partnerships with international organizations and development partners. Training programs for technicians in renewable energy, water management, waste management, and sustainable agriculture are being implemented to ensure the long-term success of these projects.

3. **Regional Cooperation:** Tuvalu participates in regional climate change initiatives such as the Pacific Islands Climate Action Network (PICAN) to share knowledge, resources, and best practices with other small island states. This cooperation helps overcome the challenges of geographical isolation.
4. **Policy Integration:** Tuvalu's National Climate Change Policy (2021-2030) and the National Strategy for Sustainable Development, National Strategic Action Plan, Climate Change Resilience Act, Environment and Social Management, Master Plan for Renewable Electricity, Integrated Waste Policy and Action Plan 2017-2026 and Disaster Risk Management integrate mitigation, adaptation, and economic diversification strategies, ensuring a cohesive approach to addressing the social and economic impacts of climate change response measures.
5. **Innovative Solutions:** Tuvalu is exploring innovative solutions such as blue carbon projects (mangrove restoration) and nature-based solutions to enhance both mitigation and adaptation outcomes. These projects also provide co-benefits such as coastal protection and biodiversity conservation.

Through these efforts, Tuvalu is striving to align its response measures with the Paris Agreement, ensuring that its adaptation actions and economic diversification strategies provide significant mitigation co-benefits while addressing the social and economic consequences of climate change. The comprehensive tracking of progress in these areas is a critical part of Tuvalu's commitment to meeting its climate goals under the Paris Agreement.

Below is a comprehensive, specific, and updated CTF table that provides the information necessary to track progress on the implementation and achievement of domestic policies and measures implemented to address the social and economic consequences of response measures, as well as Tuvalu's adaptation actions and economic diversification plans that offer mitigation co-benefits.

**This table presents updated and specific information to provide a clearer view of progress tracking on each measure, aligning with Tuvalu's domestic policies and Article 4, paragraph 7, of the Paris Agreement.**

| Policy/Measure                                                     | Sectors and Activities Associated with the Response Measures                                                                            | Social and Economic Consequences of the Response Measures                                                                 | Challenges and Barriers to Addressing the Consequences                                                                                    | Actions to Address the Consequences                                                                                                                                            |
|--------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Te Kete: National Strategy for Sustainable Development (2021-2030) | Multi-sectoral: focuses on sustainable economic development, infrastructure resilience, health, education, and environmental protection | Enhances livelihood resilience, promotes sustainable job creation, fosters education, and improves public health outcomes | Limited national budget and dependency on international financing; the need for enhanced technical capacity and local workforce readiness | Partnerships with international donors and regional organizations; training programs for workforce upskilling, especially in green jobs in agriculture, fisheries, and tourism |
| Infrastructure Strategy and Investment Plan 2016–2025 (TISIP)      | Infrastructure: development of resilient transport, public buildings, and utilities                                                     | Supports economic diversification by improving infrastructure, thereby enhancing resilience to climate impacts            | High costs of climate-resilient infrastructure; limited local resources and skilled workforce in engineering and maintenance              | Securing financing from the Green Climate Fund (GCF), World Bank, and Asian Development Bank (ADB); capacity-building initiatives for the construction and                     |



|                                                                           |                                                                                                                             |                                                                                                                                                 |                                                                                                                                   |                                                                                                                                                                                                                                     |
|---------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                                           |                                                                                                                             |                                                                                                                                                 |                                                                                                                                   | maintenance of resilient infrastructure                                                                                                                                                                                             |
| Tuvalu's NDC Implementation and Investment Plan (2022)                    | Energy-renewable energy, energy efficiency, transport, and other sectors; agriculture; waste; and resilient infrastructure. | Provides diversified economic opportunities; facilitates climate mitigation and adaptation in all sectors; reduces reliance on imported energy. | High up-front costs of renewable energy and adaptation infrastructure; limited technical capacity for implementing new techniques | Access to global climate finance and capacity-building programs; community engagement for sustainable agriculture, waste management, and energy efficiency practices; subsidies for energy efficiency and renewable energy systems. |
| Te Vaka Fenua o Tuvalu: National Climate Change Policy 2021-2030          | Cross-sectoral: climate-resilient agriculture, fisheries, and water management                                              | Builds community resilience to climate impacts; supports economic diversification through adaptation in primary sectors                         | Financial limitations for climate-resilient technology; reluctance to shift from traditional practices                            | Engagement programs for stakeholder buy-in; mobilizing funds for climate resilience; promoting local champions for sustainable practices                                                                                            |
| Recovery and Vulnerability Reduction Plan (2015)                          | Disaster resilience, infrastructure, and public health                                                                      | Reduces economic losses from extreme weather; strengthens social resilience and public health infrastructure                                    | Limited disaster response resources; need for enhanced logistical and technical skills in emergency response                      | Assistance from regional disaster management partners; regular emergency drills and capacity building in disaster response management                                                                                               |
| Climate Change Resilience Act 2019                                        | Governance, land use, infrastructure resilience                                                                             | Legal backing for adaptation actions and land use planning; protects key economic sectors and public infrastructure                             | Lack of enforcement capacity; challenges in public acceptance of new regulations                                                  | Public education campaigns; training local authorities for legal enforcement; collaborations with local councils for community compliance                                                                                           |
| Renewable Electricity and Energy Efficiency Master Plan (2012)            | Renewable energy, solar PV installations, and energy efficiency                                                             | Reduces fuel import dependency, lowers national energy costs, and creates clean energy jobs                                                     | High initial investment; technical maintenance challenges due to lack of skilled workers                                          | Securing grants from international donors; capacity-building for technical maintenance and operations of renewable energy systems                                                                                                   |
| Tuvalu Sustainable and Integrated Water and Sanitation Policy (2012-2021) | Water resource management, sanitation infrastructure                                                                        | Improves access to clean water, reduces health risks, and supports agricultural resilience, enhancing productivity                              | Cost barriers in expanding water infrastructure; technical skills gaps in sustainable water management                            | Collaboration with regional agencies for technical assistance; community training in water conservation techniques                                                                                                                  |
| Tuvalu's Integrated Waste Policy and Action Plan (2017-2026)              | Waste management, recycling, environmental protection                                                                       | Reduces pollution, preserves local ecosystems, and creates job opportunities in recycling and waste management                                  | Lack of infrastructure for waste processing; public resistance to adopting new waste management practices                         | Infrastructure development supported by international aid; public awareness campaigns on waste reduction and recycling benefits                                                                                                     |

|                                                                                            |                                                             |                                                                                                             |                                                                                                       |                                                                                                                                             |
|--------------------------------------------------------------------------------------------|-------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------|
| E-bike initiative                                                                          | Transport and emissions reduction                           | Reduces fuel imports, lowers air pollution, and cuts transport-related emissions, benefitting public health | High initial costs for e-bike procurement and maintenance; limited charging infrastructure            | Subsidies for e-bikes and charging stations; awareness campaigns on health and cost benefits of e-bikes                                     |
| Electrification of Tuvalu's light vehicle fleet                                            | Transport, energy transition                                | Lowers transport emissions, reduces fuel imports, and supports public health with reduced air pollution     | Financial barriers for vehicle replacement; limited charging infrastructure                           | Access to international funding; subsidies for electric vehicles; developing a charging network across key locations                        |
| Outboard motor transition from 2-stroke petrol outboards to 4-stroke                       | Marine transport and fisheries                              | Reduces marine pollution, preserves fish stocks, and improves economic stability for fishing communities    | High costs for engine replacement; limited access to newer motor models                               | Providing subsidies and incentives for 4-stroke engine purchases; partnering with suppliers for improved access                             |
| FASNETT (Facilitation of the Achievement of Sustainable National Energy Targets of Tuvalu) | Renewable energy, energy efficiency                         | Advances clean energy, reduces fuel dependency, creates green jobs, and strengthens energy security         | Funding constraints; lack of local expertise in renewable energy installation                         | Training programs for installation and maintenance; mobilizing climate finance from GCF and other international sources                     |
| Low Carbon Fund and Energy Efficiency Revolving Fund                                       | Energy efficiency, housing retrofits, appliance replacement | Promotes energy savings, reduces household energy costs, and cuts carbon emissions                          | Limited access to affordable energy-efficient appliances; financial constraints for initial retrofits | Establishing a revolving fund to make energy-efficient appliances more accessible; partnerships with local suppliers for discounted pricing |
| 770 kW solar PV plant (with battery storage) in Funafuti                                   | Renewable energy, power generation                          | Enhances energy security, cuts fuel import costs, and lowers greenhouse gas emissions                       | High installation and maintenance costs; limited expertise in advanced battery systems                | Financial support from New Zealand's Ministry of Foreign Affairs and Trade; capacity-building for system operation and maintenance          |
| 2 MW of solar PV, 2 MWh of battery storage on Funafuti                                     | Renewable energy, sustainable power supply                  | Reduces reliance on diesel generators, stabilizes energy costs, and contributes to emissions reduction      | Technical skill gaps in maintenance; need for expanded storage to fully meet peak demands             | Training programs for local technicians; Financial support from the World Bank and the Asian Development Bank (ADB).                        |

Tuvalu's policies and measures for adaptation and economic diversification reflect a proactive approach to addressing climate change challenges while promoting sustainable development. By focusing on sectors like sustainable infrastructure and renewable energy, Tuvalu not only tackles immediate adaptation needs but also harnesses mitigation co-benefits consistent with Article 4, paragraph 7, of the Paris Agreement.



The identification of social and economic consequences, along with the challenges in implementation, underscores the need for adaptive management and community engagement. Tuvalu's commitment to addressing these barriers through targeted actions, such as financial and technological support, enhancing local capacity, and fostering partnerships, demonstrates a clear pathway toward sustainable growth.

These policies and measures position Tuvalu to effectively manage climate risks while maintaining transparency and accountability in its reporting. By continuously refining its strategies and embracing innovative solutions, Tuvalu sets an example for other nations facing similar climate challenges, illustrating the potential for sustainable practices to drive resilience and economic prosperity.

**8. Regular Reporting and Updates:** Tuvalu is committed to regular reporting and updates on its progress toward its NDC goals, aligning with Decision 4/CMA.1. This commitment entails maintaining up-to-date greenhouse gas inventories and progress reports, which include periodic updates on GHG emissions, reductions achieved, and the implementation of sector-specific mitigation strategies. Tuvalu ensures that the methodologies and data sources used are consistent with prior UNFCCC reports, allowing for comparability with earlier assessments. Adopting a continuous improvement approach, Tuvalu will refine its accounting methodologies based on lessons learned and advancements in reporting standards. Additionally, the country commits to periodic reviews of its emissions inventory and NDC targets, making necessary adjustments based on emerging data and technological advancements.

**9. Building Trust through Stakeholder Engagement:** Lastly, Tuvalu's consistent stakeholder engagement strategy aligns with Decision 4/CMA.1's provisions on transparency. By involving local communities, private sector stakeholders, and international partners in the reporting process, Tuvalu ensures that its NDC implementation is inclusive and transparent. This approach fosters trust and accountability, ensuring that all stakeholders have access to information on the country's progress and challenges in achieving its climate targets.

By aligning with Decision 4/CMA.1, Tuvalu's accounting approach meets international standards for climate transparency, reinforcing its commitment to contributing to global climate efforts. This alignment not only strengthens Tuvalu's climate reporting capacity but also enhances its ability to attract international support and funding for its climate actions.

**10. Structured Summary for Tracking Progress:** The following structured summary consolidates Tuvalu's progress from 2010 to 2023, with targets for 2030:

| Sector               | Key Indicator                                                  | Base Year (2010)                                                                                                           | 2030 Target                                                                                                                                                                 | Status (2023)                                                                                                                                                    | Assessment                                                                                                                                                                                                                 |
|----------------------|----------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Energy – Electricity | Percentage of electricity generated from renewable sources (%) | 1% renewable energy – the system was almost entirely diesel-dependent with fossil fuels dominating electricity generation. | 100% renewable electricity nationwide – complete phase-out of diesel generators by expanding solar PV, battery storage, and exploring offshore wind/ocean energy solutions. | Outer islands has achieved 41% renewable penetration; Funafuti has decreased to 6% renewable energy, supported by ongoing solar PV and battery storage projects. | Significant progress in the outer islands demonstrates the feasibility of a renewable transition. However, Funafuti still relies heavily on diesel, indicating that further investments in grid modernization and offshore |

|                                        |                                                                                                                |                                                                                                                                                                   |                                                                                                                                                                                                                                   |                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                    |
|----------------------------------------|----------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                        |                                                                                                                |                                                                                                                                                                   |                                                                                                                                                                                                                                   |                                                                                                                                                                                                        | renewable technologies are essential to meet the 2030 target.                                                                                                                                                                                                                                                      |
| Energy – Energy Efficiency in Funafuti | Per Capita Electricity Consumption (kWh/capita/year)                                                           | 969 kWh/capita/year – baseline consumption with minimal energy efficiency measures in place and high energy intensity due to diesel-based electricity generation. | 678 kWh/capita/year – representing a 30% improvement in energy efficiency achieved through comprehensive demand-side management, appliance upgrades, and building retrofits.                                                      | 1006 kWh/capita/year – early-stage measures such as retrofitting public buildings, efficient cooling systems, and pilot efficiency projects have been initiated, but overall consumption remains high. | Initial improvements have been made, primarily in the public sector, yet the rate of progress is slower than needed. Scaling up efforts to include commercial and residential sectors, along with stronger regulatory incentives and increased public awareness, is crucial to achieve the 30% improvement target. |
| Energy – GHG Emission Reduction        | Reduction in Total GHG Emissions from the Energy Sector (ktCO <sub>2</sub> eq or % Reduction from 2010 Levels) | 13.39 KtCO <sub>2</sub> eq – high emissions driven by fossil fuel dependency in power generation and transport.                                                   | 5.36 KtCO <sub>2</sub> eq – representing a 60% reduction in energy sector emissions relative to 2010, achieved through accelerated renewable energy deployment, enhanced energy efficiency, and low-carbon transport initiatives. | 15.81 KtCO <sub>2</sub> eq – current emissions are higher than the baseline despite ongoing mitigation measures such as renewable energy expansion, EV pilot projects, and efficiency improvements.    | Mitigation efforts have begun, but overall progress is moderate. To achieve the 60% reduction target, Tuvalu must intensify low-carbon interventions—particularly in the transport and maritime sectors—and secure additional funding and technical capacity to accelerate the transition.                         |

This table encapsulates the essential details of Tuvalu's NDC progress and implementation tracking, providing a clear overview of the indicators and their assessments in line with UNFCCC reporting requirements.

Tuvalu has made significant progress in renewable energy adoption, particularly in the electricity sector, with solar PV and battery storage driving reductions in fossil fuel dependency. By 2023, Tuvalu is well-positioned to meet its 100% renewable energy target by 2030. The transport sector is in the early stages



of electrification and transitioning to cleaner maritime fuel technologies, while the waste and AFOLU sectors are implementing strategies to reduce emissions by 2030. Tuvalu's transparent tracking methodologies and structured summaries ensure compliance with UNFCCC MPGs and the effective monitoring of its NDC target.

## 3.5 Mitigation Policies and Measures

Tuvalu's NDC is supported by a range of policies and measures aimed at achieving the stated targets. These actions are designed to reduce emissions while enhancing resilience and supporting sustainable development. Tuvalu is using the flexibility offered by MPG paragraph 85 due to current capacity limitations in quantifying GHG emission reductions from its mitigation actions. While this report includes all available information, future reports will provide more detailed and quantitative data as Tuvalu's capacity to collect and analyze this information improves.

### 3.5.1 Key Mitigation Strategies, Policies and Regulations

#### 3.5.1.1 Tuvalu's Updated NDC (2022)

The Government of Tuvalu developed its Intended Nationally Determined Contribution (INDC) and submitted it to the United Nations Framework Convention on Climate Change (UNFCCC) in 2015 and ratified the Paris Agreement on 22 April 2016. When the Paris Agreement came into force on 04 November 2016, Tuvalu's INDC submitted in 2015 automatically became Tuvalu's First NDC.

In accordance with decision 1/CP.21, Tuvalu hereby communicated Tuvalu's Updated Nationally Determined Contribution (NDC) in November 2022 under Article 4 of the Paris Agreement.

In this Updated NDC, Tuvalu hereby communicates to the UNFCCC:

| Aspect        | Details                                                                              | Mitigation Benefits                                                 | Co-benefits                                                                                                                                                            | Impact Estimation & Tracking                                                                                                                                                                              |
|---------------|--------------------------------------------------------------------------------------|---------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Target</b> | 100% GHG emission reduction in the electricity sector by 2030 (near-zero emissions). | Significant reduction in GHG emissions from electricity generation. | Increased energy independence, reduced reliance on fossil fuel imports, potential cost savings, improved air quality, and job creation in the renewable energy sector. | Track electricity generation data (kWh) from renewable and fossil fuel sources. Calculate emissions based on emission factors for each source. Monitor progress towards the 100% renewable energy target. |
| <b>Target</b> | 30% increase in energy efficiency in Funafuti by 2030.                               | Reduced energy consumption, leading to lower GHG emissions.         | Lower energy bills for consumers, improved energy security, and reduced strain on the electricity grid.                                                                | Conduct energy audits in Funafuti and track energy consumption data (kWh) before and after implementation of energy efficiency measures. Establish baseline energy consumption and measure reductions.    |
| <b>Target</b> | Indicative economy-wide GHG emission                                                 | Substantial reduction in                                            | Broader economic benefits from low-carbon development,                                                                                                                 | Develop a national GHG inventory, and track emissions from all energy sub-sectors                                                                                                                         |

|               |                                                                                    |                                               |                                                                                           |                                                                                                                                                                                  |
|---------------|------------------------------------------------------------------------------------|-----------------------------------------------|-------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|               | reduction target of 60% below 2010 levels by 2030 (from the entire energy sector). | national GHG emissions.                       | improved air quality, and enhanced resilience to climate change impacts.                  | (electricity, transport, etc.). Compare current emissions to the 2010 baseline and monitor progress towards the 60% reduction target. Use IPCC methodologies for GHG accounting. |
| <b>Target</b> | Zero carbon development pathway by 2050.                                           | Complete decarbonization of Tuvalu's economy. | Long-term sustainability, enhanced resilience, potential for green growth and innovation. | Develop a long-term decarbonization strategy, set interim targets, and track progress across all sectors. Utilize scenario analysis and modelling to assess different pathways.  |

### 3.5.1.2 Tuvalu's NDC Implementation Roadmap and Investment Plan

The NDC Roadmap and Plan sets out practical steps for the GoT to successfully implement the projects in the pipeline and is also intended to help generate interest from potential implementation partners, including donors and private investors, for implementing the pipeline of projects.

This NDC Roadmap and Plan identifies six GHG mitigation opportunities—two in the land transport sector, two in the maritime transport sector, and two in the electricity energy efficiency sector. Implementation of GHG mitigation projects in the pipeline will occur between 2022 and 2030. The two projects in each sector can be implemented at the same time.

The NDC Roadmap and Plan sets out practical steps for the GoT to successfully implement the projects in the pipeline and is also intended to help generate interest from potential implementation partners, including donors and private investors, for implementing the pipeline of projects. The details of the GHG mitigation pipeline projects for each sector, along with indicative investment needs to 2030, the annual GHG mitigation potential in 2030, and the cumulative GHG mitigation potential by 2030 are discussed in detail in the following sections of the report. The below table presents the key aspects of the Plan:

| Aspect           | Details                                                                                                             | Mitigation Benefits                              | Co-benefits                                                                                                       | Impact Estimation & Tracking                                                                                                                                                                         |
|------------------|---------------------------------------------------------------------------------------------------------------------|--------------------------------------------------|-------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Focus</b>     | Six GHG mitigation opportunities (2 each in land transport, maritime transport, and electricity energy efficiency). | Targeted GHG emission reductions in key sectors. | Sector-specific co-benefits, such as improved transport systems, reduced air pollution, and economic development. | For each project: 1. Establish baseline emissions. 2. Monitor project implementation. 3. Track energy consumption and fuel use. 4. Calculate emission reductions using appropriate emission factors. |
| <b>Potential</b> | Total potential to reduce 9.258 kt CO <sub>2</sub> e by 2030                                                        | Significant contribution to national GHG         | Economic benefits from project implementation,                                                                    | Track overall GHG emission reductions achieved through the                                                                                                                                           |



|                   |                                           |                                                          |                                  |                                                                                                           |
|-------------------|-------------------------------------------|----------------------------------------------------------|----------------------------------|-----------------------------------------------------------------------------------------------------------|
|                   | (1.777 kt CO <sub>2</sub> e annually).    | emission reduction targets.                              | potential for job creation.      | implemented projects. Compare against projected reductions in the NDC Roadmap and Plan.                   |
| <b>Investment</b> | US\$19,850,000 investment needed by 2030. | Mobilization of climate finance for mitigation projects. | Economic growth and development. | Track investment flows and monitor the effectiveness of funded projects in achieving mitigation outcomes. |

Furthermore, Annexure 1 & 2, outlines the existing projects or initiatives (either in development or recently implemented) identified in the NDC IR&IP to reduce GHG emissions in the priority sectors.

### 3.5.1.3 National Climate Change Policy (2021-2030)

This National Climate Change Policy 2020-2030, Te Vaka Fenua o Tuvalu, has been developed to respond to the needs of the Tuvalu people. The policy advances national priorities set out in the National Strategy for Sustainable Development 2021-2030 Te Kete, some of which contribute towards addressing regional and international commitments on climate change. The policy draws on evidence and findings from numerous assessments, including the review of the previous climate change policy and its strategic plan of action in 2016 and the nationwide consultations on the initial framework for this policy in 2018. The National Advisory Council on Climate Change (NACCC) played an important role in both processes by providing strategic guidance and technical advice to the Climate Change Department (CCD).

**Policy Vision:** A strong and resilient Tuvalu that protects the identity, culture, and existence of our people and meets our commitment to environmental sustainability.

**Policy Goal:** To protect Tuvalu from the impacts of climate change through bold and decisive actions that strengthen the resilience of our people and natural ecosystems to climate change risks by 2030.

**Policy Outcomes:** There are three priority outcomes of the policy, a total of 12 objectives, and 40 priority actions.

1. Strengthened access to climate finance and strategic partnerships (2 objectives and 7 priority actions).
2. Reduced vulnerability to climate change impacts through enhanced resilience (8 objectives and 26 priority actions); and
3. Managed human mobility and protection of national sovereignty (2 objectives and 7 priority actions).
4. Some of the key Policy outcomes and Objectives described in the policy are

The below table highlights the key goal of the policy 'Goal 5'. Ensuring Energy Security and a Low Carbon Future for Tuvalu.

| Aspect        | Details                            | Mitigation Benefits      | Co-benefits                                                                | Impact Estimation & Tracking                                                       |
|---------------|------------------------------------|--------------------------|----------------------------------------------------------------------------|------------------------------------------------------------------------------------|
| <b>Goal 5</b> | Ensuring Energy Security and a Low | Supports transition to a | Energy security, reduced dependence on fossil fuels, and economic benefits | Track progress on renewable energy deployment, energy efficiency improvements, and |

|  |                           |                           |                                    |                                                |
|--|---------------------------|---------------------------|------------------------------------|------------------------------------------------|
|  | Carbon Future for Tuvalu. | low-carbon energy system. | from renewable energy development. | GHG emissions reductions in the energy sector. |
|--|---------------------------|---------------------------|------------------------------------|------------------------------------------------|

#### 3.5.1.4 National Strategy for Sustainable Development 2021-2030

Tuvalu has a 10-year National Strategy for Sustainable Development- ‘Te Kete’ (2021-2030). It was released in 2021 to replace the previous Te Kakeega II and Te Kakeega III National Strategies. Te Kete, which in both Tuvaluan and Te reo Māori translates as a basket, symbolizes the storage and preservation of traditional knowledge that can be drawn on to support daily needs and well-being at the same time as building a resilient future. It presents the vision of a peaceful, resilient, and prosperous Tuvalu.

Te Kete includes five strategic priority areas: the enabling environment for sustainable development; economic development; social development and inclusion; islands and culture; and infrastructure development. These five strategic areas include 20 national outcomes (NOs) and 89 key strategic actions (KSAs). All programs will be aligned to the national vision, goals, and policy objectives in order to realize noble results.

Out of 20 national outcomes, the following outcomes are identified as they appear linked to the increase of greenhouse gas (GHG) emissions over the short term.

- National Outcome 7 – increasing fisheries contribution to socio-economic development and quality of life is likely to increase GHG emissions from Tuvalu’s maritime sub-sector.
- National Outcome 8 – increasing agricultural productivity, particularly through increasing local food production, including crops and livestock, may increase GHG emissions from Tuvalu’s agriculture sector.
- National Outcome 17 – developing and implementing resilient housing and upgrading national building facilities may increase GHG emissions from Tuvalu’s energy sector temporarily.
- National Outcome 18 – improving shipping, networking, and harbour facilities may increase GHG emissions across the energy sector and sub-sectors.
- National Outcome 20 – access to clean water and sanitation may require additional energy as well, which could also be associated with an increase in emissions.

| Aspect                  | Details                                                                                                                             | Mitigation Benefits                                                          | Co-benefits                                     | Impact Estimation & Tracking                                                                                                                                                 |
|-------------------------|-------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------|-------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Overall Strategy</b> | While not solely focused on mitigation, several outcomes (e.g., related to energy, transport, and waste) can contribute indirectly. | Indirect support for mitigation through sustainable development initiatives. | Sustainable development across various sectors. | Difficult to directly quantify mitigation impacts. Monitor implementation of relevant sustainable development initiatives and their potential influence on emissions trends. |

#### 3.5.1.5 Tuvalu National Energy Policy (TNEP) (2009-2023)

The Tuvalu National Energy Policy Framework was published in 2009 to set out the Government’s policies for the planning and management of the energy sector over the period 2009-2023.



Vision “By the year 2020 guided by the principles in the “Te Kakeega II” and the “Malefatunga Declaration”, Tuvalu shall attain a prosperous living standard that is fostered through an energy policy that promotes the provision of social, financial, economically, technically, politically and environmentally sustainable energy systems and within the framework of the Tuvalu Initial National Communication under the United Nations Framework on Climate Change (Oct 1999)”

Goal: To improve the well-being of the Tuvalu people by promoting the use of its renewable energy resources and implementing cost-effective, equitable, reliable, accessible, affordable, secure, and environmentally sustainable energy systems

The Policy identifies three main energy policy considerations:

- Adequate, secure, and cost-effective supply.
- Efficient utilization to avoid wasteful or non-productive energy consumption.
- Minimizing the negative impacts of energy production, transport, conversion, utilization, and consumption on the environment.

The TNEP is developed with six guiding principles namely: sustainability, gender equity, environment compatibility, stakeholder participation, good governance, and cultural and traditional compatibility.

The policy is divided into seven key areas:

1. Energy Sector Planning, Coordination, and Management
2. Petroleum
3. Transport
4. Electricity
5. Renewable Energy
6. Conservation and Efficiency
7. Environment

Tuvalu’s 2009 National Energy Policy set a national target of 100% renewable energy for power generation by 2025. To achieve this goal it suggests, among other strategies, reviving a national solar energy company that ceased operations due to management issues and calls for energy efficiency measures in all sectors. The policy also aims to reduce dependence on petroleum products by encouraging fuel conservation and actively searching for alternatives. The government of Tuvalu is revising the TNEP for the period 2021-2030 which is yet to be approved by the cabinet.

| Aspect        | Details                                                                          | Mitigation Benefits                                     | Co-benefits                                                      | Impact Estimation & Tracking                                                                                                                                            |
|---------------|----------------------------------------------------------------------------------|---------------------------------------------------------|------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Goal</b>   | Improve well-being by promoting renewable energy and sustainable energy systems. | Shift towards renewable energy, reducing GHG emissions. | Energy access, energy security, economic development.            | Track renewable energy generation capacity, energy consumption patterns, and GHG emissions from the energy sector.                                                      |
| <b>Target</b> | 100% renewable energy for power generation by 2025.                              | Decarbonization of the electricity sector.              | Energy independence, reduced fuel costs, environmental benefits. | Monitor electricity generation from renewable sources, calculate the percentage of renewable energy in the electricity mix, and track progress towards the 100% target. |

### 3.5.1.6 Enetise Tutumau 2012-2020 Master Plan for Renewable Electricity

The Government of Tuvalu (GoT) published and endorsed Enetise Tutumau's 2012-2020 Master Plan for Renewable Electricity and Energy Efficiency in February 2013. It provides the framework for developments in the energy sector in Tuvalu. The Master Plan set a target for electricity to be 100% from renewable energy by 2020 (subsequently revised to 2025) and for energy efficiency to be increased by 30%.

The Master Plan is also linked to Te Kakeega II the National Strategy for Sustainable Development (2005-2015), Te Kaniva the National Climate Change Policy (2012), the National Strategic Action Plan for Climate Change and Disaster Risk Management (2012-2016) and the Tuvalu National Energy Policy (2009).

As per the Master Plan, the priorities for the electricity sector in Tuvalu are:

- a. To provide a reliable and affordable electricity supply to all the people of Tuvalu.
- b. To safeguard Tuvalu from future diesel price shocks.
- c. To improve the efficiency of electricity utilization and further reduce the already low energy consumption per person and GDP; and
- d. To reduce Tuvalu's "carbon footprint" and become an international role model concerning climate change mitigation.

The Master Plan provided a framework for the achievement of these goals which it estimated would require a total renewable electricity generation capacity of 6 MW involving a capital investment of A\$52 million (in 2012 dollars).

| Aspect        | Details                                               | Mitigation Benefits                                      | Co-benefits                                                                | Impact Estimation & Tracking                                                                                        |
|---------------|-------------------------------------------------------|----------------------------------------------------------|----------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------|
| <b>Target</b> | 100% renewable electricity by 2020 (revised to 2025). | Decarbonization of the electricity sector.               | Energy security, reduced reliance on fossil fuels, environmental benefits. | Track renewable energy generation, calculate its share in the electricity mix, and compare against the 100% target. |
| <b>Target</b> | 30% increase in energy efficiency.                    | Reduced energy consumption and associated GHG emissions. | Lower energy costs for consumers, and improved energy security.            | Conduct energy audits, monitor energy consumption, and track progress towards the 30% energy efficiency target.     |

The key elements of the renewable electricity program were:

1. Development of renewable electricity generation supplemented with batteries initially on the Outer Islands.
2. The provision of additional renewable electricity generation capacity in Funafuti.
3. A program on the Outer Islands initially followed the implementation of an energy efficiency program in Funafuti.
4. Conversion of supplementary generation from diesel to bio-diesel fuel

Assessing the program in 2019, element 1 is almost complete, with all outer islands now based on hybrid solar/battery/diesel power systems, with many of the islands operating for long periods without



any diesel generator usage. With the completion of element 1, element 2 is now ready to be implemented.

### 3.5.1.7 Other national and sectoral strategies, plans, and policies

Several other national and sectoral strategies, plans, and policies are relevant to climate change mitigation efforts in Tuvalu, are detailed in the Table below.

**Table 35: National Strategic, Policy, and Legislative Framework related to Climate Change Mitigation**

| Document Title                                                                                                                                         | Mitigation Benefits                                                                                                                                        | Co-benefits                                                         | Impact Estimation & Tracking                                                                                                                                                 |
|--------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Te Kete: National Strategy for Sustainable Development (2021-2030)</b>                                                                              | Indirect support for mitigation through sustainable development initiatives.                                                                               | Sustainable development across various sectors.                     | Difficult to directly quantify mitigation impacts. Monitor implementation of relevant sustainable development initiatives and their potential influence on emissions trends. |
| <b>Infrastructure Strategy and Investment Plan 2016–2025 (TISIP) (2017) &amp; Infrastructure Strategy and Investment Plan 2016-2020 (TISIP) (2016)</b> | Investments in sustainable infrastructure (e.g., renewable energy, energy efficiency, public transport) can contribute to mitigation.                      | Improved infrastructure, economic development.                      | Track investments in relevant sectors and assess their impact on energy consumption and emissions.                                                                           |
| <b>Tuvalu’s Nationally Determined Contribution (NDC) (2015)</b>                                                                                        | Precursor to the updated NDC (2022). Its targets and actions contribute to mitigation.                                                                     | Similar to the updated NDC, but with potentially different targets. | Track implementation of NDC actions and their impact on emissions.                                                                                                           |
| <b>Second National Communication to the UNFCCC (SNC) (2015)</b>                                                                                        | Reports on GHG emissions and mitigation efforts. Provides data and information for tracking progress.                                                      | Improved understanding of emissions trends.                         | Use data from the SNC to establish baselines and track changes in emissions over time.                                                                                       |
| <b>Recovery and Vulnerability Reduction Plan (2015)</b>                                                                                                | May include elements related to resilient infrastructure, which can have indirect mitigation co-benefits (e.g., reduced energy demand for reconstruction). | Enhanced resilience to climate impacts.                             | Assess the impact of recovery and vulnerability reduction measures on energy use and emissions.                                                                              |
| <b>The National Strategic Action Plan (NSAP) 2012-2016</b>                                                                                             | Could include actions related to energy efficiency or renewable energy that contribute to mitigation.                                                      | Depends on the specific actions included in the plan.               | Track implementation of relevant actions and their impact on emissions.                                                                                                      |

|                                                                                 |                                                                                                                                                                                                                                   |                                                                        |                                                                                                                                      |
|---------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------|
| <b>Climate Change Resilience Act 2019</b>                                       | Provides the legal framework for climate action, including mitigation.                                                                                                                                                            | Strengthened institutional capacity for climate action.                | Monitor the effectiveness of the Act in supporting mitigation efforts.                                                               |
| <b>Traffic Act 2008 &amp; Police Powers and Duties Act 2009</b>                 | May indirectly influence fuel consumption through traffic management, but the impact is likely small and difficult to isolate for mitigation benefits.                                                                            | Improved traffic flow, road safety.                                    | Difficult to directly link these acts to quantifiable mitigation outcomes.                                                           |
| <b>Tuvalu Merchant Shipping Act 2008 &amp; Tuvalu Marine Pollution Act 2008</b> | While these acts address maritime activities, their primary focus is on shipping regulations and pollution prevention, not direct GHG mitigation. They could have some indirect effect by promoting efficient shipping practices. | Safe and sustainable maritime transport.                               | Difficult to isolate direct mitigation benefits.                                                                                     |
| <b>Energy Efficiency Act 2016</b>                                               | Promotes energy efficiency, directly contributing to mitigation.                                                                                                                                                                  | Reduced energy costs, improved energy security.                        | Track implementation of the Act and its impact on energy consumption and emissions.                                                  |
| <b>National Energy Policy 2009-2023 Tuvalu (2009)</b>                           | Precursor to the updated energy policy. Its targets and strategies contribute to mitigation.                                                                                                                                      | Similar to the updated policy, but with potentially different targets. | Track implementation of the policy and its impact on emissions.                                                                      |
| <b>The Integrated Water and Sanitation Policy 2012 – 2021</b>                   | May have indirect links to energy consumption (e.g., energy required for water pumping and treatment). Efficiency improvements in water and sanitation systems can therefore have co-benefits for energy use and mitigation.      | Improved access to water and sanitation.                               | Assess the energy intensity of water and sanitation systems and track any reductions in energy use related to policy implementation. |
| <b>Tuvalu's Integrated Waste Policy and Action Plan 2017-2026</b>               | Waste management practices can have indirect impacts on GHG emissions (e.g., through reduced methane emissions from landfills).                                                                                                   | Improved waste management, reduced pollution.                          | Track the implementation of waste management strategies and their potential impact on GHG emissions.                                 |



### 3.5.2 Comprehensive reporting of Tuvalu's mitigation policies and measures

Comprehensive Reporting on Tuvalu's Climate Policies and Mitigation Actions as per MPGs requirements:

| Name                                          | Included in | Description         |                                                                                                                                   |                                                                                                      | Objectives             | Type of instrument | Status  | Sector(s) affected | Gases affected                                       | Start the year of implementation | Implementing entity or entities | Estimates of GHG emission reductions (kt CO <sub>2</sub> eq.) |          | Methodology                         |
|-----------------------------------------------|-------------|---------------------|-----------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------|------------------------|--------------------|---------|--------------------|------------------------------------------------------|----------------------------------|---------------------------------|---------------------------------------------------------------|----------|-------------------------------------|
|                                               |             | Cost (US\$ million) | Non-GHG benefits (Selection: Economic Social Environmental Technological Gender and Other Vulnerable Groups Cross-Cutting Others) | Mitigation action Interaction (Selection: GHG Emissions, Removals, Impacting key categories, others) |                        |                    |         |                    |                                                      |                                  |                                 | Achieved                                                      | Expected |                                     |
| Te Kete: National Strategy for Sustainability | WEM         | N/A                 | Economic, Social, Environmental,                                                                                                  | GHG Emissions, Key Categories (Sustainable Development Goals)                                        | Adaptation, Mitigation | Other (Policies)   | Adopted | Other              | CO <sub>2</sub> , CH <sub>4</sub> , N <sub>2</sub> O | 2021                             | Government of Tuvalu            | FX                                                            | FX       | National policy analysis; Developed |

|                                                                                                      |     |         |                                                       |                                                                            |                                             |               |                 |       |                                                            |      |                                                                                |    |    |                                                                                                                                                               |
|------------------------------------------------------------------------------------------------------|-----|---------|-------------------------------------------------------|----------------------------------------------------------------------------|---------------------------------------------|---------------|-----------------|-------|------------------------------------------------------------|------|--------------------------------------------------------------------------------|----|----|---------------------------------------------------------------------------------------------------------------------------------------------------------------|
| nable<br>Devel<br>opme<br>nt<br>(2021-<br>2030)                                                      |     |         | Cross<br>-<br>Cutting                                 | inable<br>Devel<br>opmen<br>t)                                             |                                             |               |                 |       |                                                            |      |                                                                                |    |    | using<br>partici<br>patory<br>approa<br>ches<br>and<br>stakeh<br>older<br>consul<br>tations<br>.                                                              |
| Infrast<br>ructur<br>e<br>Strate<br>gy and<br>Invest<br>ment<br>Plan<br>2016–<br>2025<br>(TISI<br>P) | WEM | N/<br>A | Econo<br>mic,<br>Social<br>,<br>Envir<br>onme<br>ntal | GHG<br>Emissi<br>ons,<br>Key<br>Categ<br>ories<br>(Infras<br>tructur<br>e) | Mitigation,<br>Adaptation,<br>cross-cutting | Other (Plans) | Adopted         | Other | CO <sub>2</sub> ,<br>CH <sub>4</sub> ,<br>N <sub>2</sub> O | 2017 | Tuval<br>u<br>Gove<br>rnme<br>nt,<br>Minis<br>try of<br>Infras<br>tructur<br>e | FX | FX | Infrast<br>ructur<br>e<br>project<br>evalua<br>tions;<br>Utilize<br>s<br>infrast<br>ructur<br>e<br>resilie<br>nce<br>assess<br>ment<br>metho<br>dologi<br>es. |
| Infrast<br>ructur<br>e<br>Strate<br>gy and<br>Invest<br>ment<br>Plan<br>2016-<br>2020<br>(TISI<br>P) | WEM | N/<br>A | Econo<br>mic,<br>Social<br>,<br>Envir<br>onme<br>ntal | GHG<br>Emissi<br>ons,<br>Key<br>Categ<br>ories<br>(Infras<br>tructur<br>e) | Mitigation,<br>Adaptation,<br>cross-cutting | Other (Plans) | Impleme<br>nted | Other | CO <sub>2</sub> ,<br>CH <sub>4</sub> ,<br>N <sub>2</sub> O | 2016 | Tuval<br>u<br>Gove<br>rnme<br>nt,<br>Minis<br>try of<br>Infras<br>tructur<br>e | FX | FX | Devel<br>oped<br>based<br>on<br>short-<br>term<br>climat<br>e<br>impact<br>assess<br>ments.                                                                   |



|                                                          |     |     |                                                                                                           |                                           |                           |                  |             |       |                                                      |      |                                               |      |      |                                                                                                                     |
|----------------------------------------------------------|-----|-----|-----------------------------------------------------------------------------------------------------------|-------------------------------------------|---------------------------|------------------|-------------|-------|------------------------------------------------------|------|-----------------------------------------------|------|------|---------------------------------------------------------------------------------------------------------------------|
| Tuvalu's NDC Implementation and Investment Plan (2022)   | WAM | N/A | Economic, Social, Environmental, Technological, Gender and Other Vulnerable Groups, Cross-Cutting, Others | GHG Emissions, Removals                   | Mitigation and Adaptation | Other (Policies) | Adopted     | Other | CO <sub>2</sub> , CH <sub>4</sub> , N <sub>2</sub> O | 2022 | Tuvalu Government, Ministry of Climate Change | 0.48 | 9.25 | Developed using investment planning methodologies aligned with NDC objectives; Implementation monitoring frameworks |
| Second National Communication to the UNFCCC (SNC) (2015) | WEM | N/A | Environmental, Social, Economic, Transparency                                                             | GHG Emissions, Key Categories (Reporting) | Transparency              | Other (Reports)  | Implemented | Other | CO <sub>2</sub> , CH <sub>4</sub> , N <sub>2</sub> O | 2015 | Tuvalu Government, Ministry of Climate Change | FX   | FX   | UNFCCC guidelines for national communications.                                                                      |
| Recovery and Vulnerability Reduction                     | WEM | N/A | Social, Economic, Environmental                                                                           | Key Categories (Resilience Building)      | Adaptation                | Other (Plans)    | Implemented | Other | CO <sub>2</sub> , CH <sub>4</sub> , N <sub>2</sub> O | 2015 | Tuvalu Government, Ministry of Finance        | FX   | FX   | Developed based on vulnerability assessments                                                                        |

|                                                                         |     |     |                                                       |                                                    |                        |                  |              |       |                                                      |      |                                                     |    |    |                                                                                                   |
|-------------------------------------------------------------------------|-----|-----|-------------------------------------------------------|----------------------------------------------------|------------------------|------------------|--------------|-------|------------------------------------------------------|------|-----------------------------------------------------|----|----|---------------------------------------------------------------------------------------------------|
| Plan (2015)                                                             |     |     |                                                       |                                                    |                        |                  |              |       |                                                      |      | ce and Econ omic Devel opme nt                      |    |    | and recove ry strateg ies.                                                                        |
| Te Vaka Fenua o Tuvalu: Tuvalu National Climate Change Policy 2021-2030 | WEM | N/A | Envir onme ntal, Social , Econo mic, Cross - Cuttin g | GHG Emissi ons, Key Categ ories (Clim ate Policy ) | Mitigation, Adaptation | Other (Policies) | Adopted      | Other | CO <sub>2</sub> , CH <sub>4</sub> , N <sub>2</sub> O | 2021 | Tuval u Gove rnme nt, Minis try of Clima te Chan ge | FX | FX | Nation al policy analys is; Devel oped using partici patory approa ches with local stakeh olders. |
| The Nation al Strate gic Actio n Plan (NSA P) 2012-2016                 | WEM | N/A | Econo mic, Envir onme ntal, Social                    | Key catego ries (Actio n Planni ng)                | Enablers               | Other (Plans)    | Impleme nted | Other | CO <sub>2</sub> , CH <sub>4</sub> , N <sub>2</sub> O | 2012 | Tuval u Gove rnme nt, Minis try of Clima te Chan ge | FX | FX | Utilize d prior assess ments and stakeh older feedba ck.                                          |
| Clima te Chang e Resili ence Act 2019                                   | WEM | N/A | Econo mic, Envir onme ntal, Social                    | Key Categ ories (Resili ence Buildi ng)            | Adaptation             | Regulatory       | Adopted      | Other | CO <sub>2</sub> , CH <sub>4</sub> , N <sub>2</sub> O | 2019 | Tuval u Gove rnme nt, Minis try of Clima            | FX | FX | Based on best practic es for climat e resilie nce                                                 |



|                                                  |     |         |                                             |                                                                          |            |            |         |           |                                                            |      |                                                                         |    |    |                                                                                                                                 |
|--------------------------------------------------|-----|---------|---------------------------------------------|--------------------------------------------------------------------------|------------|------------|---------|-----------|------------------------------------------------------------|------|-------------------------------------------------------------------------|----|----|---------------------------------------------------------------------------------------------------------------------------------|
|                                                  |     |         |                                             |                                                                          |            |            |         |           |                                                            |      | te<br>Chan<br>ge                                                        |    |    | legisla<br>tion.                                                                                                                |
| Traffi<br>c Act<br>2008                          | WEM | N/<br>A | Social<br>, Econo<br>mic, Envir<br>onmental | GHG<br>Emissi<br>ons,<br>Key Categ<br>ories<br>(Trans<br>portati<br>on)  | Mitigation | Regulatory | Adopted | Transport | CO <sub>2</sub> ,<br>CH <sub>4</sub> ,<br>N <sub>2</sub> O | 2008 | Minis<br>try of Trans<br>port, Energ<br>y and Touri<br>sm<br>(MTE<br>T) | FX | FX | Follo<br>ws enviro<br>nmental<br>assess<br>ment meth<br>odologi<br>es for trans<br>port. Traffic<br>manag<br>ement<br>studies   |
| Tuval<br>u Merch<br>ant Shippi<br>ng Act<br>2008 | WEM | N/<br>A | Envir<br>onmental,<br>Econo<br>mic          | GHG<br>Emissi<br>ons,<br>Key Categ<br>ories<br>(Marit<br>ime Sector<br>) | Mitigation | Regulatory | Adopted | Transport | CO <sub>2</sub> ,<br>CH <sub>4</sub> ,<br>N <sub>2</sub> O | 2008 | Minis<br>try of Trans<br>port, Energ<br>y and Touri<br>sm<br>(MTE<br>T) | FX | FX | Devel<br>oped based<br>on interna<br>tional shippi<br>ng standa<br>rds and best<br>practic<br>es. Mariti<br>me regulat<br>ions. |
| Tuval<br>u Marin<br>e Pollut                     | WEM | N/<br>A | Envir<br>onmental,<br>Social                | GHG<br>Emissi<br>ons,<br>Key Categ                                       | Mitigation | Regulatory | Adopted | Other     | CO <sub>2</sub> ,<br>CH <sub>4</sub> ,<br>N <sub>2</sub> O | 2008 | Gove<br>rnme<br>nt of<br>Tuval<br>u                                     | FX | FX | Follo<br>ws interna<br>tional marine                                                                                            |

|                                                                |     |      |                                            |                             |            |               |         |        |                                                      |      |                      |    |    |                                                                                                  |                                                                                  |
|----------------------------------------------------------------|-----|------|--------------------------------------------|-----------------------------|------------|---------------|---------|--------|------------------------------------------------------|------|----------------------|----|----|--------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------|
| ion Act 2008                                                   |     |      |                                            | ories (Mari ne Protec tion) |            |               |         |        |                                                      |      |                      |    |    |                                                                                                  | polluti on guideli nes and best practic es. Enviro nment al legisla tion studies |
| Energy Efficiency Act 2016                                     | WEM | N/ A | Econo mic, Envir onmental, Techn ologic al | GHG Emissi ons,             | Mitigation | Regulatory    | Adopted | Energy | CO <sub>2</sub> , CH <sub>4</sub> , N <sub>2</sub> O | 2016 | Minis try of Energ y | FX | FX | Devel oped based on energy efficie ncy standa rds and assess ments. GHG accoun ting metho dology |                                                                                  |
| Renewable Electricity and Energy Efficiency Master Plan (2012) | WEM | N/ A | Econo mic, Envir onmental, Techn ologic al | GHG Emissi ons              | Mitigation | Other (Plans) | Adopted | Energy | CO <sub>2</sub> , CH <sub>4</sub> , N <sub>2</sub> O | 2012 | Minis try of Energ y | FX | FX | Based on renew able energy assess ments and project ions. Master plan                            |                                                                                  |



|                                                                         |     |     |                                                |                        |            |                  |             |                  |                                                      |      |                                                                    |    |    |                                                                                                              |
|-------------------------------------------------------------------------|-----|-----|------------------------------------------------|------------------------|------------|------------------|-------------|------------------|------------------------------------------------------|------|--------------------------------------------------------------------|----|----|--------------------------------------------------------------------------------------------------------------|
|                                                                         |     |     |                                                |                        |            |                  |             |                  |                                                      |      |                                                                    |    |    | evaluations                                                                                                  |
| National Energy Policy 2009-2023 Tuvalu                                 | WEM | N/A | Economic, Environmental, Technological         | GHG Emissions          | Mitigation | Other (Policies) | Adopted     | Energy           | CO <sub>2</sub> , CH <sub>4</sub> , N <sub>2</sub> O | 2009 | Ministry of Energy                                                 | FX | FX | Developed based on national energy assessments and international standards. Policy assessments               |
| Tuvalu Sustainable and Integrated Water and Sanitation Policy 2012-2021 | WEM | N/A | Economic, Social, Environmental, Technological | key categories (Waste) | Mitigation | Other (Policies) | Implemented | Waste Management | CH <sub>4</sub> , N <sub>2</sub> O                   | 2012 | Ministry of Public Utilities and the National Water and Sanitation | FX | FX | Developed based on national water and sanitation assessments and international standards. Policy assessments |

|                                                            |     |       |                                                |                        |            |                  |         |                  |                                                      |      |                                                                    |        |       |                                                                                   |
|------------------------------------------------------------|-----|-------|------------------------------------------------|------------------------|------------|------------------|---------|------------------|------------------------------------------------------|------|--------------------------------------------------------------------|--------|-------|-----------------------------------------------------------------------------------|
| Tuvalu's Integrated Waste Policy and Action Plan 2017-2026 | WEM | N/A   | Economic, Social, Environmental, Technological | key categories (Waste) | Mitigation | Other (Plans)    | Adopted | Waste Management | CH <sub>4</sub> , N <sub>2</sub> O                   | 2017 | Ministry of Public Utilities and the National Water and Sanitation | FX     | FX    | Developed based on national waste sector assessments and international standards. |
| E-bike initiative                                          | WAM | 3.444 | Environmental, Economic, social, Technological | GHG Emissions          | Mitigation | Other (Measures) | Planned | Transport        | CO <sub>2</sub> , CH <sub>4</sub> , N <sub>2</sub> O | 2022 | Ministry of Transport, Energy and Tourism (MTE T)                  | 0.074  | 1.087 | GHG accounting methodology                                                        |
| Electrification of Tuvalu's light vehicle fleet            | WAM | 13.47 | Environmental, Economic, social, Technological | GHG Emissions          | Mitigation | Other (Measures) | Planned | Transport        | CO <sub>2</sub> , CH <sub>4</sub> , N <sub>2</sub> O | 2023 | Ministry of Transport, Energy and Tourism (MTE T)                  | 0.0671 | 2.417 | GHG accounting methodology                                                        |
| The outboard motor transition from 2-                      | WAM | 2.619 | Environmental, Economic, social, Technological | GHG Emissions          | Mitigation | Other (Measures) | Planned | Transport        | CO <sub>2</sub> , CH <sub>4</sub> , N <sub>2</sub> O | 2022 | Ministry of Transport, Energy and Tourism                          | 0.251  | 3.819 | GHG accounting methodology                                                        |



|                                                                      |     |       |                                                    |                |            |                  |         |        |                                                      |      |                                                       |       |       |                              |
|----------------------------------------------------------------------|-----|-------|----------------------------------------------------|----------------|------------|------------------|---------|--------|------------------------------------------------------|------|-------------------------------------------------------|-------|-------|------------------------------|
| stroke petrol outboards to 4-stroke                                  |     |       | ologic al                                          |                |            |                  |         |        |                                                      |      | (MTE T)                                               |       |       |                              |
| Shore side electrical supply for at-berth vessels                    | WAM | 0.5   | Envir onmental, Economic, social , Techn ologic al | GHG Emissi ons | Mitigation | Other (Measures) | Planned | Energy | CO <sub>2</sub> , CH <sub>4</sub> , N <sub>2</sub> O | 2023 | Minis try of Trans port, Energ y and Touri sm (MTE T) | 0.072 | 1.08  | GHG accou nting metho dology |
| Retrofitting of major hotels and commercial and government buildings | WAM | 0.14  | Envir onmental, Economic, social , Techn ologic al | GHG Emissi ons | Mitigation | Other (Measures) | Planned | Energy | CO <sub>2</sub> , CH <sub>4</sub> , N <sub>2</sub> O | 2024 | Minis try of Trans port, Energ y and Touri sm (MTE T) | 0     | 0.517 | GHG accou nting metho dology |
| Cold storage energy efficiency                                       | WAM | 0.125 | Envir onmental, Economic, Social , Techn ologic al | GHG Emissi ons | Mitigation | Other (Measures) | Planned | Energy | CO <sub>2</sub> , CH <sub>4</sub> , N <sub>2</sub> O | 2022 | Minis try of Trans port, Energ y and Touri sm (MTE T) | 0.02  | 0.336 | GHG accou nting metho dology |

|                                                                                                  |     |        |                                                |               |            |                  |         |        |                                                      |      |                                                   |                      |                      |                                                                                       |
|--------------------------------------------------------------------------------------------------|-----|--------|------------------------------------------------|---------------|------------|------------------|---------|--------|------------------------------------------------------|------|---------------------------------------------------|----------------------|----------------------|---------------------------------------------------------------------------------------|
| The Facilitation of the Achievement of Sustainable National Energy Targets of Tuvalu (FASNETT)   | WAM | 18     | Environmental, Economic, Social, Technological | GHG Emissions | Mitigation | Other (Measures) | Planned | Energy | CO <sub>2</sub> , CH <sub>4</sub> , N <sub>2</sub> O | 2017 | Ministry of Transport, Energy and Tourism (MTE T) | 8.49                 | 25.25                | ED/M PUI and TEC reports and calculation according to GEF GHG measurement methodology |
| Low Carbon Fund and Energy Efficiency Revolving Fund for energy-efficient appliances and housing | WAM | 0.0386 | Environmental, Economic, social, Technological | GHG Emissions | Mitigation | Other (Measures) | Planned | Energy | CO <sub>2</sub> , CH <sub>4</sub> , N <sub>2</sub> O | 2016 | Ministry of Transport, Energy and Tourism (MTE T) | Included in FASNET T | Included in FASNET T | ED/M PUI and TEC reports and calculation according to GEF GHG measurement methodology |



|                                                          |     |     |                                                |               |            |                  |         |        |                                                      |      |                                                   |   |       |                            |
|----------------------------------------------------------|-----|-----|------------------------------------------------|---------------|------------|------------------|---------|--------|------------------------------------------------------|------|---------------------------------------------------|---|-------|----------------------------|
| retrofits                                                |     |     |                                                |               |            |                  |         |        |                                                      |      |                                                   |   |       |                            |
| 770 kW solar PV plant (with battery storage) in Funafuti | WAM | 6.1 | Environmental, Economic, Social, Technological | GHG Emissions | Mitigation | Other (Measures) | Planned | Energy | CO <sub>2</sub> , CH <sub>4</sub> , N <sub>2</sub> O | 2023 | Ministry of Transport, Energy and Tourism (MTE T) | 0 | 19.84 | GHG accounting methodology |
| 2 MW of solar PV, 2 MWh of battery storage on Funafuti   | WAM | 8   | Environmental, Economic, Social, Technological | GHG Emissions | Mitigation | Other (Measures) | Planned | Energy | CO <sub>2</sub> , CH <sub>4</sub> , N <sub>2</sub> O | 2023 | Ministry of Transport, Energy and Tourism (MTE T) | 0 | 51.53 | GHG accounting methodology |

### 3.6 General Methodological Framework:

- **Estimation Methods:** Each of the expected and achieved reductions will be calculated based on methodologies provided by the UNFCCC and IPCC guidelines, considering local emission factors, baseline assessments, and targeted interventions.
- **Indicators:** The effectiveness of each policy and action will be measured through specific indicators, including reductions in GHG emissions, renewable energy mix, energy savings, reduction in fossil fuel consumption, and electrification.
- **Monitoring and Reporting:** Regular assessments will be conducted to monitor progress, including periodic updates to the NDCs to the UNFCCC, ensuring transparency and accountability.
- **Stakeholder Engagement:** Involvement of local communities, civil society organizations, and private sectors will be encouraged in implementing and monitoring these policies to ensure broad-based support and effectiveness.

This framework will not only guide the implementation and reporting of Tuvalu's climate-mitigating actions but also demonstrate the nation's commitment to achieving its climate goals in alignment with international frameworks. It provides a comprehensive overview of policies, actions, plans, and expected outcomes, facilitating clear communication with stakeholders and the global community.

### 3.7 Summary of Achievements and Next Steps

- **Cumulative GHG Reductions:** The combined estimated GHG emissions reductions across all policies and actions detailed above amount to approximately 106 KtCO<sub>2</sub>eq by 2030, with significant achievements already recorded in various sectors till this BTR's recent assessment year i.e. 2023.
- **Ongoing Monitoring:** Continuous tracking and reporting of the implementation of these policies and measures are essential to ensure that Tuvalu meets its climate objectives. Regular assessments will be conducted to update data on achieved reductions, implementation challenges, and progress toward targets.
- **Investment Needs:** An estimated \$52.44 million is required to fully implement the outstanding actions and initiatives described as the 'With Additional Measures' in the above table, highlighting the importance of securing international funding and partnerships.
- **Community Engagement:** Ongoing efforts to engage local communities, stakeholders, and private sector actors are crucial for the successful implementation of these strategies, enhancing resilience and ensuring the sustainability of Tuvalu's climate initiatives.
- **Integration with Global Standards:** All policies align with international climate commitments, including the Paris Agreement and the UN Sustainable Development Goals (SDGs), ensuring a comprehensive approach to tackling climate change while promoting sustainable development.

### 3.8 Mitigation analysis by sector

Tuvalu's national mitigation efforts, as detailed in its Nationally Determined Contribution (NDC) and supporting documents, prioritize the Energy, Agriculture, Forestry and Other Land Use (AFOLU), and Waste sectors, recognizing their respective contributions to national greenhouse gas (GHG) emissions. These sectors are central to implementing national mitigation priorities. Tuvalu has conducted GHG inventories in 1994, 2014, and 2021, adhering to UNFCCC reporting guidelines. The most recent



inventory, compiled for Tuvalu's first Biennial Transparency Report (BTR) submission in 2024, uses 2010 as the base year, consistent with Tuvalu's updated NDC (2022), and covers 2010 and 2015-2023. Analysis of these inventories reveals a trend of increasing GHG emissions, with continued growth across all three key sectors: Energy, AFOLU, and Waste.

The Energy sector, heavily dependent on imported fossil fuels for electricity generation and transportation, is the largest emission source, with electricity generation and transport being the primary sub-sectors. The AFOLU sector, characterized by subsistence agriculture, limited livestock rearing, and reliance on imported food, is the second largest emitter. The Waste sector, while contributing a smaller share, is also a focus of mitigation efforts, addressing emissions from solid waste disposal and wastewater treatment. While current mitigation targets and actions are primarily concentrated in the Energy sector, Tuvalu's National Climate Change Policy Framework and the NDC acknowledge the importance of considering mitigation opportunities across all sectors to achieve broader climate change and sustainable development goals. The following subsections provide a detailed sectoral mitigation analysis, examining implemented measures, planned projects, their potential impact on GHG emissions reductions, and any sector-specific challenges.

### **3.8.1 Energy Sector**

The energy sector is the largest GHG emission-contributing sector in Tuvalu. In 2023, the energy sector emitted 61% of the total national GHG emissions, mainly by fossil fuel combustion activities, comprising energy industries (45%), transport (44%), and other sectors (11%).

#### **3.8.1.1 Electricity Generation: Renewable Energy**

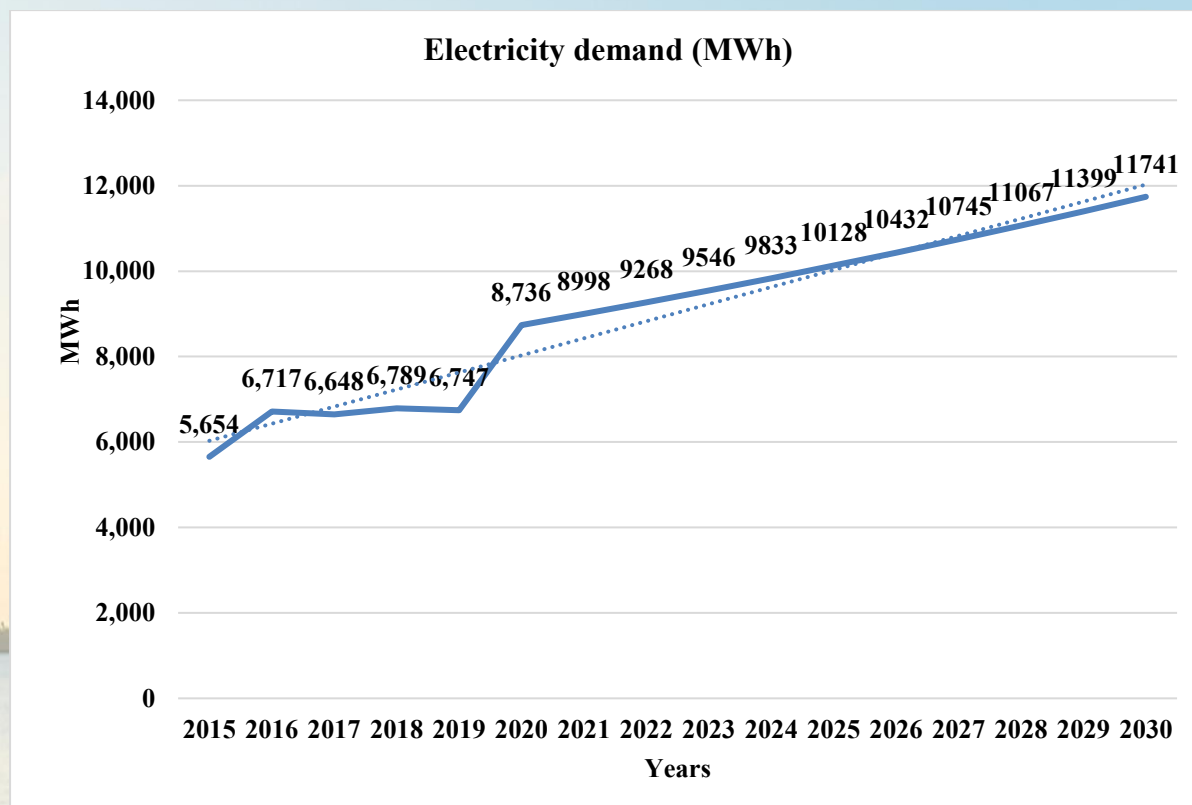
In 2023, Electricity generation accounted for 7.134 kt CO<sub>2</sub>e (i.e., approximately 28%) of the total national emissions, and 45% of the energy sector emissions indicating that electricity generation is the largest fossil fuel consumer and GHG emitter within the 'Energy Sector'. Electricity generation is heavily reliant on diesel fuel, which has a high cost and also exposes the states to energy security risks including fuel price volatility. Tariffs are largely insufficient to recover current operating costs and there is no provision for capital works or unexpected maintenance. As of 2020, Funafuti's total installed generation capacity is 2,550 kW, of which 1,800 kW (74%) is diesel. Off-grid generators and solar PV installations make up the additional electricity capacity. The outer islands of Tuvalu are already generating 80% to 90% of their electricity from renewable sources. Diesel is used for 10% to 20% of generation on these outer islands. This is because demand is high so solar PV panels alone cannot meet the demand, so diesel generators are being used.

The Government of Tuvalu (GoT) endorsed Enetise Tutumau's 2012-2020 Master Plan for Renewable Electricity and Energy Efficiency which provides the framework for developments in the energy sector in Tuvalu. Enetise Tutumau was published and endorsed by the Government of Tuvalu in February 2013. The Master Plan set a target for electricity to be 100% from renewable energy by 2020 (subsequently revised to 2025) and for energy efficiency to be increased by 30%. Accordingly, the Government of Tuvalu set a target of 100% renewable electricity generation by 2025 in its INDC. However, considering Tuvalu's national circumstances, the timeline has been changed to 2030 in the updated NDC. The GoT is committed to increasing the use of renewables for electricity generation to strengthen Tuvalu's energy security, particularly on the country's main island of Funafuti.

The Tuvalu Electricity Corporation (TEC) is solely responsible for the generation and distribution of electricity in Tuvalu. There are no independent power producers (IPPs), and the current legislative framework does not allow generation by entities other than TEC. TEC provides 24-hour electricity supply to eight of Tuvalu's nine islands via electricity grids. The electricity demand in Tuvalu is

expected to reach 11740 MWh by 2030 increasing from 8736 MWh in 2020 (35% increase during 2020-2030). Given that electricity access in Tuvalu is already near-universal (close to 100%), it is projected that the consumer base will not expand significantly. Further, an average growth rate of 3% in electricity demand is assumed and it is in line with the previous studies<sup>12</sup>.

**Figure 37. Electricity demand projection in Tuvalu: 2021-2030**



At present approximately 14% of the penetration level of renewable energy is through solar power and still a lot to go to achieve the target. There are some recent pipeline projects by the donor community, which will significantly increase the penetration level to a higher level.

Tuvalu, with funding from New Zealand's Ministry of Foreign Affairs and Trade, is developing a new solar PV plant (with battery storage) in Funafuti. The US\$6 million project will include 770 kW of Solar PV and at least 1 MWh of battery storage. The plant will help replace diesel on the island, where about 85 percent of electricity is currently generated from diesel. The plant was expected to be completed by the end of 2020 but has been delayed due to COVID-19 travel restrictions and are expected to complete by the end of 2024.

In addition, two large renewable energy projects, funded by the World Bank and the Asian Development Bank (ADB), will see the installation of an additional 2 MW of solar PV, 2 MWh of battery storage, and a small wind turbine in Funafuti. Following the completion of these projects, Funafuti is expected to achieve a renewable energy contribution of approximately 90 percent. This will mean that nationwide, Tuvalu will generate approximately 90 percent of its electricity through renewable sources. This project is expected to be completed by the end of 2024.

A list of existing, recently completed, and pipeline RE projects is attached in Annexure 2.

<sup>12</sup> Tuvalu - Funafuti Road Map (2019), <https://www.adb.org/sites/default/files/linked-documents/49450-015-sd-04.pdf>



The existing Fongafale power system on Funafuti Island consists of the following major components:

- 3 x 600kW diesel generation at TEC, with SMA ‘fuel saver’ control system
- 735 kWp of installed, operational solar PV capacity.

**Table 36: Details of list of existing World Bank and Asian Development Bank projects**

| <b>Project 1</b>     |                                                                                     |
|----------------------|-------------------------------------------------------------------------------------|
| <b>Project Title</b> | <b>Tuvalu Energy Sector Development Project</b>                                     |
| <b>Donor</b>         | World Bank                                                                          |
| <b>Project Site</b>  | Fongafale, Funafuti                                                                 |
| <b>Activities</b>    | 700kW solar PV and 1MW/2MWh                                                         |
| <b>Operational</b>   | 2023                                                                                |
| <b>Project 2</b>     |                                                                                     |
| <b>Project Title</b> | <b>Increasing Access to Renewable Energy</b>                                        |
| <b>Donor</b>         | Asian Development bank                                                              |
| <b>Project Site</b>  | Fongafale, Funafuti and solar PV for Outer Islands of Nukulaelae, Nukufetau and Nui |
| <b>Activities</b>    | 500kW solar PV and 1MW/3MWh and 224kW for Outer Islands                             |
| <b>Operational</b>   | 2023                                                                                |

The Tuvalu- Funafuti Road Map report of 2019 details the Funafuti Road Map to 100% Renewable Energy as part of the Tuvalu Renewable Energy Project. The main island of Funafuti constitutes the majority of electrical demand for the country, with the outer islands already on the way towards 100% renewable energy. To achieve a 100% renewable contribution for Funafuti by 2030 would require 7.6 MW of solar PV and 3 MW / 14 MWh of battery energy storage<sup>13</sup>. Funding for the World Bank project and Stage 1 (by ADB) are assumed to be locked in. Funding for Stages 2 and 3 are unfunded and it is estimated would require cumulative capital of US\$21.1m. Table, provided below, presents the summary of existing as well as solar expansion options for Funafuti.

**Table 37: Summary solar expansion options for Funafuti**

| <b>Road Map Stages</b> | <b>PV Site</b> | <b>Site totals (kWp)</b> | <b>Cumulative capacity (kWp)</b> | <b>System</b> |
|------------------------|----------------|--------------------------|----------------------------------|---------------|
|------------------------|----------------|--------------------------|----------------------------------|---------------|

<sup>13</sup> Apart from the World bank and ADB project addition of 3,300 kWp of solar PV and 1000 kW / 11,000 kWh BESS will be required in Roadmap Stage 3 to achieve 100% RE target by 2025.

|                             |                                                     |       |       |
|-----------------------------|-----------------------------------------------------|-------|-------|
| <b>Existing</b>             | Government building                                 | 130   | 735   |
|                             | Hospital                                            | 75    |       |
|                             | Media building                                      | 40    |       |
|                             | Fisheries main warehouse                            | 75    |       |
|                             | Public works department                             | 65    |       |
|                             | TEC power station                                   | 350   |       |
| <b>World Bank Project</b>   | World Bank solar site                               | 750   | 1,485 |
| <b>ADB Project, Stage 1</b> | Government building rooftops                        | 500   | 1,985 |
| <b>Road Map Stage 2</b>     | FASTNETT wetlands pilot floating solar project      | 100   | 4,385 |
|                             | Other Government controlled buildings or land       | 580   |       |
|                             | QE II Park rooftop and raised framing structures    | 1,720 |       |
| <b>Road Map Stage 3</b>     | Floating solar in Funafuti Lagoon                   | 2000+ | 7,635 |
|                             | Other government-controlled land                    | 500+  |       |
|                             | Non-government organizations rooftops or land       | 500+  |       |
|                             | Raised fixed structure (roads or alternative sites) | 750+  |       |
|                             | Non-Government organisations building rooftops      | 500+  |       |

### 3.8.1.2 Transportation- Road transport and Maritime transport

In 2023, GHG emissions from the transport sector are 6.942 kt CO<sub>2</sub>eq which is about 45% of total CO<sub>2</sub>eq emissions from the energy sector and 27% of total national GHG emissions (excluding removals). The road transport sector accounted for 59% of the total GHG emissions from the transport sector followed by water-borne navigation (41%). The transport subsector is the second largest consumer of commercial fuel energy within the Energy sector in Tuvalu. Connections between the outer islands of Tuvalu and the main port in Funafuti depend crucially on the maritime sector. The small size of this island nation and the infertile soil make inhabitants heavily dependent on shipping operations as



there are no domestic aviation services in the country. Funafuti has the only sealed road infrastructure in Tuvalu, with 15.5 kilometres of sealed roads constructed. There are currently no plans to seal roads on the outer islands, and no bridges exist. Motorcycle numbers have grown rapidly in recent years throughout the country. Other forms of transport including bicycles are limited.

The Transport sector is identified as one of the key strategic areas for energy security, Electric Vehicle is the target technology identified for phasing out fossil fuel and minimizing emissions in the sector. However, reducing GHG emissions from land transport and maritime transport could play an important part in Tuvalu's goal to reduce total GHG emissions of GHGs from the entire energy sector.

As discussed in earlier sections, Tuvalu's NDC Implementation Roadmap and Plan has identified two mitigation opportunities each in the land transport sector and maritime transport. Jointly these mitigation opportunities have.

- Total potential to reduce emissions by 8.406 kt CO<sub>2</sub>e by 2030.
- An annual GHG mitigation potential of 1.283 kt CO<sub>2</sub>e in 2030. (i.e. 18.48% of the Transport sector's total emission in 2023).
- An indicative investment need of US\$19,585,000 by 2030.

A detailed description of these projects is delineated in Table 4 provided below.

**Table 38: Land and Maritime transport mitigation opportunities**

| Opportunity                                                              | Indicative investment needs to 2030 (US\$) | Annual GHG emissions reduction in 2030 (kt CO <sub>2</sub> e) | Cumulative GHG emissions reduction by 2030 (kt CO <sub>2</sub> e) | Implementation timeframe |
|--------------------------------------------------------------------------|--------------------------------------------|---------------------------------------------------------------|-------------------------------------------------------------------|--------------------------|
| <b>Land transport</b>                                                    |                                            |                                                               |                                                                   |                          |
| E-bike initiative                                                        | 3,444,000                                  | 0.198                                                         | 1.089                                                             | 2022-2030                |
| Electrification of Tuvalu's light vehicle fleet                          | 13,470,000                                 | 0.537                                                         | 2.417                                                             | 2022-2030                |
| <b>Maritime transport</b>                                                |                                            |                                                               |                                                                   |                          |
| The outboard motor transition from 2-stroke petrol outboards to 4-stroke | 2,619,000                                  | 0.764                                                         | 3.82                                                              | 2022-2030                |
| Shoreside electrical                                                     | 50,000                                     | 0.144                                                         | 1.08                                                              | 2022-2024                |

|                             |  |  |  |  |
|-----------------------------|--|--|--|--|
| supply for at-berth vessels |  |  |  |  |
|-----------------------------|--|--|--|--|

### 3.8.1.3 Energy Efficiency

Energy efficiency, defined as using less energy to provide the same level of energy services, thereby reducing energy waste, costs, and environmental impacts, is a cornerstone of Tuvalu's sustainable energy strategy. It is typically measured by quantifying the reduction in energy consumption for a given output or service, often expressed as a percentage improvement or in specific energy units (e.g., kWh) saved per unit of output. Tuvalu has prioritized energy efficiency through several key initiatives.

The Pacific Appliance Labelling Scheme (PALS) encourages the purchase of more energy-efficient imported appliances, though enforcement remains a challenge. The Energy Efficiency Act of 2016 further strengthens this commitment by promoting energy efficiency and regulating the import, use, and sale of electrical appliances, specifically targeting inefficient models. Tuvalu's updated Nationally Determined Contribution (NDC) sets a target to increase energy efficiency by 30% in Funafuti, with plans to extend this target to the outer islands. These initiatives primarily affect the residential, commercial (including hotels and government buildings), and potentially industrial (e.g., cold storage) sectors. Specific energy efficiency measures being promoted include building insulation upgrades, LED lighting transitions, and the adoption of more efficient cooling technologies (e.g., high-efficiency air conditioners).

Tuvalu's NDC Implementation Roadmap and Plan has identified two mitigation opportunities that focus on energy efficiency. These are outlined in Table 5 below. The mitigation opportunities have:

- Potential to reduce GHG emissions by 0.852 kt CO<sub>2</sub>e by 2030
- An annual GHG mitigation potential of 0.134 kt CO<sub>2</sub>e in 2030
- An indicative investment need of US\$265,000 by 2030.

**Table 39: Energy Efficiency mitigation opportunities**

| Opportunity                                                          | Indicative investment needs to 2030 (US\$) | Annual GHG emissions reduction in 2030 (kt CO <sub>2</sub> e) | Cumulative GHG emissions reduction by 2030 (kt CO <sub>2</sub> e) | Implementation timeframe |
|----------------------------------------------------------------------|--------------------------------------------|---------------------------------------------------------------|-------------------------------------------------------------------|--------------------------|
| <b>Energy Efficiency</b>                                             |                                            |                                                               |                                                                   |                          |
| Retrofitting of major hotels and commercial and government buildings | 140,000                                    | 0.086                                                         | 0.516                                                             | 2022-2026                |



|                                |         |       |       |           |
|--------------------------------|---------|-------|-------|-----------|
| Cold storage energy efficiency | 125,000 | 0.048 | 0.336 | 2023-2030 |
|--------------------------------|---------|-------|-------|-----------|

The annual GHG mitigation potential will be estimated based on projected reductions in energy consumption resulting from the implementation of the identified energy efficiency measures. This estimation likely involves a combination of 1) establishing a baseline energy consumption for targeted sectors (commercial, public, industrial); 2) estimating potential energy savings from each specific measure; 3) projecting future activity levels in 2030 for the targeted sectors; and 4) applying relevant emission factors to the estimated energy savings. The specific details of the methodology, including data sources, assumptions, and models will be documented for transparency and accuracy in future versions.

A list of existing, recently completed, and pipeline energy efficiency projects is included in Annexure 2. Effective monitoring and evaluation are crucial. This includes establishing robust data collection and analysis systems to track energy consumption patterns, assess progress toward the 30% target, and inform future policies. Specifically, data on energy savings achieved (e.g., kWh saved per capita) will be collected and analyzed. Future reporting will incorporate recent updates on Tuvalu's energy efficiency initiatives, including revisions to the Energy Efficiency Act, new programs (e.g., awareness campaigns, incentives), the development of specific energy efficiency standards, and information on any technical assistance received.

#### 3.8.1.4 AFOLU Sector

In 2023, Tuvalu's agriculture sector was the second largest GHG emitting sector and accounted for 8.53 kt CO<sub>2</sub>eq viz about 33% of the total GHG emissions (excluding removals). Tuvalu's Agriculture is dominated by subsistence agriculture and has traditionally been the preoccupation of Tuvaluan people and involves the cultivation of trees and crops and raising a limited number of pigs, chickens, and ducks. Crop production is primarily for subsistence, crops comprising coconut, babai (swamp taro), taro, breadfruit, pandanus, banana, pumpkin, sweet potatoes, and pawpaw. Advancing of farming systems with the introduction of exotic food crops and livestock has gradually progressed over the years. Livestock production in the country is at a subsistence level, with pigs and free-range chickens being the main livestock kept. Pigs are the main livestock raised nationally with 76.4% of households owning them. For outer islands, chicken followed by pigs is the most common type of livestock being raised by 88.2% and 75.8% of households respectively<sup>14</sup>. Most households at the outer islands keep a few pigs and a number of local chickens. There is opportunity for some import substitution through improved livestock management and production. A decisive factor determining increased livestock production is the cost of animal feed since such feed has to be imported. The 2017 census recorded a total 27 546 livestock and poultry (chickens and ducks) in Tuvalu in November 2017<sup>15</sup>. This included 10,894 pigs, 15, 443 chickens and 1,209 ducks. When compared with livestock counts reported in the previous 2012 Census, the number of pigs and poultry all declined. Poultry flock numbers experienced the largest decline, with chicken numbers decreasing by 20 percent between 2012 and 2017, and duck numbers experiencing a decline of 34 percent. These reductions were reflective of the reduced number of poultry households reported in 2017.

<sup>14</sup> Tuvalu Population & Housing Mini-Census 2017 Report, Central Statistics Division of the Government of Tuvalu. Funafuti, Tuvalu. <https://stats.gov.tv/census/#81-85-population-and-housing-census>

<sup>15</sup> Anon. 2021. Tuvalu agriculture and fisheries report: based on the analysis of the 2017 population and housing census. Tuvalu, Funafuti: Central Statistics Division (CSD) of the Government of Tuvalu. 102 p. <https://stats.gov.tv/news/tuvalu-agriculture-and-fisheries-report/>



Tuvalu's mitigation targets and initiatives are limited to the Energy sector and the updated NDC does not include any mitigation targets for the AFOLU sector. Moreover, Agriculture was not included in the current NDC Implementation Roadmap and Investment Plan.

### 3.8.1.5 Waste Sector

In 2023, GHG emissions from the waste sector were 1.56 kt CO<sub>2</sub>eq (1.14 kt CO<sub>2</sub>eq- MSW disposal and 0.412 kt CO<sub>2</sub>eq- domestic wastewater treatment and discharge) viz about 6% of the total GHG emissions (excluding removals). Alike the AFOLU sector, there are no mitigation initiatives identified for the waste sector and neither thus the updated NDC targets include any target for this sector.

Tuvalu's Integrated Waste Policy and Action Plan 2017-2026 outlines strategic goals and actions to support waste management in Tuvalu. These include introducing waste reduction and resource recovery programs, improving waste collection services on the outer islands, and creating, amending, and updating laws, regulations, and policies to support waste reduction<sup>16</sup>. The Plan also includes an activity to undertake a baseline survey of existing waste conditions and services and regular collection of data. Work undertaken by Tuvalu's Department of Waste Management (DWM), SPREP, and the JPRISM project has improved solid waste collection and the capture of sector data, such as the amount of solid waste sent to the landfill daily<sup>17</sup>.

As an atoll island with limited land resources, Tuvalu faces several challenges in delivering and expanding current waste management systems. In addition to land barriers and space restrictions, there are several complications for the waste management industry in Tuvalu. The private sector is small and has limited capacity in terms of equipment and other resources. Like many of its neighbouring PICs, Tuvalu is at a critical point, with landfill space close to capacity and limited systems in place for recycling and recovery of recyclable materials, especially plastics, glass, and bulky waste. Most recently, Tuvalu has implemented a Waste Management Levy and has banned the import of single-use plastic under the Waste Management (Prohibition on the Importation of Single-Use Plastic) Regulation 2019. These two regulations, in addition to the Litter Waste Management (Littering and Disposal) Regulation 2018, are set to significantly change the way Tuvalu manages waste. There is one local recycling operator currently collecting scrap metals across Funafuti.

Recyclable materials that are not currently being considered through any recycling or recovery scheme account for almost 30% of the waste stream. Future projects involving the recovery of Cardboard offer the highest savings in landfill and fill space and more than 20% diversion from landfills.

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<sup>16</sup> Tuvalu Integrated Waste Policy and Action Plan 2016, <https://tuvalu-data.sprep.org/system/files/Tuvalu%20Integrated%20Waste%20Policy%20%26%20Action%20Plan.pdf>

<sup>17</sup> PRIF (2019), Tuvalu: Waste Audit Report, [https://tuvalu-data.sprep.org/system/files/Tuvalu%20Waste%20Audit%20Report\\_2019\\_Final%20v1.1.pdf](https://tuvalu-data.sprep.org/system/files/Tuvalu%20Waste%20Audit%20Report_2019_Final%20v1.1.pdf)

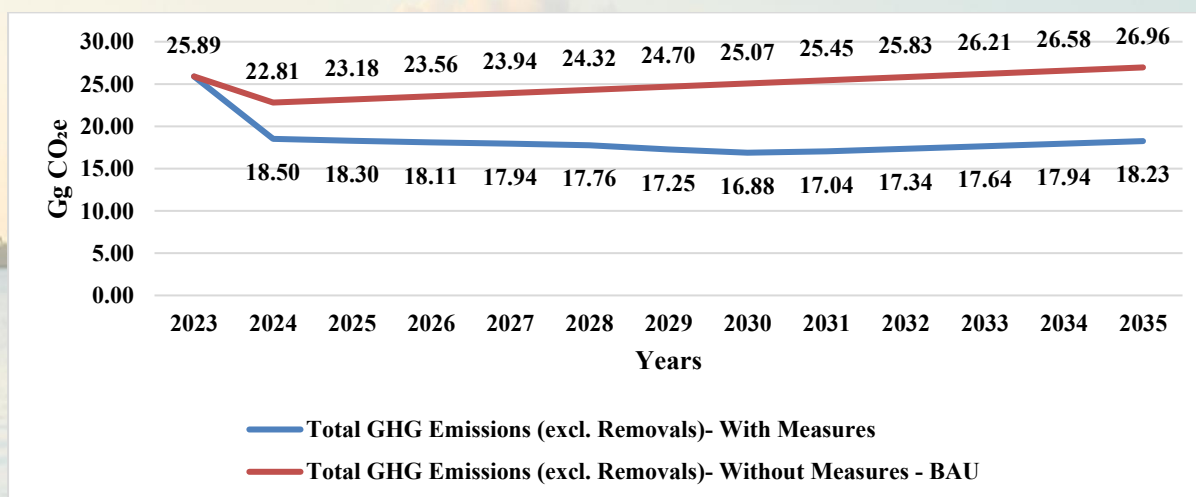


### 3.9 GHG Emissions Scenario – ‘Without Measures’ and ‘With Measures’

This section of the report projects Tuvalu's GHG emissions to 2030, aligning with the end point of its NDC under Article 4 of the Paris Agreement. In accordance with paragraph 95 of the MPGs, Tuvalu has exercised flexibility regarding the provision of projections, opting to extend its projections to 2030. GHG projections are estimates of future emissions based on assumptions about how emission-causing activities may change over time. Two scenarios are presented:

- (1) **Without Measures (WoM) Scenario:** This scenario presents a business-as-usual (BAU) projection of Tuvalu's GHG emissions between 2020-2030. It is assumed that emissions will continue to increase with the current trend and that no GHG abatement measures will be implemented.
- (2) **With Measures (WM) Scenario:** This scenario is built on the assumption that all of the mitigation opportunities identified in the previous section are being implemented and planned. It is important to note that these scenarios do not include emissions and removal from land-use change and forestry.

**Figure 38. Projected GHG Emissions Reduction Scenarios**



**Without Measures (WoM) Scenario:** In the WoM/BAU scenario, Tuvalu's GHG emissions (excluding removals) are projected to reach 25.07 kt CO<sub>2</sub>e by 2030. This indicates an increase in GHG emissions by about 34% between 2021-2030. The energy sector will continue to dominate the total GHG emissions (11.81 kt CO<sub>2</sub>e viz approx. 47%). This is followed by the agriculture sector (11.39 kt CO<sub>2</sub>e viz approx. 45%) and the waste sector (1.87 kt CO<sub>2</sub>e viz approx. 7%) respectively.

**With Measures (WM) Scenario:** Under the mitigation scenario i.e. With Measures Scenario, It is projected that the GHG emissions will reach 16.88 kt CO<sub>2</sub>e by 2030 indicating a reduction of about 49% compared to the BAU scenario. The agriculture sector will be the dominant GHG emitting sector, contributing about 68% of the total GHG emissions. While the remaining will come from energy (21%) and waste sector (11%). Under this scenario, it is projected that the implementation of identified mitigation measures in the energy sector will reduce the energy sector GHG emissions by 227% compared to the BAU scenario by 2030.

## 3.10 Methodology, Model, and Assumptions

### 3.10.1 Methodology, Model, and Assumptions for Tuvalu's NDC Implementation

This section provides a comprehensive overview of the methodologies, assumptions, models, and parameters used in estimating greenhouse gas (GHG) emissions reductions and removals from Tuvalu's mitigation actions, policies, and measures. The information presented aligns with Tuvalu's updated Nationally Determined Contribution (NDC), the NDC Implementation Roadmap, and Investment Plan, addressing the requirements stipulated under the Paris Agreement's Modalities, Procedures, and Guidelines (MPGs).

#### 3.10.1.1 Key Elements of the Methodology

1. Methodologies and Models Used for Estimations
2. Key Assumptions and Parameters for Projections
3. Methodological Changes Since Previous Reporting
4. Assumptions for 'Without Measures', 'With Measures', and 'With Additional Measures' Projections
5. Sensitivity Analysis of Key Projections

#### 3.10.1.2 Methodologies and Models Used for Estimations

In line with the objectives outlined in Tuvalu's NDC and the UNFCCC transparency requirements, the following methodologies and models are utilized to estimate GHG emissions reductions and removals:

- **IPCC 2006 Guidelines for National Greenhouse Gas Inventories:** These guidelines are applied as the primary methodological framework for emissions accounting across all sectors, ensuring that estimations meet international consistency and comparability standards. Tuvalu primarily employs the Tier 1 approach, using default emission factors and available activity data to estimate emissions. Given data and capacity limitations, this approach aligns well with Tuvalu's resources.
- **Data Sources and Collection:**
  - **Energy Sector:** Data on energy consumption, fuel use, and electricity generation is derived from utility records and surveys.
  - **Agriculture, Forestry, and Other Land Use (AFOLU) Sector:** Remote sensing, field surveys, and national statistics inform land use data, including rates of deforestation, reforestation, soil carbon stocks, livestock population, and projections.
  - **Waste Sector:** Waste generation rates, composition, and management practices are estimated using surveys, characterization studies, and waste management records and reports.

#### 3.10.1.3 Key Assumptions and Parameters for Projections

Projections are based on several assumptions that shape GHG estimates, including economic, demographic, and sector-specific assumptions:

- **Economic Growth Rate (GDP):** Tuvalu's economic growth, crucial for understanding its GHG emissions trajectory, has been volatile. World Bank data shows fluctuating GDP growth rates, with 2021 seeing a modest 1.8% increase after a decline in 2020 due to the COVID-19 pandemic. The long-term economic outlook remains uncertain due to challenges like climate change impacts, limited natural resources, and reliance on foreign aid. The Asian Development Bank projects GDP growth of 3.5% for 2024 and 2.4% for 2025. Analyzing Tuvalu's economic landscape is essential for assessing the feasibility and impact of its renewable energy targets. While GDP per capita has generally trended upwards, increasing from US\$3,025 in 2010 to



US\$6,345 in 2023 (World Bank Data), this growth has not consistently correlated with GHG emission reductions. For projection purposes, GDP per capita until 2030 has been linearly forecasted based on available World Bank data up to 2023, reaching US\$8,055 in 2030. This disconnects between GDPs per capita growth and GHG emissions highlights the complex relationship between economic development and environmental impact in Tuvalu.

- **Population Growth Rate:** Tuvalu's population projections, crucial for GHG emission estimates, are based on a complex interplay of past, present, and future trends. Historically, slow and uneven growth, influenced by migration, has characterized Tuvalu's population. Currently, based on the 2017 census (10,645 residents) and recent data suggesting a slight decline, the population is youthful with a trend towards urbanization, particularly in Funafuti. Future projections, using SPC (2013) data, estimate a gradual increase to 13,300 by 2025 and 15,600 by 2035, though these projections are subject to uncertainties related to migration (including potential climate displacement), fertility, and mortality rates. These projections serve as a baseline for the BTR while acknowledging data limitations and the need for further research to refine future estimates.
- **Renewable Energy Transition:** Tuvalu, a small island nation, is actively transitioning to renewable energy to reduce its reliance on fossil fuels and mitigate climate change impacts. Its ambitious NDC commits to achieving 100% renewable energy by 2030, primarily through the deployment of solar PV systems with battery storage across its inhabited islands. While solar power currently contributes around 14% to the national energy mix, ongoing projects funded by international donors and the government's strong commitment are driving significant progress towards this goal.
- **Waste Management Improvements:** Tuvalu's Waste Survey Report 2017 provides the waste characterization, per capita waste generation rate, and other relevant details for estimating and projecting waste sector emissions. Tuvalu has made progress in waste management, particularly in waste collection and hazardous waste management. However, challenges remain in scaling up recycling and waste reduction programs and developing waste-to-energy technologies. To achieve significant GHG emission reductions, Tuvalu needs to accelerate waste diversion efforts, expand waste processing capacity, and enhance community engagement.
- **Agriculture:** The 2017 Population and Housing Census and the 2002 census data were used to estimate livestock populations and trends in Tuvalu's Agriculture and Fisheries Report. Tuvalu has made some progress in reducing agricultural emissions, particularly through biogas projects. However, broader adoption of sustainable farming practices and improved soil management is needed. To meet its 2030 targets, Tuvalu must scale up climate-smart agriculture, expand biogas initiatives, and strengthen policy frameworks and capacity-building programs.

#### 3.10.1.4 Methodological Changes Since Previous Reporting

Since this is Tuvalu's first Biennial Transparency Report, there is no prior report for comparison. However, future BTR submissions will document any methodological updates driven by enhanced data availability, analytical improvements, or changes in international best practices. Areas identified for methodological refinement include sectoral data accuracy across islands and sector-specific emissions factors.

#### 3.10.1.5 Assumptions for 'Without Measures', 'With Measures', and 'With Additional Measures' Projections

A 'with measures' scenario encompasses currently implemented and adopted policies and measures. A 'with additional measures' scenario encompasses implemented, adopted, and planned policies and measures. A 'without measures' projection excludes all policies and measures implemented, adopted,



and planned after the year chosen as the starting points for the projection. To evaluate Tuvalu's potential emissions pathways, three projection scenarios are outlined in accordance with the MPGs definitions:

- **'Without Measures' (WoM) Projections:** This scenario provides a baseline that assumes no mitigation policies or measures beyond those in place before the starting point for Tuvalu's emissions projections, set as the year 2023. It excludes any implemented, adopted, or planned actions. The WoM projection offers a Business-as-Usual (BAU) scenario, estimating emissions trends if current practices in energy use, waste management, and agriculture remain unchanged. This scenario serves as a reference point for measuring the future impacts of policy changes up to 2030, aligning with Tuvalu's Updated NDC timeline.
- **'With Measures' (WM) Projections:** This scenario includes all mitigation policies and measures currently implemented and adopted by Tuvalu as outlined in Tuvalu's NDC Implementation Roadmap and Investment Plan. These include six specific GHG mitigation initiatives: two in land transport, two in maritime transport, and two in electricity energy efficiency. Tuvalu aims to achieve 100% renewable energy in the electricity sector by 2030, increase energy efficiency in Funafuti by 30%, and reduce total GHG emissions from the entire energy sector to 60% below 2010 levels by 2030. This projection assumes timely funding and effective project execution, capturing emissions trends based on Tuvalu's current climate actions through 2030, without considering future planned policies and measures.
- **'With Additional Measures' (WAM) Projections:** In accordance with paragraph 95 of the MPGs, Tuvalu has exercised flexibility regarding the provision of projections, opting to extend its projections to 2030. This scenario builds on the 'With Measures' (WM) scenario by incorporating planned future policies and measures that are not yet implemented, aiming to expand emissions reductions based on both existing and anticipated climate initiatives. The WAM projection includes policies aligned with Tuvalu's commitment to a zero-carbon development pathway by 2050, as well as enhancements in waste treatment, biogas digester deployment, and livestock management practices, supported by development partners. These projections assume timely planning, adequate funding, and effective project execution, positioning Tuvalu to achieve its ambitious climate targets. The outcomes of these projections will be detailed in Tuvalu's second Biennial Transparency Report (BTR).

By presenting these "Without Measures," "With Measures," and "With Additional Measures" scenarios, Tuvalu can effectively analyze the impact of its planned and implemented climate actions against a baseline scenario, providing insights into the effectiveness of policies aimed at achieving its NDC targets.

#### 3.10.1.6 Sensitivity Analysis of Key Projections

Sensitivity analyses guide the GHG reduction projections against variations in key assumptions:

- **Renewable Energy Implementation Timeline:** Alternative scenarios consider potential delays in achieving the 100% renewable target by 2030 due to logistical or financial constraints. If PV installation is delayed, alternative solutions like smaller PV systems or biofuel-powered backup generators could be deployed.
- **Economic and Population Growth Variability:** Higher-than-expected economic activity or population growth would likely increase energy demand and emissions from waste and agriculture. Contingency measures, including energy efficiency and intensified waste reduction, could be incorporated to mitigate these impacts.
- **Sector-Specific Sensitivity in Waste Management:** Projections also account for variances in waste composition and management practices. Lower-than-expected emission reductions could



be countered by implementing additional recycling programs or methane capture technologies, public awareness campaigns, strengthening policy frameworks, and institutional capacity. These sensitivity analyses confirm the robustness of Tuvalu's mitigation strategies, although successful outcomes hinge on continuous international funding and technical support.

#### **3.10.1.7 Conclusion**

This methodological framework for estimating GHG reductions aligns with Tuvalu's updated NDC and implementation roadmap, meeting MPG requirements and ensuring transparency in tracking emissions. By aligning with the MPGs, Tuvalu is well-positioned to report on mitigation progress effectively, adapt strategies in response to new challenges, and leverage international support for its climate goals.

### **3.11 Conclusion**

Tuvalu is the world's second lowest-lying country and sea level rise poses a fundamental risk to its very existence. With the current commitments expressed in the NDCs imply global warming of about 3°C above pre-industrial levels by 2100 it is difficult to be optimistic in terms of conclusions for any specific country such as Tuvalu. The effective implementation of mitigation measures would require accessibility, availability, and timely provision of financial resources, technology, and capacity-building support.

## 4 Chapter 4: Climate Change Impacts and Adaptation Under Article 7

This chapter provides an extensive overview of Tuvalu's strategies, policies, plans, goals, actions, and progress related to climate change adaptation. It aligns with the Modalities, Procedures, and Guidelines (MPGs) under Article 7 of the Paris Agreement. It ensures comprehensive coverage of all sectors and initiatives while employing updated data and information to track progress and inform future actions related to climate change impacts and adaptation under Article 7 of the Paris Agreement.

### 4.1 National Circumstances, Institutional Arrangements, and Legal Frameworks

#### 4.1.1 Bio-geophysical and Environmental Characteristics

##### Geographic Profile and Climate Vulnerabilities:

Tuvalu, a Pacific atoll nation composed of nine islands over 26 square kilometres, faces critical vulnerabilities due to its low-lying geography. The highest natural elevation is around 4.6 meters above sea level, with most areas below 2 meters, exposing Tuvalu to high risk from sea-level rise, storm surges, and coastal erosion. Sea-level rise has been increasing by an average of 5 mm per year, and projections indicate a rise of 50–100 cm by 2100, which poses a major threat to Tuvalu's habitability and infrastructure.

- **Climate and Extreme Events:** Tuvalu's climate is defined by two distinct seasons, with tropical cyclones frequently affecting the wet season (November to April). The intensity and frequency of cyclones are expected to increase due to climate change, contributing to coastal flooding and groundwater salinization. The 2022 Tuvalu Meteorological Report indicates higher variability in rainfall, increased drought occurrence, and a 1.1°C increase in average temperature from pre-industrial levels, which impact agriculture, water resources, and ecosystems.
- **Ecosystem and Biodiversity:** Tuvalu's coastal ecosystems, including coral reefs, mangroves, and seagrasses, play crucial roles in natural coastal protection and biodiversity. Coral reefs support the livelihoods of nearly 50% of the population, and mangroves offer protection against erosion. However, rising ocean temperatures and acidification have increased coral bleaching, threatening biodiversity and fish stocks. The Coastal Management Strategy (CMS) emphasizes reef and mangrove restoration as an ecosystem-based adaptation strategy.

#### 4.1.2 Demographic and Socioeconomic Context

##### Population Distribution and Socioeconomic Dependencies:

Tuvalu's population was 10,645 according to the 2017 Census, with 63.1% (6,716 people) residing in urban areas, primarily in the capital, Funafuti. This concentration of population in Funafuti places increased pressure on the island's limited resources and infrastructure. Urbanization has heightened the demand for freshwater, food, and energy resources, stretching Tuvalu's limited adaptive capacity. The remaining 36.9% (3,929 people) live in rural areas across the other inhabited islands. Employment is primarily in the public sector, subsistence agriculture, fishing, and remittances from overseas, which contribute nearly 40% of household incomes. The 2023 Household Income and Expenditure Survey



highlights these dependencies and underscores the vulnerability of Tuvalu's economy to climate shocks. It is important to note that while the 2017 Census provides a valuable snapshot, the population may have changed since then. However, using the most reliable data available, the census is crucial for accuracy.

- **Economic Vulnerability:** Tuvalu's economy is highly vulnerable to the impacts of climate change and external economic shocks. A significant portion of its revenue is derived from fisheries licensing fees, remittances, and the Tuvalu Trust Fund. Climate-induced events, such as sea-level rise, coastal erosion, and extreme weather, pose significant threats to these income sources. Disruptions to fisheries, tourism, and other economic activities could have severe consequences for Tuvalu's economic stability.

To address these challenges, Tuvalu's National Strategies prioritizes diversifying the economy, promoting sustainable development, and building resilience to climate change. However, the country's limited resources, geographic constraints, and reliance on international aid pose significant challenges to economic diversification and climate adaptation.

According to the United Nations Development Programme (UNDP), Tuvalu is one of the most vulnerable countries to climate change. The country's low-lying islands are at risk of inundation from rising sea levels, and its coastal ecosystems are threatened by erosion and saltwater intrusion. These impacts could have devastating consequences for Tuvalu's economy, environment, and society.

### 4.1.3 Infrastructure Resilience and Adaptive Capacity

#### Water and Food Security:

Tuvalu's water and food security are significantly threatened by climate change impacts, such as sea-level rise, saltwater intrusion, and extreme weather events. The limited availability of freshwater resources, coupled with increasing water demand, poses a significant challenge to the country's sustainability.

- **Water Security:**
  - **Water Scarcity:** Tuvalu's freshwater resources are predominantly rainwater, which is subject to variability due to climate change.
  - **Desalination:** To address water scarcity, the government has invested in desalination plants, particularly on outer islands. However, the high energy consumption and operational costs associated with desalination pose challenges.
  - **Water Storage:** A significant portion of households in Tuvalu lack adequate water storage capacity, making them vulnerable to water shortages during dry periods.
- **Food Security:**
  - **Climate-Induced Challenges:** Climate change impacts, such as saltwater intrusion, soil degradation, and extreme weather events, pose significant threats to agriculture and food production.
  - **Import Dependency:** Tuvalu relies heavily on food imports, making it vulnerable to global food price fluctuations and supply chain disruptions.
  - **Resilient Agriculture:** To enhance food security, the government has implemented the Agricultural Resilience and Innovation Program (2022), which focuses on promoting climate-

resilient agriculture practices, such as salt-tolerant crop varieties and sustainable farming techniques.

To mitigate these challenges, Tuvalu requires sustained investments in water infrastructure, climate-resilient agriculture, and disaster risk reduction measures. Additionally, international cooperation and support are essential to help Tuvalu adapt to the impacts of climate change and build a sustainable future.

### **Infrastructure Challenges:**

Tuvalu's low-lying coastal infrastructure, including schools, healthcare facilities, and government buildings, is highly vulnerable to the impacts of climate change, such as sea-level rise, coastal erosion, and extreme weather events. The Infrastructure Resilience Plan (IRP) outlines strategies to mitigate these risks and protect critical infrastructure.

#### **Key challenges and adaptation measures include:**

- **Sea-Level Rise:** The rising sea levels pose a significant threat to coastal infrastructure. To address this, the IRP emphasizes the importance of elevating critical infrastructure, such as schools, health clinics, and government buildings.
- **Coastal Erosion:** Coastal erosion is another major concern, as it can undermine the structural integrity of coastal infrastructure. To mitigate erosion, the IRP promotes the implementation of coastal defense systems, such as seawalls and raised roads.
- **Extreme Weather Events:** Tuvalu is susceptible to extreme weather events, including cyclones and storm surges. The IRP highlights the need for resilient infrastructure design, including the use of climate-resistant materials and construction techniques.
- **Relocation:** As a last resort, the IRP considers the relocation of communities from high-risk areas to safer locations. However, this is a complex and challenging process, requiring careful planning and significant resources.

While the IRP provides a roadmap for building resilience, the implementation of these measures faces significant challenges, including limited financial resources, technical expertise, and institutional capacity. International cooperation and support are crucial to help Tuvalu address these challenges and safeguard its critical infrastructure.

## **4.2 Institutional Arrangements and Governance**

Tuvalu's institutional arrangements for climate change mitigation and adaptation are closely intertwined. However, specific institutional arrangements have been established to address adaptation challenges. Below is a description of the institutional arrangement for Tuvalu's adaptation.

### **4.2.1 National Institutional Framework for Climate Adaptation**

The Climate Change Resilience Act of 2019 provides the foundation for Tuvalu's climate resilience and adaptation efforts, establishing responsibilities across several critical entities that collaborate to implement adaptation actions and align with international reporting obligations.

- **Climate Change Department (CCD):** Operating under the Ministry of Home Affairs, Climate Change and Environment (MHACCE), the CCD leads the development and implementation of national climate policies and adaptation projects, manages international funding, and coordinates with UNFCCC standards. It is also responsible for mobilizing climate finance and liaising with



international partners to advance Tuvalu's climate goals outlined in the Nationally Determined Contributions (NDC).

- **National Advisory Council on Climate Change (NACCC):** Established in 2018, the NACCC includes representatives from government ministries, local councils, NGOs, and the private sector. It provides oversight for adaptation strategies, prioritizes projects based on vulnerability assessments, and ensures integration with Tuvalu's broader national development objectives. The NACCC facilitates consultations to engage stakeholders and align adaptation actions with local needs, playing a key role in integrating climate change issues into diverse sectors.
- **Island Councils and Community Committees:** The Falekaupule Act of 2008 grants the Island Councils the authority to implement climate adaptation measures in local communities, working closely with the NACCC and CCD. These councils engage in grassroots projects such as mangrove restoration and water conservation, fostering community-driven adaptation efforts.

**Existing Institutional Mechanisms to Support Adaptation Planning and Decision-Making:** Tuvalu's adaptation planning, especially through the National Adaptation Plan (NAP), builds upon existing institutional structures, incorporating lessons learned from past projects and facilitating multi-level engagement.

- **Project Advisory Boards for Multi-Stakeholder Engagement:** Advisory boards comprising national, island, and community representatives have demonstrated their value in adaptation planning (e.g., through NAPA and Ridge-to-Reef (R2R) projects). These boards support engagement and decision-making across diverse levels, contributing to effective adaptation strategy formulation.
- **NACCC as a Platform for Integrated Climate Actions:** As highlighted by Morioka et al. (2019), the NACCC serves as a mechanism to integrate climate considerations into cross-sectoral policies and actions. Regular NACCC meetings enable information sharing among government bodies, NGOs, and other stakeholders, supporting data-informed and inclusive adaptation decisions. The council has also become a platform for gender and social inclusion, promoting advocacy for vulnerable groups in climate adaptation planning.

**Suggested Actions to Enhance Institutional Arrangements for Adaptation:** The current institutional framework can be strengthened to support Tuvalu's National adaptation process and to foster more inclusive, transparent, and resilient adaptation actions. Suggested actions include:

- **Establish a Permanent Technical Working Group:** To reinforce the linkage between national and subnational planning, a permanent NAP technical working group under NACCC could be established. This group would include technical officers from both government and civil society, with a mandate to facilitate vertical integration of adaptation priorities and actions. The group would also support the technical aspects of adaptation projects, ensuring that the NAP aligns with Tuvalu's national and local contexts.
- **Strengthen Collaboration with Civil Society and Faith-Based Organizations:** Horizontal and vertical integration requires robust collaboration between formal government institutions, Island Kaupule, civil society, and faith-based organizations. Given Tuvalu's small and interconnected population, these organizations often operate in sectors sensitive to climate impacts, making them key partners in community adaptation efforts.
- **Enhance Private Sector Engagement:** Dialogue with micro-, small, and medium-sized enterprises (MSMEs) in Funafuti and the outer islands is essential for aligning adaptation measures with economic opportunities. Legislative or regulatory changes from the NAP process may affect these businesses, but they also create potential for new opportunities in priority adaptation areas such as water and food security, and resilient infrastructure.



**Opportunities for Improved Governance and Accountability:** Enhancing governance mechanisms can support long-term adaptation planning, particularly in achieving transparency and fostering public trust in adaptation actions. Key opportunities include:

- **Parliamentary Committee on NAP:** A Parliamentary Committee on NAP could provide high-level oversight, ensuring that the NAP aligns with Tuvalu's sustainable development goals and is shielded from political shifts. This committee, consisting of parliament members, would convene semi-annually to review progress, monitor accountability, and ensure that adaptation actions adhere to the broader national agenda.
- **Annual National Climate Change Resilience Forum:** Enacting Section 18 of the Climate Change Resilience Act, the National Climate Change Resilience Forum could serve as a participatory platform to guide NAP implementation. This forum would include representatives from government, civil society, the private sector, and development partners, enhancing transparency, and fostering collaboration. Convened annually, it would provide a venue for stakeholders to discuss adaptation progress, share insights, and co-develop strategies.

This detailed framework aligns with the Modalities, Procedures, and Guidelines (MPGs) set forth by the UNFCCC, establishing a cohesive institutional arrangement to support Tuvalu's adaptation initiatives. By building on existing structures and fostering inclusive engagement, Tuvalu's NAP process can address current climate risks and build long-term resilience across its communities.

#### **Decision-Making, Monitoring, Reporting, and Review:**

The Climate Change Department (CCD) within the Ministry of Home Affairs, Climate Change and Environment (MHACCE) will be responsible for monitoring and reviewing the policy's implementation. The CCD will develop a dedicated Monitoring and Evaluation Framework aligned with the targets and indicators of Te Kete, SDGs 13 and 14, and the UNFCCC Paris Agreement. The policy's implementation will be tracked through existing mechanisms: the National Strategy for Sustainable Development Te Kete (quarterly reporting), the CCD's Annual Report, and the National Advisory Council on Climate Change (NACCC) monthly meetings. A mid-term review in 2024 will assess progress and inform a revised implementation plan for 2025-2030. A final review in 2030 will align with global and national reviews of the SDGs and other relevant agreements.

- **Decision-Making Protocols:** Adaptation actions are guided by vulnerability assessments conducted by the CCD and scientific input from the Pacific Climate Change Science Program. The National Climate Change Monitoring and Evaluation (M&E) Framework (to be prepared) will be used to track project progress and outcomes, reporting biannually to the NACCC for adaptation projects funded by the Green Climate Fund (GCF), Adaptation Fund (AF), and other multilateral donors.
- **Cross-Sectoral Coordination:** Climate adaptation actions are integrated across sectors, including health, water, infrastructure, and agriculture. The NAP specifies inter-ministerial cooperation mechanisms for cross-cutting adaptation actions, such as water resource management, food security, and ecosystem protection.
- **Data Collection and Governance:** Data collection is managed by the CCD in coordination with the Tuvalu Meteorological Service, focusing on indicators such as sea level, temperature, rainfall, and biodiversity health. The National Climate Data Repository will be established to centralize data for use in policy development, adaptation planning, and transparent reporting under UNFCCC requirements.



### 4.3 Legal and Policy Frameworks and Regulations

Tuvalu's legal and policy framework for climate change adaptation is centered around the Climate Change Department (CCD) within the Ministry of Home Affairs, Climate Change and Environment (MHACCE). The CCD is responsible for coordinating and implementing climate change policies and strategies, including the National Adaptation Plan (NAP). The National Advisory Council on Climate Change (NACCC) provides high-level guidance and support to the CCD.

#### Legal and Policy Frameworks

Tuvalu, a small island nation highly vulnerable to climate change, has established a robust legal and policy framework to address the challenges posed by climate change. This framework provides the foundation for implementing adaptation measures, mobilizing resources, and building resilience.

#### Key Legal and Policy Instruments

- **Tuvalu Climate Change Resilience Act (2019):**
  - Provides the overarching legal framework for climate change action in Tuvalu.
  - Establishes the Climate Change Department (CCD) as the primary agency responsible for climate change coordination and implementation.
  - Outlines the roles and responsibilities of key stakeholders, including government agencies, civil society organizations, and the private sector.
  - Provides a legal basis for the development and implementation of climate change policies, plans, and strategies, including the National Adaptation Plan (NAP).
- **National Adaptation Plan (NAP):**
  - Outlines Tuvalu's long-term adaptation strategies and priorities, focusing on sectors such as water security, food security, and infrastructure.
  - Identifies specific adaptation actions and projects and prioritizes them based on vulnerability assessments and risk analysis.
  - Provides a roadmap for implementing adaptation measures and mobilizing resources.
- **National Adaptation Programme of Action (NAPA):**
  - Outlines immediate adaptation priorities and projects, particularly in the areas of water resource management, agriculture, and coastal zone management.
  - Focuses on community-based adaptation initiatives and small-scale projects.
- **National Strategy for Sustainable Development (Te Kete):**
  - This overarching development plan integrates climate change adaptation and mitigation into various sectors, including infrastructure, agriculture, and tourism.
  - Provides a framework for sustainable development, with a strong emphasis on climate resilience.
- **Environmental Protection Act (Amendment) 2017:**
  - Strengthens environmental protection and mandates environmental impact assessments (EIAs) for development projects.

- Ensures that development projects are designed to be climate-resilient and minimize environmental impacts.
- **Disaster Management Act 2008:**
  - Provides a legal framework for disaster risk reduction and management, including climate-related disasters.
  - Outlines measures for early warning systems, evacuation plans, and post-disaster recovery.
- **Water Resources Management Policy (2021):**
  - Addresses water security challenges in Tuvalu, promoting sustainable water use practices, including rainwater harvesting, desalination, and efficient water management.

### International and Regional Commitments and Partnerships

Tuvalu is an active member of the United Nations Framework Convention on Climate Change (UNFCCC) and has ratified the Paris Agreement. The country is committed to implementing ambitious climate actions and has submitted its Nationally Determined Contributions (NDCs) to the UNFCCC Secretariat, with its initial submission ahead of COP 21 in 2015. Tuvalu was among the first six Pacific Island nations to ratify the Paris Agreement on 22 April 2016, demonstrating its commitment to global climate action.

Tuvalu also collaborates with various regional and international organizations, such as the Pacific Islands Forum, the Pacific Community, and the United Nations Development Programme (UNDP), to access technical and financial support for climate adaptation initiatives. A key regional document guiding these efforts is the Framework for Resilient Development in the Pacific (FRDP) 2017-2030, endorsed by Pacific Island Forum Leaders in 2016. The FRDP supports the 2030 Agenda for Sustainable Development, the Sendai Framework for Disaster Risk Reduction 2015-2030, the World Humanitarian Summit, and Tuvalu's obligations under the UNFCCC, as well as other relevant regional agreements.

Tuvalu's climate policy aligns closely with the Goals 1 and 2 of the FRDP, emphasizing resilience and sustainable development. Additionally, the country incorporates commitments from other regional instruments, including the SIDS Accelerated Modalities of Action (S.A.M.O.A) Pathway, the Framework for Pacific Regionalism, the Boe Declaration on Regional Security, and the Kainaki II Declaration for Urgent Climate Action Now.

By leveraging these legal and policy frameworks, Tuvalu aims to build resilience against climate change, protect its natural resources, and promote sustainable development for its communities.

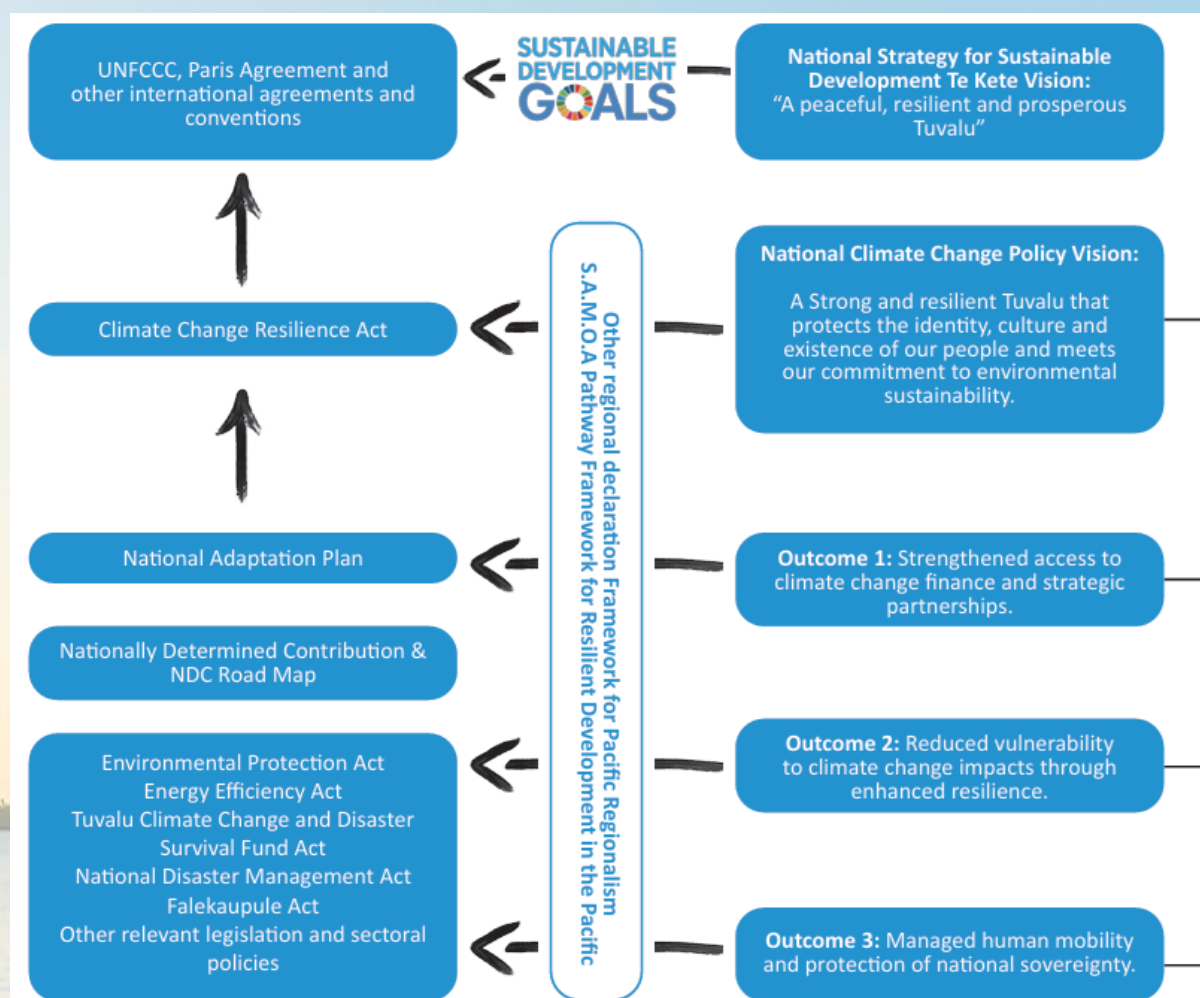
**Table 40: Relevant international and regional commitments**

| Conventions and Agreements                                     | Intent/Relevance to this Polic                                                                                                  | Date Ratified by Tuvalu |
|----------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------|-------------------------|
| United Nations Framework Convention on Climate Change (UNFCCC) | Limiting greenhouse gas (GHG) concentrations at a level that would prevent dangerous human interference with the climate system | 8 June 1992             |
| Kyoto Protocol                                                 | A legally binding agreement that commits industrialized countries to limit and reduce GHG emissions in accordance with agreed   | 16 November 1998        |



|                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                   |
|------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|
|                                                                  | individual targets for the period 2008-2012 (first commitment period).                                                                                                                                                                                                                                                                                                                                                                                                                  |                   |
| Doha Amendment to the Kyoto Protocol                             | Adopted for a second commitment period which covers 2013-2020. It identifies new commitments for limiting and reducing GHG emissions.                                                                                                                                                                                                                                                                                                                                                   | 4 December 2014   |
| Paris Agreement                                                  | Sets ambitious targets to limit global warming by well below 2 °C this century and even further to 1.5 °C above pre-industrial levels. The Paris Agreement aims to bolster the ability of most vulnerable countries to deal with the impacts of climate change through capacity building, technology transfer and finance flows, and it provides a more robust arrangement for countries to be transparent about the actions and support they undertake to meet the agreed obligations. | 22 April 2016     |
| 2030 Sustainable Agenda and Sustainable Development Goals (SDGs) | Adopted by all United Nations Member States in 2015 as a universal call to action to end poverty, protect the planet and ensure that all people enjoy peace and prosperity by 2030. There are 17 SDGs and 169 targets.                                                                                                                                                                                                                                                                  | 25 September 2015 |
| Framework for Resilient Development in the Pacific 2017-2030     | A voluntary regional policy framework that provides an integrated and all-stakeholder approach for addressing climate change and disaster risks. The FRDP has three goals: 1. Strengthened integrated adaptation and risk reduction to enhance resilience to climate change and disasters 2. Low carbon development 3. Strengthened disaster preparedness, response and recovery                                                                                                        | 8 September 2017  |
| SIDS Accelerated Modalities of Action (S.A.M.O.A) Pathway        | An outcome from the Third International Conference on SIDS. It recognises the special case of SIDS in achieving sustainable development, including the adverse impacts of climate change and sea level rise, in transgressing the development efforts made by SIDS.                                                                                                                                                                                                                     | 4 September 2014  |
| Framework for Pacific Regionalism                                | Articulates the region's collective identity as the "Blue Pacific" to reaffirm the connections of the Pacific people with their natural resources, environment, culture and livelihoods.                                                                                                                                                                                                                                                                                                | 29 July 2014      |
| Boe Declaration on Regional Security                             | Climate change is identified as the single greatest threat to the livelihoods, security and wellbeing of the Pacific people and the Pacific nations' commitment to progress the implementation of the Paris Agreement.                                                                                                                                                                                                                                                                  | 6 September 2018  |
| Kainaki II Declaration for Urgent Climate Action Now             | Calls for bold and transformative action to address the climate crisis faced by island nations and to urgently pursue efforts to limit global warming to 1.5°C above preindustrial levels.                                                                                                                                                                                                                                                                                              | 16 August 2019    |

**Figure 39: Policy linkage to legal and policy frameworks. Source: Te Vaka Fenua o Tuvalu: National Climate Change Policy 2021-2030**



## 4.4 Approaches, Methodologies, and Tools

To understand and address climate impacts in Tuvalu, a range of methodologies and tools are employed. These include climate modelling, vulnerability assessments, and community-based tools, each of which contributes to a more comprehensive understanding of Tuvalu's unique climate vulnerabilities and adaptation needs. However, these approaches also face limitations, particularly in terms of data availability and the resolution of climate projections for small islands.

### 4.4.1 Climate Modelling and Data Sources

- **Models Used:** This assessment integrates projections from the IPCC's Coupled Model Intercomparison Project Phase 5 (CMIP5) and recent updates from IPCC AR6. To refine projections, the Pacific-Australia Climate Change Science Adaptation Planning (PACCSAP) program provides regional data specific to the western Pacific, enhancing the reliability of temperature, precipitation, and sea-level projections for Tuvalu.
- **Emissions Scenarios:** The models utilize IPCC Representative Concentration Pathways (RCPs), ranging from low-emission (RCP2.6) to high-emission (RCP8.5) scenarios. Each scenario allows for a different trajectory of greenhouse gas emissions, providing a range of possible climate futures.



#### 4.4.2 Data Uncertainties

- **Model Limitations:** Climate models for small islands often struggle with limited spatial resolution, reducing the accuracy of localized climate projections. Additionally, the influence of ENSO phases introduces significant inter-annual variability in Tuvalu's climate, complicating long-term predictions.
- **Uncertainties in Sea-Level and Cyclone Intensity Projections:** Small-island models also face limitations in projecting precise changes in sea-level rise and cyclone intensity. These projections are particularly sensitive to variability in ENSO patterns, which are challenging to predict.

#### 4.4.3 Vulnerability Assessment Tools

##### Tuvalu Integrated Vulnerability Assessment

Between 2018 and 2021, the Government of Tuvalu conducted an Integrated Vulnerability Analysis (IVA) across all nine islands, with initial support from the Global NAP Network and the International Institute for Sustainable Development. The IVA framework, based on the IPCC's definition of vulnerability as a predisposition to be adversely affected, assessed vulnerability across seven human security sectors and five livelihood assets, resulting in 35 intersecting components. These components align with six priority sectors of Tuvalu's National Adaptation Plan (NAP): fisheries, agriculture, health, water, coastal protection, and disaster risk management (IPCC, 2014; Pacific Community et al., 2016).

Using a participatory rural appraisal approach, the National Advisory Council on Climate Change (NACCC) conducted focus group discussions across 14 communities, including six localities in Funafuti. Data were stored and analyzed using the Fulcrum platform, with findings validated through community workshops and synthesized into final reports for each island and locality (CSIRO, 2024).

##### Limitations of TIVA

The Tuvalu Integrated Vulnerability Analysis (TIVA) has several limitations. Firstly, it provides a series of single-time snapshots of community perceptions of vulnerability without specifying a time horizon, implicitly if the current state of vulnerability will persist. This approach does not account for future climate uncertainties or potential changes in physical, social, and economic conditions. Secondly, TIVA was conducted before and during the implementation of the Tuvalu Coastal Adaptation Project (TCAP), which influenced community perceptions, particularly regarding coastal protection, as these views were tied to ongoing or pending TCAP actions during the consultations. Thirdly, while TIVA presents both qualitative and quantitative results, they are highly context-specific due to disaggregated data collection based on geographic location and social groups (men, women, and youth). Though efforts were made to aggregate these findings into high-level national vulnerability statements for the Climate Impact, Vulnerability, and Risk Assessment (CIVRA), they remain generalized and may be misinterpreted if taken out of context. Therefore, it is recommended to interpret TIVA results at the original scale of data collection (island or locality).

Additionally, aspects of exposure, sensitivity, and adaptive capacity—such as financial, technical, and technological resources—were implicitly addressed due to limitations in available data, resources, and project timelines. TIVA also reviewed Island Strategic Plans (ISPs) developed in 2021 to identify existing adaptation strategies. However, the current progress and effectiveness of these strategies remain unknown, necessitating further consultations with Island Kaupule(s) to update this information. Finally, continuous monitoring and evaluation are essential to assess the outcomes of adaptation

strategies, identify areas for improvement, and explore opportunities for scaling and replication within the National Adaptation Plan (NAP).

### Community-Based Vulnerability Assessments (CVAs)

- **Participatory Approach:** The Government of Tuvalu has implemented participatory vulnerability assessments across communities, particularly in outer islands, to capture local knowledge and specific adaptation needs. These assessments are critical for identifying risks that may not be captured in broader climate models, offering unique insights into vulnerabilities related to water, food security, and coastal erosion.
- **Community Involvement:** CVAs support direct community engagement in adaptation planning, providing locally relevant data to inform policy decisions. The process empowers local communities, fostering ownership of adaptation strategies and ensuring more effective and culturally appropriate responses.

### Indicators and Analytical Tools

- **Data Portals:** The Pacific Climate Change Science Program and World Bank's Climate Change Knowledge Portal are used to access historical and projected data on temperature, rainfall, and sea levels. These resources provide essential data for vulnerability assessments and adaptation planning, particularly in areas where local data are sparse.
- **Climate Indicators:** Climate indicators, such as sea temperature, frequency of extreme weather events, and aragonite saturation for coral health, are used to track changes in key sectors like fisheries, agriculture, and public health.

## 4.4.4 Challenges and Methodological Limitations

### Data Gaps and Accessibility

- **Limited Observational Infrastructure:** Due to Tuvalu's remote location and small size, there is limited infrastructure to continuously monitor climate variables. This lack of local data restricts the accuracy of climate models and makes it challenging to project-specific impacts for small islands.
- **Reliance on Global Models:** Due to limited resources, Tuvalu relies on global climate models, which may not capture localized climate conditions accurately. This reliance can lead to potential inaccuracies in projecting the specific impacts of climate change on Tuvalu's unique environment.

### Adaptive Capacity and Financial Constraints

- **Institutional and Technical Limitations:** Limited financial resources and technical expertise reduce Tuvalu's capacity to monitor, analyze, and update climate adaptation plans regularly. This constrains the development of robust adaptation strategies, making external funding and technical support critical for resilience building.
- **Resource Constraints:** Adaptation planning requires substantial funding, which Tuvalu typically sources from international climate finance mechanisms. Competition for these funds can delay the timely implementation of adaptation projects, limiting Tuvalu's ability to respond proactively to climate impacts.



**Table 41: Methodologies and Tools for Climate Impact Assessment**

| Methodology/Tool                              | Description                                         | Challenges                               |
|-----------------------------------------------|-----------------------------------------------------|------------------------------------------|
| CMIP5 and IPCC AR6 Climate Models             | Global models providing long-term projections       | Limited resolution for small islands     |
| Pacific-Australia Climate Adaptation Planning | Regional projections for temperature and sea level  | Dependent on ENSO cycles                 |
| Community-Based Vulnerability Assessments     | Localized assessments to capture community insights | Resource-intensive and time-consuming    |
| World Bank Climate Knowledge Portal           | Data on historical and projected climate impacts    | Data availability and access limitations |

Tuvalu's observed and potential impacts of climate change and approaches, methodologies, and tools emphasize the importance of robust climate modelling, community engagement, and adaptive capacity while highlighting the challenges of limited data and resources. These insights inform adaptation strategies and policies aimed at increasing Tuvalu's resilience to climate change.

## 4.5 Impacts, risks, and vulnerabilities

### 4.5.1 Current and Projected Climate Trends and Hazards

Tuvalu is one of the most climate-vulnerable nations globally, facing acute and chronic climate-related hazards. Given its low-lying geography, limited landmass, and dependency on natural resources, Tuvalu's exposure to climate risks is amplified.

The climate conditions in Tuvalu are marked by significant year-to-year variability, primarily driven by the El Niño-Southern Oscillation (ENSO). This variability impacts temperature, precipitation, and extreme events, leading to both short-term and long-term challenges. Here, we provide a detailed overview of observed trends and projections for air temperature, rainfall, sea surface temperature, ocean acidification, mean and extreme sea levels, and extreme weather events, drawing on the most recent data from the *Pacific-Australia Climate Change Science Adaptation Planning (PACCSAP)* program, *World Bank Climate Change Knowledge Portal*, and IPCC scenarios.

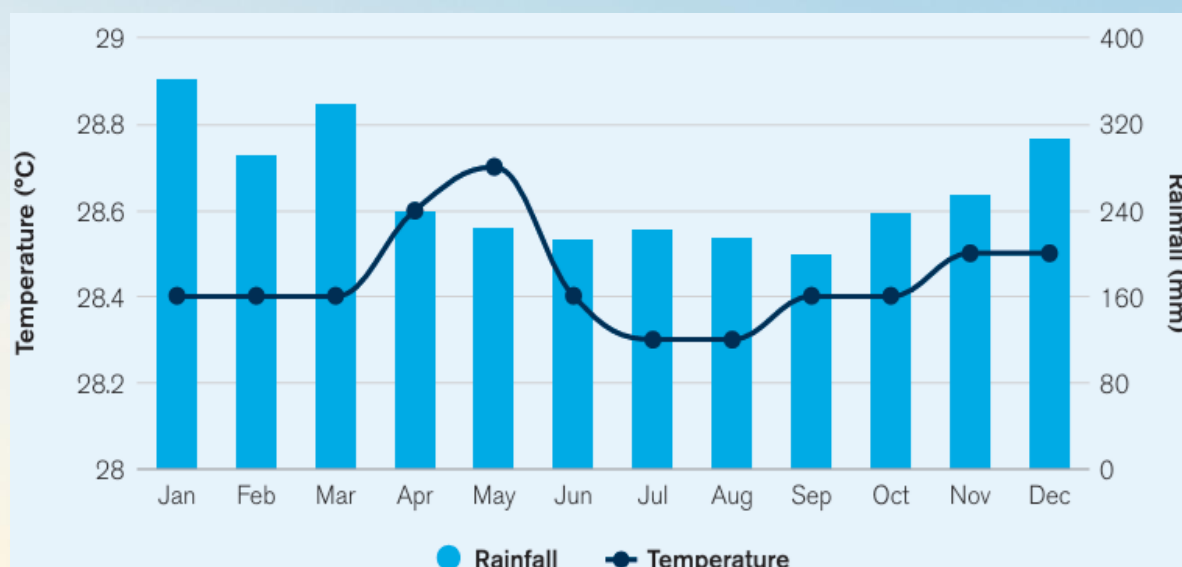
### 4.5.2 Climatic Influence of El Niño-Southern Oscillation (ENSO)

- **Description:** ENSO, comprising El Niño and La Niña phases, drives significant climate variability across the Pacific. In Tuvalu, El Niño events bring warmer, wetter conditions, while La Niña leads to cooler, drier weather. ENSO influences sea level, wave height, and temperature patterns, complicating long-term climate resilience planning.
- **Implications:** The dependence of Tuvalu's climate on ENSO phases introduces uncertainty in climate projections. This year-to-year variability challenges the ability to accurately predict rainfall and temperature extremes, complicating water resource and disaster preparedness strategies.

### 4.5.3 Current and Projected Trends in Key Climate Indicators

Tuvalu experiences a tropical climate characterized by consistently high temperatures, typically ranging from 27°C to 29°C year-round. Annual rainfall averages between 2,500 and 3,000 millimetres, though this can vary significantly from year to year. El Niño years tend to bring higher rainfall, while La Niña years are generally drier. The tropical cyclone season typically occurs from November to April, followed by a dry season from May to October.

**Figure 40: Average monthly temperature and rainfall in Tuvalu (1991–2020)<sup>18</sup>**



### Air Temperature

- Historical Trends:** According to PACCSAP and the *World Bank Climate Change Knowledge Portal*, Tuvalu's average temperatures have increased by approximately 0.24°C per decade for minimum temperatures and 0.21°C per decade for maximum temperatures since 1950. Sea surface temperatures have increased by about 0.13°C per decade since 1970.
- Future Projections:** Using IPCC's Representative Concentration Pathways (RCPs), we project Tuvalu's temperatures to increase further. Under the low-emissions RCP2.6 scenario, temperatures are expected to rise by 0.5–0.9°C by 2030, 0.5–1.2°C by 2050, and up to 1.3°C by 2090. Conversely, under the high-emissions RCP8.5 scenario, temperatures could increase by up to 4.0°C by 2090, drastically impacting ecosystems, human health, and agriculture.

**Table 42: Projected Annual Average Surface Air Temperature Increases for Tuvalu (Relative to 1986–2005 Baseline)**

| Scenario                                                           | 2030 (°C) | 2050 (°C) | 2070 (°C) | 2090 (°C) |
|--------------------------------------------------------------------|-----------|-----------|-----------|-----------|
| Very low emissions (RCP2.6)                                        | 0.5–0.9   | 0.5–1.2   | 0.5–1.2   | 0.4–1.3   |
| Low emissions (RCP4.5)                                             | 0.5–1.0   | 0.7–1.4   | 0.9–1.8   | 1.0–2.1   |
| Medium emissions (RCP6.0)                                          | 0.4–0.9   | 0.6–1.4   | 0.9–2.0   | 1.1–2.6   |
| Very high emissions (RCP8.5)                                       | 0.5–1.0   | 1.0–1.9   | 1.5–3.1   | 2.0–4.0   |
| <i>Source: PACCSAP, World Bank Climate Change Knowledge Portal</i> |           |           |           |           |

- Extreme Temperature Days:** Projections indicate that extremely hot days (1-in-20-year events) could become annual occurrences by the end of the century, with night-time temperatures rising faster than daytime temperatures. By 2090, high-emission scenarios project

<sup>18</sup> WBG Climate Change Knowledge Portal (CCKP, 2020). Tuvalu. URL: <https://climateknowledgeportal.worldbank.org/country/tuvalu>



up to a 3.0°C increase in extremely hot day temperatures, posing serious public health risks and impacting energy demands for cooling.

### Precipitation and Extreme Rainfall Events

- **Historical Patterns:** Tuvalu's precipitation is marked by variability, largely influenced by ENSO phases. The annual rainfall in Funafuti ranges between 2,500 and 3,000 mm, but the northern atolls receive 500–600 mm less, with droughts occurring during La Niña years.
- **Future Projections:** Models predict that rainfall variability will continue, with an increase in the frequency of extreme rainfall events under high-emission scenarios. By 2090, 1-in-20-year heavy rainfall events are projected to become 1-in-6-year events under RCP8.5, increasing the risk of flash floods and infrastructure damage.

**Table 43: Projected Changes in Rainfall Extremes in Tuvalu**

| Scenario               | 2030          | 2050          | 2070         | 2090          |
|------------------------|---------------|---------------|--------------|---------------|
| RCP2.6 (Low)           | 1-in-15 years | 1-in-10 years | 1-in-9 years | 1-in-10 years |
| RCP8.5 (High)          | 1-in-12 years | 1-in-8 years  | 1-in-7 years | 1-in-6 years  |
| <b>Source:</b> PACCSAP |               |               |              |               |

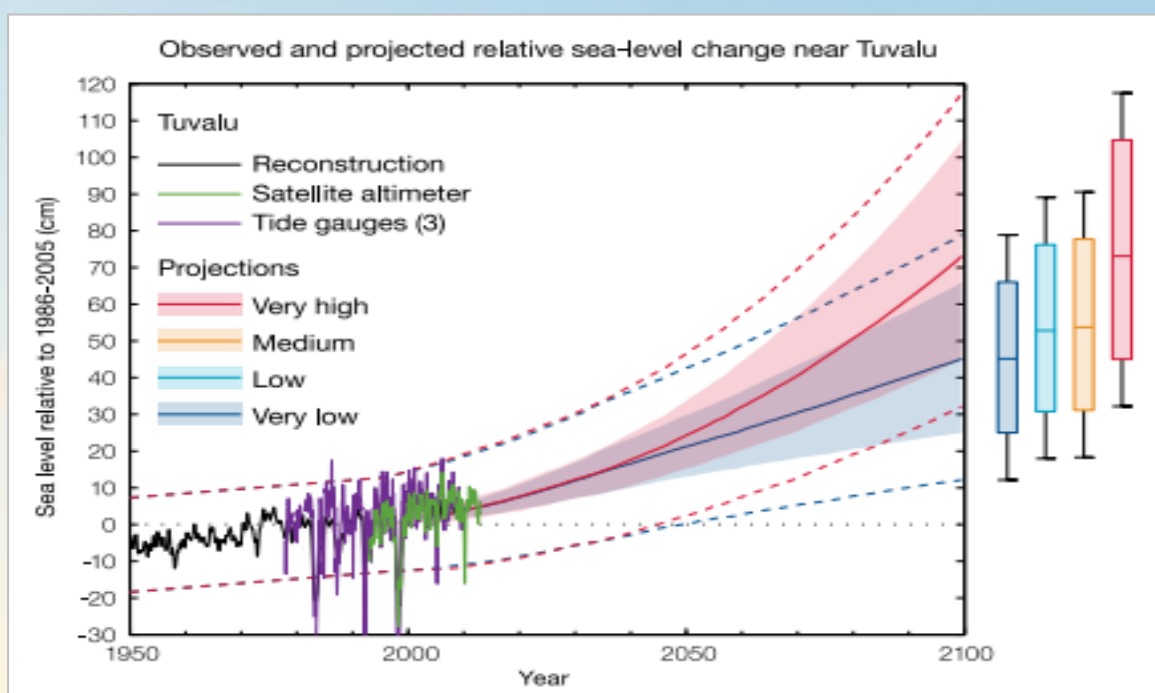
### Sea-Level Rise

- **Historical Trends:** Tuvalu has experienced an average annual sea-level rise of 5 mm since 1993, which is higher than the global mean. Rising seas threaten coastal zones, essential infrastructure, and arable land, accelerating the erosion of beaches and increasing saltwater intrusion into freshwater resources.
- **Projected Increases:** Projections under RCP8.5 indicate that by 2090, sea levels around Tuvalu could rise by 39–87 cm, with the upper ranges leading to severe land loss and forced migration. Even under low-emission scenarios, a rise of 23–59 cm is anticipated.

**Table 44: Projected Sea-Level Rise for Tuvalu (cm)**

| Scenario                         | 2030 (cm) | 2050 (cm) | 2070 (cm) | 2090 (cm) |
|----------------------------------|-----------|-----------|-----------|-----------|
| Very low emissions (RCP2.6)      | 7–17      | 13–30     | 19–44     | 23–59     |
| Very high emissions (RCP8.5)     | 7–18      | 16–34     | 26–57     | 39–87     |
| <b>Source:</b> IPCC AR6, PACCSAP |           |           |           |           |

**Figure 41: Observed and Projected Sea-Level Rise (RCP2.6 vs. RCP8.5) Near Tuvalu.**



*Source: IPCC AR6*

#### Wind-driven waves and Ocean Acidification

- **Wind-Driven Waves:** Seasonally, wave direction and height in Tuvalu vary with trade winds, ENSO conditions, and cyclone activity. Projections under RCP4.5 and RCP8.5 scenarios show minimal significant changes in wave height by 2090, although higher waves from tropical cyclones pose increased risks.
- **Ocean Acidification:** Rising CO<sub>2</sub> levels are increasing ocean acidity, threatening coral reefs that provide coastal protection and support fisheries. Projections indicate that if global emissions remain high, coral reef ecosystems in Tuvalu could experience irreversible damage within the next few decades.

## 4.6 Projected Climate Hazards

Tuvalu faces a spectrum of climate hazards due to rising global temperatures, changing precipitation patterns, ocean acidification, and sea-level rise. These changes, projected under various emissions scenarios, present significant risks to the country's ecosystems, infrastructure, and public health. Below, we examine each hazard in detail.

- **Increased Temperatures:**
  - **Projections:** Future temperature increases under high-emission scenarios (RCP8.5) are projected to be substantial. By 2100, Tuvalu could see temperatures rise by up to 2.8°C, with corresponding increases in the frequency and intensity of heatwaves. Even moderate emission scenarios predict warming that would heighten heat stress.
  - **Implications:** Rising temperatures will severely affect human health and agricultural productivity. Heat stress is anticipated to increase, impacting labor-intensive sectors and worsening health conditions, especially for vulnerable populations. Additionally, temperature-sensitive crops may experience lower yields, reducing local food security.



- **Cyclones and Storm Surge:**

- **Historical Context:** Tropical cyclones frequently affect Tuvalu from November to April, with historical records showing about eight cyclones per decade within Tuvalu's Exclusive Economic Zone (EEZ). Cyclone frequency varies significantly depending on ENSO phases, with more cyclones during El Niño years and fewer during La Niña years. Severe cyclones (Category 3 or stronger) have been relatively infrequent, comprising 13% of cyclones affecting the EEZ between 1981 and 2011.
- **Projected Changes:** Although climate models do not project an increase in the overall frequency of cyclones, they indicate a likely increase in cyclone intensity, with higher wind speeds and increased rainfall. This will exacerbate storm surges and flooding risks, especially when coupled with ongoing sea-level rise.
- **Recent Events:** Tropical Cyclone Pam (March 2015) was particularly destructive, causing extensive damage to housing, agriculture, and coastlines, and temporarily displacing nearly half of Tuvalu's population. More recently, Cyclones Ula (December 2015) and Tino (January 2020) caused localized damage to crops and infrastructure.

**Table 45: Projected Changes in Cyclone Intensity and Frequency in Tuvalu**

| Scenario      | Cyclone Intensity | Cyclone Frequency     |
|---------------|-------------------|-----------------------|
| RCP2.6 (Low)  | Slight increase   | No significant change |
| RCP8.5 (High) | Higher intensity  | Decrease in frequency |

**Source:** IPCC AR6, Australian Bureau of Meteorology

- **Droughts and Water Scarcity:**

- **Historical Trends:** Drought is a persistent issue in Tuvalu, largely influenced by ENSO phases. During La Niña years, droughts become more severe, especially in the northern atolls, leading to water scarcity issues across the country.
- **Projections:** Under RCP8.5, the proportion of time spent in drought is projected to decrease slightly. However, extreme drought events are expected to remain stable, while overall water scarcity may intensify due to higher evaporation rates associated with warming temperatures.
- **Challenges:** Limited freshwater resources and dependence on rainwater harvesting make Tuvalu especially vulnerable to prolonged droughts. Future temperature increases may exacerbate these water issues, particularly in outer islands with limited storage facilities.

**Table 46: Projected Changes in Drought Frequency and Duration in Tuvalu**

| Scenario      | Drought Frequency   | Drought Duration        |
|---------------|---------------------|-------------------------|
| RCP2.6 (Low)  | Decreased frequency | Stable duration         |
| RCP8.5 (High) | Slight decrease     | Stable extreme droughts |

**Source:** Australian Bureau of Meteorology, CSIRO

- **Coral Reefs and Ocean Acidification:**

- **Aragonite Saturation State:** Rising atmospheric CO<sub>2</sub> concentrations result in ocean acidification, which reduces the aragonite saturation state—a key measure for coral health. Lower aragonite levels impair coral growth and resilience, leading to coral bleaching and degradation.

- **Projections:** Under high emissions scenarios (RCP8.5), the aragonite saturation state in Tuvalu is projected to drop to levels that will create marginal or unfavorable conditions for coral reef survival by mid-century.  
Even under moderate emissions (RCP4.5), ocean acidification will stress coral reefs, though at a slower rate. However, under the low-emissions RCP2.6, coral health could remain relatively stable.
- **Implications:** Degraded coral reefs will affect biodiversity, fisheries, and coastal protection, disrupting food security and increasing vulnerability to storm surges.
- **Tropical Cyclone Projections:**
  - **Cyclone Frequency:** Projections indicate a likely decrease in cyclone frequency in the southeast Pacific basin, including Tuvalu's EEZ. This decrease, ranging from 5% to 50% depending on model estimates, is anticipated under both RCP4.5 and RCP8.5 scenarios.
  - **Cyclone Intensity:** Despite a potential reduction in cyclone frequency, the mean maximum wind speed of cyclones is projected to increase by 2-11% globally, along with a 20% rise in rainfall rates near cyclone centers. This intensification, coupled with rising sea levels, will amplify the impacts of cyclones when they do occur.
  - **Model Confidence:** These projections are supported by a medium level of confidence due to consistency across multiple General Circulation Models (GCMs) and empirical analysis of cyclone formation.

**Table 47: Tropical Cyclone Projections for Tuvalu**

| Parameter          | Projected Change             | Confidence Level |
|--------------------|------------------------------|------------------|
| Cyclone Frequency  | Decrease (5–50%)             | High             |
| Maximum Wind Speed | Increase (2–11%)             | Medium           |
| Cyclone Rainfall   | Increase by ~20% near center | Medium           |

**Source:** IPCC AR6, Australian Bureau of Meteorology, CSIRO

- **Summary of Projected Climate Trends:**  
Climate change is expected to impact nearly all facets of life in Tuvalu. Key projected trends and their implications include:
  - **Temperature Rise:** Increased annual mean temperatures and extreme daily temperatures.
  - **Precipitation and Drought:** Uncertain changes in annual rainfall, but an increase in extreme rainfall events and stable extreme drought durations.
  - **Sea-Level Rise:** Continued rise in sea levels, posing existential risks to Tuvalu's land and freshwater resources.
  - **Ocean Acidification:** Reduced aragonite saturation levels, threatening coral reef health and biodiversity.

**Table 48: Summary of Projected Climate Trends for Tuvalu**

| Climate Parameter    | RCP2.6 (Low)          | RCP8.5 (High)    |
|----------------------|-----------------------|------------------|
| Temperature Increase | +0.8°C by 2100        | +2.8°C by 2100   |
| Sea-Level Rise       | 0.44 m by 2100        | 0.74 m by 2100   |
| Cyclone Intensity    | No significant change | Higher intensity |



|                   |                       |                         |
|-------------------|-----------------------|-------------------------|
| Drought Frequency | Increased variability | Stable extreme droughts |
|-------------------|-----------------------|-------------------------|

**Source:** IPCC AR6, World Bank, Australian Bureau of Meteorology

This detailed analysis of projected climate hazards provides Tuvalu with critical insights to support its climate adaptation and resilience planning, informing key sectors such as agriculture, water resources, public health, and infrastructure.

#### 4.6.1 Climate Hazard Rating

Climate risk in Tuvalu arises from the interaction of climate hazards, exposure, and vulnerability, as highlighted by the IPCC (2022) and the Tuvalu Vulnerability Assessment Report (TVAR). Key hazards include sea level rise, tropical cyclones, flooding, drought, and marine heatwaves, to which Tuvalu's coastal communities and infrastructure are particularly exposed and vulnerable. The TVAR emphasizes the intensifying threat of sea level rise and flooding by 2050, necessitating the integration of these findings into the Tuvalu National Adaptation Plan (NAP). The NAP should prioritize risk reduction through measures like coastal protection, improved water management, resilient infrastructure development, and ecosystem conservation to enhance adaptive capacity and minimize climate risk.

The below table presents historical climate data (centered on 1995) and projected changes for 2030 and 2050 (relative to 1995) for key climate variables. Projections are based on CMIP5 (for most variables) and CMIP6 (for extreme wind speed and marine heatwaves) global climate models under low (RCP2.6/SSP1-2.6) and high (RCP8.5/SSP5-8.5) emission scenarios. Confidence ratings, based on the IPCC framework (Mastrandrea et al., 2010), assess the level of evidence and agreement across multiple lines of evidence. These confidence ratings are crucial for determining Tuvalu's overall risk and vulnerability by informing several key aspects of risk assessment and adaptation planning:

**Table 49: Historical climate and projected climate change for 20-year periods centered on 2030 and 2050, relative to 20 years centered on 1995.**

| Variable                                     | 20 Years<br>Centered on<br>1995 | 2030                 | Projections                       |                                            |            |
|----------------------------------------------|---------------------------------|----------------------|-----------------------------------|--------------------------------------------|------------|
|                                              |                                 |                      | 2050 (Low<br>Emissions<br>RCP2.6) | 2050 (Very<br>High<br>Emissions<br>RCP8.5) | Confidence |
| ATMOSPHERIC VARIABLES                        |                                 |                      |                                   |                                            |            |
| Annual average<br>temperature (°C)           | Min 26°C                        | +0.7 (0.4 to<br>1.0) | +0.8 (0.5 to<br>1.2)              | +1.4 (1.0 to<br>1.9)                       | High       |
|                                              | Max 31°C                        |                      |                                   |                                            |            |
| Hot days (days ><br>33°C)                    | 12 (0 to 31)<br>days            |                      | +181 (140 to<br>222)              | +264 (140 to<br>331)                       | High       |
| Annual average<br>rainfall (%)               | 3460 mm                         | +4 (-4 to<br>+12)    | +3 (-6 to +11)                    | +3 (-11 to<br>+17)                         | Medium     |
| Annual maximum<br>daily rainfall (mm)        | 134 (119 to<br>160) mm/day      |                      | +12 (-17 to<br>39)                | +15 (-15 to<br>65)                         | Medium     |
| Average drought<br>intensity                 | Slight<br>increase              | No data              | Slight<br>increase                |                                            | Medium     |
| Average drought<br>frequency (per 20<br>yrs) | 1.2 per 20<br>years             | Slight<br>decrease   | No data                           | Slight<br>decrease                         | Medium     |
| Average drought<br>duration (months)         | ~17 months                      | Slight<br>decrease   | No data                           | Slight<br>decrease                         | Medium     |

|                                                                               |                    |                      |                      |                      |      |
|-------------------------------------------------------------------------------|--------------------|----------------------|----------------------|----------------------|------|
| <b>Tropical cyclone windspeed (m/s)</b>                                       | ~30 (20-39) m/s    |                      |                      | Increase             | Low  |
| <b>Tropical cyclone frequency (%)</b>                                         |                    |                      |                      | Decrease             | Low  |
| <b>OCEAN VARIABLES</b>                                                        |                    |                      |                      |                      |      |
| <b>Annual average sea level (m)</b>                                           | 0 m                | +0.13 (0.09 to 0.17) | +0.22 (0.17 to 0.29) | +0.27 (0.19 to 0.37) | High |
| <b>Extreme sea level proxy (50-yr ARI Tuvalu flooded area km<sup>2</sup>)</b> | 11 km <sup>2</sup> | No data              | ~16 (2060; SSP2-4.5) | ~16.5 (2060)         | High |
| <b>Sea surface temperature (°C) over EEZ</b>                                  | 28.6-29.5°C        | +0.7 (-0.6 to 1.7)   | +0.9 (-0.5 to 2.1)   | +1.3 (0.0 to 2.5)    | High |
| <b>Marine heatwave frequency (days/year)</b>                                  | ~10 days/year      | 110-290              |                      | 220-360              | High |
| <b>Coral bleaching days (per 20 years)</b>                                    | 0 days/20 years    | No data              | 169-2934             | 1652-6460            | High |
| <b>Annual average ocean pH over EEZ</b>                                       | ~8.08 (8.1-8.07)   | 8.02 (7.99-8.04)     | 8.0 (7.99-8.02)      | 7.95 (7.93-7.96)     | High |
| <b>Annual average aragonite saturation</b>                                    | ~4.1 (4.0-4.2)     | 3.77 (3.51-4.06)     | 3.69 (3.53-4.01)     | 3.4 (3.18-3.70)      | High |

- **Prioritization of Hazards:** High confidence in projections for hazards like sea level rise allows for focused attention and resource allocation toward mitigating their impacts. For instance, the high confidence in projected sea level rise strengthens the case for investing in coastal defences and land-use planning. Conversely, while projections for other hazards like cyclone frequency may have lower confidence, their potential impacts, especially when combined with high-confidence projections of increased intensity, cannot be discounted. Even low confidence in increased cyclone intensity combined with high-confidence sea level rise increases the risk of storm surge, which must be considered.
- **Weighting of Projections:** Confidence ratings provide a measure of certainty for each projection, influencing how heavily it's weighted in the overall risk assessment. High-confidence projections carry more weight, while lower-confidence projections are still considered but may require further investigation or a more precautionary approach. For instance, the high confidence in sea surface temperature increases informs risk assessments related to coral bleaching and marine ecosystems, even if the precise magnitude of change is uncertain for other variables.
- **Informing Adaptation Strategies:** High-confidence projections enable targeted adaptation strategies. For example, the high confidence in sea level rise projections justifies investments in specific coastal protection measures. Lower confidence projections require more flexible and adaptive strategies. For instance, while the frequency of cyclones has low confidence, the projected *increase* in intensity (also low confidence) combined with high-confidence sea level rise suggests a heightened risk of devastating storm surges. This justifies preparedness measures and building resilience even with uncertainty in frequency.
- **Uncertainty Management:** Confidence ratings facilitate uncertainty management in decision-making. High-confidence projections allow for more direct action. Lower-confidence projections necessitate considering a wider range of scenarios and adopting flexible strategies. This might involve prioritizing "no-regrets" options that offer benefits regardless of the precise climate change impacts.
- **Risk Communication:** Confidence ratings are essential for transparent communication of climate risks to stakeholders and the public. Conveying the level of certainty associated with projections



avoids misinterpretations and fosters informed decision-making. It's crucial to emphasize that low confidence does not equate to low risk. It indicates greater uncertainty about the magnitude of change, not necessarily the direction of change.

Confidence ratings are integral to Tuvalu's climate risk assessment. They provide a structured approach to evaluating the reliability of climate projections, thereby informing hazard prioritization, adaptation planning, resource allocation, and communication of climate risks. While uncertainties exist, particularly for some atmospheric variables, the high confidence in critical projections like sea level rise underscores the urgent need for action to protect Tuvalu's vulnerable communities and ecosystems.

## 4.7 Risk Assessment

Tuvalu's climate risk framework is built on the integration of climate hazards, exposure, and vulnerability to assess and prioritize adaptation needs. In this framework, hazards—such as sea-level rise, intensified cyclones, prolonged droughts, and ocean acidification—are combined with the degree of exposure (the presence of communities, infrastructure, and ecosystems in hazard-prone areas) and vulnerability (the sensitivity of these systems coupled with their limited adaptive capacity). The overall risk is calculated as the product of exposure and sensitivity, and the resulting score is mapped onto a risk matrix that categorizes outcomes into four levels: minor, moderate, major, and extreme. This method, which is fundamental to the Tuvalu National Adaptation Plan, ensures that each sector—from agriculture and fisheries to coastal infrastructure and public health—is evaluated based on both historical data and future climate scenarios.

The following table shows the scorecard of consequences of climate hazards to Tuvalu's 7 key sectors/domains by 2030 (low and very high emissions), 2050 (low emissions), and 2050 (very high emissions)

**Table 50: Scorecard of consequences of climate hazards to Tuvalu's 7 key sectors/domains by 2030 (low and very high emissions), 2050 (low emissions), and 2050 (very high emissions)**

| Sector/<br>Domain | Sub-<br>sector/Domai<br>n  | Hazard                                 | Baseline | 2030 Low &<br>High<br>Emissions<br>Scenario | 2050 Low<br>Emissions<br>Scenario | 2050 High<br>Emissions<br>Scenario |
|-------------------|----------------------------|----------------------------------------|----------|---------------------------------------------|-----------------------------------|------------------------------------|
| Agriculture       | Crops                      | Saline intrusion due to sea level rise | Major    | Major                                       | Major                             | Extreme                            |
|                   | Livestock                  | Temperature increase                   | Moderate | Major                                       | Major                             | Major                              |
| Fisheries         | Oceanic fisheries          | Sea surface temperature                | Minor    | Moderate                                    | Major                             | Extreme                            |
|                   | Coastal fisheries, lagoons | Marine heatwaves/tropical cyclones     | Moderate | Moderate                                    | Major                             | Extreme                            |
|                   | Fisheries infrastructure   | Temperature increase/extreme heat      | Minor    | Moderate                                    | Moderate                          | Moderate                           |

|                            |                                      |                                                      |          |          |         |         |
|----------------------------|--------------------------------------|------------------------------------------------------|----------|----------|---------|---------|
|                            | Biodiversity that supports fisheries | Marine heatwaves                                     | Moderate | Major    | Major   | Extreme |
| Health and Wellbeing       | Physical health                      | Heatwaves and increased temperature                  | Minor    | Minor    | Major   | Major   |
|                            |                                      | Sea level rise, extreme rainfall, drought            | Minor    | Moderate | Major   | Extreme |
|                            | Non-communicable disease (NCD)       | All hazards                                          | Minor    | Moderate | Major   | Extreme |
|                            | Mental health                        | All hazards                                          | Minor    | Moderate | Major   | Extreme |
|                            | Health infrastructure                | Sea level rise, coastal inundation                   | Minor    | Minor    | Major   | Extreme |
|                            | Access to health services            | Sea level rise, coastal inundation                   | Minor    | Minor    | Major   | Extreme |
| Social Cohesion & Heritage | Cultural heritage                    | Coastal inundation, sea level rise, marine heatwaves | Moderate | Major    | Extreme | Extreme |
|                            | Socio-economic & gendered inequality | All hazards                                          | Moderate | Major    | Extreme | Extreme |
|                            | Migration to Funafuti                | Coastal inundation, sea level rise                   | Major    | Major    | Extreme | Extreme |
| Disaster Management        | Demand for emergency services        | Tropical cyclone and storm surge                     | Moderate | Major    | Extreme | Extreme |
|                            | Evacuation centres                   | Tropical cyclone and storm surge                     | Major    | Major    | Major   | Major   |
| Water                      | Water availability                   | Extreme drought                                      | Major    | Major    | Extreme | Extreme |
|                            | Water demand                         | Extreme heat                                         | Moderate | Moderate | Major   | Major   |
|                            | Water quality                        | Saline intrusion due to sea level rise               | Major    | Major    | Major   | Extreme |
|                            | Water infrastructure                 | Sea level rise, coastal inundation                   | Major    | Major    | Extreme | Extreme |
| Coastal Protection         | Coastal assets and flood defences    | Tropical cyclone-induced storm surge                 | Major    | Major    | Extreme | Extreme |
| Infrastructure             | Transport & supply chains            | Sea level rise, coastal inundation                   | Moderate | Major    | Extreme | Extreme |
|                            | Buildings and structures             | Sea level rise, coastal inundation                   | Major    | Major    | Extreme | Extreme |
|                            | Electricity supply                   | Sea level rise, coastal inundation                   | Moderate | Major    | Extreme | Extreme |
|                            | Internet and telecommunication       | Sea level rise, coastal inundation                   | Minor    | Moderate | Major   | Major   |



|  |                  |                                 |          |       |       |       |
|--|------------------|---------------------------------|----------|-------|-------|-------|
|  | Waste management | Coastal inundation and flooding | Moderate | Major | Major | Major |
|--|------------------|---------------------------------|----------|-------|-------|-------|

In the "Tuvalu National Adaptation Plan: Climate Impact, Vulnerability & Risk Assessment – Risk Assessment: Technical Supplement," report the risk assessment process outlined in Chapter 2 is applied using climate change projections specific to Tuvalu to identify and understand key risks across various sectors and domains. This approach ensures that the assessment is tailored to the unique environmental and socio-economic context of Tuvalu.

#### Process Overview:

- 1. Sector and Sub-sector Identification:** Each major sector/domain relevant to Tuvalu is divided into key sub-sectors/domains to ensure a comprehensive analysis.
- 2. Hazard Determination:** For each sub-sector/domain, dominant climate hazards are identified using inputs from the CSIRO Hazard Report and the Tuvalu Integrated Vulnerability Assessment (TIVA). This step ensures that the most significant threats are considered for each area.
- 3. Consequence Estimation:** The potential consequences of each identified hazard are estimated for different timeframes and emission scenarios. This estimation is based on the magnitude of consequence criteria outlined in Appendix 1 of the report. The consequence levels are categorized as minor, moderate, major, or extreme, reflecting the severity of potential impacts.
- 4. Risk Summary Presentation:** The findings are summarized in a scorecard (Table 40), which presents the consequence ratings for each sub-sector/domain across different timeframes and emission scenarios. This table provides a clear overview of how climate hazards are expected to impact various areas over time.

For a more detailed discussion of the identified risks for each sector/domain, including specific analyses and considerations, please refer to "Tuvalu National Adaptation Plan: Climate Impact, Vulnerability & Risk Assessment – Risk Assessment: Technical Supplement", report.

This structured approach ensures that the risk assessment is both comprehensive and specific to Tuvalu's context, facilitating informed decision-making for adaptation planning.

## 4.8 Observed and Potential Impacts of Climate Change

Tuvalu's geographic, social, and economic profile makes it acutely vulnerable to the adverse effects of climate change. The nation faces a range of impacts due to rising temperatures, sea-level rise, changing precipitation patterns, and extreme weather events. These impacts affect multiple sectors—such as water resources, agriculture, fisheries, health, and infrastructure—and create additional economic and social vulnerabilities. This section provides a detailed analysis of sectoral vulnerabilities, the broader social and economic impacts, and the critical environmental pressures caused by climate change.

### 4.8.1 Sectoral Vulnerabilities and Climate Impacts

#### Water Resources

- Current Challenges:** As a low-lying island nation, Tuvalu has limited access to freshwater resources and relies heavily on rainwater harvesting systems for drinking water and daily use. Sea-level rise, coupled with periodic storm surges, has resulted in increased saltwater intrusion into

groundwater sources, reducing the availability of freshwater for both residential and agricultural use.

- **Drought and Evaporation:** Droughts, particularly during La Niña events, create severe water shortages, exacerbating stress on rainwater-dependent systems. Additionally, rising temperatures contribute to higher evaporation rates, which further reduce stored rainwater availability and intensify the impacts of prolonged dry periods.
- **Public Health Implications:** Water scarcity directly affects hygiene, sanitation, and public health outcomes, increasing the risk of waterborne diseases and challenging the capacity of local health services.
- **Adaptation Needs:** Adaptation priorities include expanding rainwater storage capacity, investing in desalination technology, and developing community-based water management practices to improve resilience to drought and water scarcity.

### Agriculture and Food Security

- **Soil Salinization and Crop Viability:** Rising sea levels and storm surges have led to saltwater intrusion into agricultural soils, particularly impacting taro and other root crops essential to local diets. Salt stress affects the growth and productivity of crops, diminishing yields and food quality.
- **Temperature and Crop Yield:** Higher temperatures increase crop stress, reduce yields, and elevate the likelihood of crop failure. Altered precipitation patterns further challenge crop growth cycles, making agricultural planning difficult.
- **Dependence on Food Imports:** Due to limited arable land, Tuvalu relies heavily on imported food, making it vulnerable to fluctuations in global food prices and supply chain disruptions. Climate change may further impact both local food production and food imports, increasing the risk of food insecurity.
- **Adaptation Needs:** Adaptive measures include developing salt-tolerant crop varieties, improving soil management to counteract salinity, and promoting alternative, climate-resilient crops to enhance food security.

### Fisheries

- **Coral Bleaching and Habitat Loss:** Coral reefs, vital to Tuvalu's fishing industry, are threatened by warming sea temperatures and ocean acidification. Repeated bleaching events reduce reef health and decrease fish populations, which are critical for local diets and livelihoods.
- **Marine Ecosystem Degradation:** As coral reefs degrade, fish habitats are lost, leading to lower fish stocks and threatening the sustainability of local fisheries. Rising sea levels and extreme weather events exacerbate habitat destruction, further impacting marine biodiversity.
- **Economic and Livelihood Risks:** Fisheries are a central component of Tuvalu's economy and food supply. Reduced fish stocks not only threaten food security but also lead to income loss for communities reliant on fishing.
- **Adaptation Needs:** Sustainable fisheries management, reef restoration, and local marine conservation efforts are crucial to maintaining fish stocks and protecting biodiversity. Capacity building for local fishers to monitor marine health and apply sustainable practices is also essential.

### Health



- **Heat Stress and Vector-Borne Diseases:** Rising temperatures are expected to increase incidences of heat-related illnesses. Additionally, warmer temperatures create favourable conditions for vector-borne diseases such as dengue fever and malaria, which are exacerbated by increased rainfall and flooding.
- **Waterborne Diseases:** Water scarcity and contamination, especially during droughts or flooding events, increase the risk of waterborne diseases like cholera. Limited healthcare access in remote islands complicates response efforts.
- **Public Health Infrastructure Challenges:** The healthcare system in Tuvalu faces challenges due to its limited capacity to manage climate-related health impacts. This is particularly critical for outer islands, which have limited healthcare facilities and face delayed response times.
- **Adaptation Needs:** Strengthening health infrastructure, improving disease monitoring and early warning systems, and enhancing public health awareness are vital to mitigating health risks. Community health programs and improved water quality monitoring are also essential.

### Energy

- **Energy Demand:** Increased temperatures drive higher energy demand for cooling, straining Tuvalu's limited energy resources, which rely primarily on imported fuels. Rising costs of fuel imports further challenge energy affordability and access.
- **Renewable Energy Goals:** Tuvalu has committed to transitioning to renewable energy sources; however, climate impacts on infrastructure and resource variability (e.g., solar intensity) add challenges.
- **Adaptation Needs:** Expanding renewable energy capacity, particularly solar, and enhancing energy storage systems are critical to meet rising demand sustainably. Policies supporting energy efficiency and resilient infrastructure can help reduce reliance on imported fuels.

### Coastal Zones

- **Sea-Level Rise and Coastal Erosion:** Tuvalu's low elevation makes it highly vulnerable to sea-level rise. Increased tidal inundations and more frequent storm surges are causing rapid erosion of coastlines, threatening residential areas, essential infrastructure, and agricultural land.
- **Loss of Land:** Rising sea levels are reducing available habitable land, directly impacting housing and public facilities. Coastal erosion threatens critical infrastructure like roads, schools, and utilities, creating cascading effects on accessibility and safety.
- **Adaptation Needs:** Coastal defences, such as seawalls, beach nourishment, and mangrove replantation, are essential to protect against erosion and flooding. Further, integrated coastal zone management is required to balance development and conservation.

### Island Ecology

- **Biodiversity Loss:** As sea levels rise and climate conditions change, habitats critical for endemic species and migratory birds are degrading. Rising temperatures and altered precipitation disrupt the ecological balance, affecting species' survival.
- **Invasive Species Risks:** Increased human movement and climate disturbances contribute to the spread of invasive species, which can displace native plants and animals.

- **Adaptation Needs:** Establishing protected areas and implementing biodiversity monitoring are essential. Restoration of native vegetation and invasive species management would support ecosystem resilience.

### Communities and Settlements

- **Urban Crowding in Funafuti:** Rising sea levels and land scarcity are driving internal migration from outer islands to the capital, Funafuti, where resources are already strained. This population shift increases pressure on housing, sanitation, and healthcare services, and contributes to overcrowding.
- **Cultural Displacement:** Climate change threatens cultural heritage sites and traditions tied to the land, raising concerns about the preservation of Tuvaluan identity if forced migration becomes necessary.
- **Adaptation Needs:** Urban planning for sustainable housing, improved sanitation, and efficient public services in Funafuti are essential. Cultural preservation programs and international support for climate-resilient infrastructure can help sustain communities in place.

**Table 51: Sectoral Impacts and Vulnerabilities in Tuvalu**

| Sector                  | Climate Impact                                | Adaptation Needs                               |
|-------------------------|-----------------------------------------------|------------------------------------------------|
| Coastal Zones           | Sea-level rise, coastal erosion               | Seawalls, beach nourishment, mangrove planting |
| Island Ecology          | Habitat loss, biodiversity degradation        | Protected areas, invasive species control      |
| Coral Reefs & Fisheries | Coral bleaching, fish stock depletion         | Sustainable fisheries, marine protected areas  |
| Water Resources         | Saltwater intrusion, drought                  | Rainwater storage, desalination                |
| Agriculture & Food      | Soil salinization, crop yield reduction       | Salt-tolerant crops, resilient agriculture     |
| Communities             | Overcrowding, cultural displacement           | Urban planning, cultural preservation programs |
| Human Health            | Heat stress, waterborne/vector-borne diseases | Health infrastructure, disease monitoring      |
| Energy                  | High energy demand, fuel import dependency    | Renewable energy expansion, energy efficiency  |

**Source:** Tuvalu NAP, and WB-Tuvalu Climate Risk Profile

### 4.8.2 Top 5 Vulnerability Sub-Sectors

The Integrated Vulnerability Analysis (IVA) survey asked participants to prioritize the top five vulnerability sub-sectors in their respective locations. This multi-stage process identified clusters of frequently reported issues, referred to as "hotspot sub-sectors," which account for 9% or more of all top vulnerability issues nationally (TIVAR, 2021).

These four hotspot sub-sectors collectively represent 47% of the top vulnerability issues:

- Ecosystem Health + Natural Resources (En) – 15%
- Security of Place + Infrastructure and Services (Pi) – 13%
- Water Security + Infrastructure and Services (Wi) – 9%
- Food Security + Natural Resources (Fn) – 9%



While the specific issues within each sub-sector vary by group and location, the most commonly identified and prioritized national issues are listed in Table 2, based on the frequency of responses across all groups.

### 4.8.3 Identified climate change risks and impacts

The analysis of key policies and plans mentioned above revealed numerous climate risks and impacts for Tuvalu. These risks and impacts were compared against the recently updated Coupled Model Inter-comparison Project Phase 5 (CMIP5) General Circulation Model (GCM) climate change projections for Tuvalu. 3 The CMIP5 uses the IPCC Representative Concentration Pathways (RCP) scenarios to generate climate change projections. The results of this analysis are presented in the Table below.

**Identified climate change risks and impacts:** The analysis of key policies and plans mentioned above revealed numerous climate risks and impacts for Tuvalu. These risks and impacts were compared against the recently updated Coupled Model Inter-comparison Project Phase 5 (CMIP5) General Circulation Model (GCM) climate change projections for Tuvalu. 3 The CMIP5 uses the IPCC Representative Concentration Pathways (RCP) scenarios to generate climate change projections. The results of this analysis are presented in the Table below.

**Table 52: Summary of Identified Risks, Impacts, and Projected Changes<sup>19</sup>**

| Climate Risk           | Risks and Impacts (a)                                                                                                                                                                                                                                              | Projected Changes for Tuvalu (b)                                                                                                                                                                                                                                                   |
|------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Sea level rise         | Coastal erosion, Flooding, Saltwater intrusion, Human displacement, Damage to critical, infrastructure                                                                                                                                                             | Sea levels are projected to rise by approximately 14-40 cm by 2050                                                                                                                                                                                                                 |
| Tropical Cyclones (TC) | Storm surge Flooding Coastal erosion Biodiversity loss, Loss of islets. Loss of livelihoods (agriculture, livestock and fisheries). Loss of cultural sites. Human displacement. Human health, Disruption to essential services, Damage to critical, infrastructure | TC-induced impacts over Tuvalu are likely to be elevated during future El Niño events where TC numbers, as well as intensity, are projected to increase                                                                                                                            |
| Coral bleaching        | Biodiversity loss, Loss of livelihoods (fisheries)                                                                                                                                                                                                                 | Elevated risk of coral bleaching with an increase in sea surface temperature of 1.5°C resulting in an average severe bleaching risk lasting for longer periods and reoccurring in shorter intervals.                                                                               |
| Ocean acidification    | Biodiversity loss, Loss of livelihoods (fisheries)                                                                                                                                                                                                                 | Decline in aragonite saturation rate in parallel with the carbon dioxide concentrations in the atmosphere                                                                                                                                                                          |
| Rainfall extreme       | Drought, Water-borne diseases, Water insecurity, Loss of livelihoods (human and livestock), Algal bloom                                                                                                                                                            | Annual maxima daily rainfall from 2030 to 2050 is projected to increase with a gradient of approximately 40 mm per decade-1<br>Future changes to the average annual rainfall and frequency of drought are uncertain due to low confidence in the magnitude of rainfall projections |

<sup>19</sup> Tuvalu National Adaptation Plan Framework (2020),  
[https://www.tuvaluclimatechange.gov.tv/sites/default/files/documents/FINAL\\_TuvaluNAP.pdf](https://www.tuvaluclimatechange.gov.tv/sites/default/files/documents/FINAL_TuvaluNAP.pdf)

|                      |                                                                                                                                |                                                                                                               |
|----------------------|--------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------|
| Temperature extremes | Heat stress, Vector-borne diseases, Plant and disease outbreaks, Loss of livelihoods (human and livestock)                     | A very high emissions scenario (RCP8.5) will see annual mean temperatures in Tuvalu increase by up to 1.9 °C  |
| Storms/wind extremes | Coastal erosion, Disruption to essential services, Damage to critical infrastructure                                           | Strong wind gusts are likely to become less frequent                                                          |
| Wave anomalies       | King tide, Flooding, Coastal erosion, Disruption to essential services, Damage to critical infrastructure, Saltwater intrusion | Elevated risk of destructive waves and coastal flooding from increase in TC occurrence during El Niño periods |

(a) Identified from the analysis of TKIII, two national policies (National Climate Change Policy 2012-2021; National Energy Policy 2009-2020), the Health and Climate Change Profile, and the TC Tino Recovery and Vulnerability Reduction Plan.

(b) Australian Government DFAT, CSIRO and SPREP, 2020.

## 4.9 Social, Economic, and Environmental Vulnerabilities

### Economic Dependency

- **Fishing Licenses, Remittances, and Foreign Aid:** Tuvalu's economy is highly dependent on fishing licenses, remittances from overseas workers, and international aid. Climate-related disruptions in fisheries directly impact the revenue generated from fishing licenses, threatening economic stability.
- **Reduced Resilience in Primary Sectors:** Climate change impacts on fisheries and agriculture reduce economic resilience and increase the risk of poverty, especially for communities reliant on subsistence farming and fishing. Economic diversification efforts are constrained by limited resources, making Tuvalu highly vulnerable to climate-induced economic instability.

### Migration and Displacement

- **Urban Crowding and Infrastructure Strain:** Rising sea levels and limited land availability drive migration from outer islands to Funafuti, the capital. This migration places pressure on infrastructure, housing, and social services, creating urban overcrowding and health risks.
- **Potential for Forced Relocation:** Continued sea-level rise and extreme weather events could necessitate relocation from Tuvalu altogether, posing significant social and cultural challenges for displaced communities.

### Environmental Degradation

- **Biodiversity Loss and Ecosystem Degradation:** As habitats degrade due to sea-level rise, saltwater intrusion, and extreme weather, biodiversity loss accelerates, affecting endemic wildlife and migratory species. Coral reefs, which provide natural coastal defence and support fisheries, face significant risks from acidification and bleaching.
- **Coastal Erosion and Infrastructure Risks:** Coastal erosion from rising seas threatens housing, roads, and utilities. This erosion exacerbates Tuvalu's exposure to natural hazards, increasing the cost of infrastructure maintenance and relocation.

**Table 53: Economic and Social Impacts of Climate Change**

| Impact Type       | Sector Affected | Impacts             |
|-------------------|-----------------|---------------------|
| Fisheries decline | Fisheries       | Loss of livelihoods |



|                      |                |                              |
|----------------------|----------------|------------------------------|
| Crop yield reduction | Agriculture    | Reduced food security        |
| Coastal erosion      | Infrastructure | Loss of habitable land       |
| Health issues        | Health         | Increased healthcare demands |

Source: Tuvalu NAP

## 4.10 Adaptation Priorities and Barriers

### 4.10.1 Domestic Priorities and Progress Towards Priorities

Tuvalu has developed a comprehensive framework for adaptation through its NAP and NAPA, which outline specific priorities aligned with the country's vulnerability to climate change impacts. The following are the key adaptation priorities for Tuvalu, along with recent progress and developments: Tuvalu, a small island nation in the Pacific Ocean, is one of the most vulnerable countries to the impacts of climate change, particularly sea-level rise, coastal erosion, and extreme weather events. To address these challenges, Tuvalu has implemented a range of adaptation strategies and policies, with a focus on building resilience and safeguarding its future.

### 4.10.2 Coastal Zone Management

**Goal:** Protect coastal areas from erosion and flooding.

**Policies and Actions:**

- **Seawall Construction:** Construction of seawalls, breakwaters, and other coastal defence structures to mitigate coastal erosion and flooding.
- **Ecosystem-Based Adaptation:** Restoration and conservation of mangrove forests, coral reefs, and other coastal ecosystems to act as natural barriers against erosion and storm surges.
- **Integrated Coastal Zone Management (ICZM):** Implementation of ICZM plans to promote sustainable development and resource management in coastal areas.
- **Community-Based Adaptation:** Empowering coastal communities to adapt to climate change through capacity building, training, and awareness-raising.

**Progress:**

- **Seawall Construction:** Significant progress has been made in constructing seawalls and breakwaters in vulnerable areas, such as Funafuti and Nanumea. The Tuvalu Coastal Adaptation Project (TCAP), funded by the Green Climate Fund, has been instrumental in this regard.
- **Mangrove Restoration:** Mangrove restoration efforts have been initiated in various coastal areas, including Nanumea and Nui. These efforts have contributed to coastal protection and biodiversity conservation.
- **Coastal Monitoring:** Regular monitoring of coastal erosion and sedimentation rates is conducted to inform adaptation planning and decision-making.

**Way Forward:**

- **Continued Seawall Construction and Maintenance:** Prioritize the construction and maintenance of seawalls in vulnerable areas.

- **Expand Mangrove Restoration:** Expand mangrove restoration efforts to cover a larger area of the coastline.
- **Strengthen Coastal Monitoring:** Invest in advanced monitoring technologies to improve data collection and analysis.
- **Community Engagement:** Involve local communities in coastal management and conservation efforts.

### 4.10.3 Island Ecology

**Goal:** Protect and restore island ecosystems.

**Policies and Actions:**

- **Protected Area Establishment:** Designation and management of marine protected areas to conserve biodiversity and critical ecosystems.
- **Invasive Species Control:** Implementation of measures to eradicate or control invasive species that threaten native ecosystems.
- **Ecosystem Restoration:** Restoration of degraded ecosystems, such as forests and wetlands.
- **Community-Based Conservation:** Engaging local communities in conservation efforts to promote sustainable practices.

**Progress:**

- **Protected Area Establishment:** Marine protected areas have been established to safeguard coral reefs and other marine ecosystems.
- **Invasive Species Control:** Successful eradication of invasive species, such as rats and feral cats, from several islands.
- **Ecosystem Restoration:** Restoration of degraded forests and wetlands, particularly on outer islands.
- **Community-Based Conservation:** Enhanced community involvement in conservation initiatives, including waste reduction and recycling programs.

**Way Forward:**

- **Strengthen Protected Area Management:** Improve the management and enforcement of regulations within protected areas.
- **Expand Invasive Species Control Programs:** Continue to monitor and control invasive species.
- **Prioritize Ecosystem Restoration:** Invest in large-scale ecosystem restoration projects, particularly for forests and wetlands.
- **Foster Community-Based Conservation:** Empower communities to take ownership of conservation efforts.

### 4.10.4 Coral Reefs and Fisheries

**Goal:** Protect coral reefs and ensure sustainable fisheries.



### Policies and Actions:

- **Coral Reef Conservation:** Establishment of marine protected areas, coral reef monitoring, and restoration efforts.
- **Sustainable Fisheries Management:** Implementation of fisheries management plans to prevent overfishing and habitat destruction.
- **Climate-Smart Fisheries:** Adoption of climate-resilient fishing practices and technologies.

### Progress:

- Successful coral reef restoration projects, including coral transplantation and nursery development.
- Improved fisheries management practices, including the establishment of marine protected areas.
- Increased awareness of sustainable fishing methods among fishers.

### Way Forward:

- **Expand Coral Reef Restoration:** Scale up coral restoration efforts to cover a larger area of reefs.
- **Strengthen Fisheries Management:** Implement stricter regulations and enforcement to protect fish stocks.
- **Promote Climate-Smart Fisheries:** Encourage the adoption of climate-resilient fishing practices.
- **Support Community-Based Fisheries Management:** Empower fishers to manage their resources sustainably.

## 4.10.5 Water Resources

**Goal:** Ensure water security and sustainable water management.

### Policies and Actions:

- **Rainwater Harvesting:** Promotion of rainwater harvesting systems to capture and store rainwater.
- **Desalination:** Investment in desalination plants to supplement water supply, especially during droughts.
- **Water Conservation and Efficiency:** Implementation of water conservation measures, such as efficient irrigation practices and water-saving technologies.
- **Water Quality Monitoring:** Regular monitoring of water quality to ensure public health and environmental protection.

### Progress:

- Increased rainwater harvesting capacity in households and communities.
- Improved water quality monitoring and management.
- Development of desalination infrastructure in some areas.

### Way Forward:

- Invest in additional desalination plants to ensure water security.
- Promote water conservation and efficiency measures.
- Improve water quality monitoring and treatment.
- Explore innovative water harvesting and storage technologies.

## 4.10.6 Agriculture and Food Security

**Goal:** Enhance food security and agricultural productivity.

### Policies and Actions:

- **Climate-Smart Agriculture:** Promotion of climate-resilient agricultural practices, such as drought-tolerant crop varieties and conservation agriculture.
- **Diversification of Crop Production:** Encouraging the cultivation of a variety of crops to reduce vulnerability to climate shocks.
- **Improved Irrigation Systems:** Investment in efficient irrigation systems to optimize water use.
- **Agricultural Extension Services:** Providing technical assistance and training to farmers.

### Progress:

- Adoption of climate-resilient crop varieties.
- Improved agricultural productivity and food security.
- Strengthened extension services to support farmers.

### Way Forward:

- Promote organic farming and agroforestry practices.
- Develop early warning systems for pests and diseases.
- Invest in agricultural research and development to develop climate-resilient crops.
- Strengthen food security programs to address food shortages and malnutrition.

## 4.10.7 Communities

**Goal:** Strengthen community resilience to climate change impacts.

### Policies and Actions:

- **Community-Based Adaptation:** Empowering communities to adapt to climate change through capacity building, training, and awareness-raising.
- **Disaster Risk Reduction:** Implementation of disaster risk reduction measures, including early warning systems, evacuation plans, and emergency response protocols.
- **Social Protection Programs:** Providing social safety nets to vulnerable communities.



#### Progress:

- Enhanced community awareness and preparedness for climate change impacts.
- Improved disaster response and recovery efforts.
- Strengthened social protection programs.

#### Way Forward:

- Strengthen community-based disaster risk reduction and response plans.
- Provide training and capacity building to community members.
- Implement effective early warning systems.
- Strengthen social safety nets to protect vulnerable populations.

### 4.10.8 Human Health

**Goal:** Protect public health from climate-related risks.

#### Policies and Actions:

- **Climate-Sensitive Health Services:** Integrating climate change considerations into health planning and service delivery.
- **Disease Surveillance and Control:** Monitoring and controlling climate-sensitive diseases, such as dengue fever and malaria.
- **Health Promotion and Education:** Raising awareness about climate-related health risks and promoting healthy behaviours.

#### Progress:

- Improved surveillance and control of climate-sensitive diseases.
- Enhanced public health capacity to address climate-related health challenges.

#### Way Forward:

- Strengthen health systems to respond to climate-related health threats.
- Promote climate-resilient health practices.
- Invest in health research to develop effective interventions.

### 4.10.9 Energy

**Goal:** Transition to renewable energy sources and improve energy efficiency.

#### Policies and Actions:

- **Renewable Energy Development:** Promotion of solar, wind, and other renewable energy sources.
- **Energy Efficiency:** Implementing energy efficiency measures in buildings, transportation, and industry.

- **Energy Access:** Expanding access to clean and affordable energy services.

#### Progress:

- Increased renewable energy generation capacity, particularly solar power.
- Improved energy efficiency in various sectors.
- Expanded access to clean energy services in rural areas.

#### Way Forward:

- Accelerate the deployment of renewable energy technologies.
- Promote energy efficiency in buildings, transportation, and industry.
- Invest in grid modernization and energy storage solutions.
- Explore opportunities for regional cooperation in the energy sector.

By implementing these adaptation strategies and leveraging international support, Tuvalu aims to build resilience to climate change and secure a sustainable future for its people. However, the small island nation faces significant challenges, including limited resources, geographic constraints, and high vulnerability to climate change impacts. Continued international cooperation and support are essential to help Tuvalu adapt to the impacts of climate change and achieve its sustainable development goals.

**Table 54: Adaptation Projects and Progress**

| Adaptation Priority     | Project Name                             | Funding Source              | Status  | Key Achievements                                 |
|-------------------------|------------------------------------------|-----------------------------|---------|--------------------------------------------------|
| Coastal Zones           | Coastal Resilience Project               | Green Climate Fund          | Ongoing | Initiated seawalls construction                  |
| Island Ecology          | Biodiversity Restoration Initiative      | Conservation NGOs           | Ongoing | Initiated restoration of native vegetation       |
| Coral Reefs & Fisheries | Coral Restoration Initiative             | Global Environment Facility | Ongoing | Initiated established coral nurseries            |
| Water Resources         | Water Security Enhancement Project       | Green Climate Fund          | Ongoing | Increasing potable water availability            |
| Agriculture & Food      | Climate-Resilient Agriculture Initiative | UNDP                        | Ongoing | increase in food production                      |
| Communities             | Community Resilience Program             | WHO                         | Ongoing | Engaging individuals in climate awareness        |
| Human Health            | Climate-Resilient Health Initiative      | WHO                         | Ongoing | Establishing climate health surveillance systems |
| Energy                  | Renewable Energy Expansion Project       | ADB                         | Ongoing | Increased renewable energy capacity by 14%       |



## 4.11 Adaptation Challenges, Gaps, and Barriers

Tuvalu's adaptation efforts are shaped by its unique challenges as a low-lying, isolated island nation highly vulnerable to climate impacts. Drawing on national policies and recent assessments, this analysis outlines Tuvalu's adaptation priorities, barriers, and the actions needed to advance resilience across sectors.

### 4.11.1 Institutional Barriers

Tuvalu faces several barriers in advancing medium- and long-term adaptation planning to enhance climate resilience. Through readiness and preparatory support, the Green Climate Fund (GCF) proposal aims to address these barriers based on insights from Tuvalu's National Adaptation Programme of Action (NAPA), National Adaptation Plan (NAP), and key climate adaptation documents. The following are the identified barriers, current gaps, and proposed actions to strengthen Tuvalu's adaptation capacity.

### 4.11.2 Capacity Constraints

Tuvalu's Capacity Needs Assessment reveals a significant shortage of skilled professionals in government and public sectors, particularly in climate science, project management, disaster response, and adaptation technologies. This shortage hampers effective planning, implementation, and long-term sustainability of adaptation projects. Tuvalu's National Climate Change Policy (2021-2030) prioritizes capacity building and advocates for continuous training and education. Developing a National Climate Change Training Center would support ongoing skill-building across climate-related fields, including the integration of traditional knowledge to better engage local communities.

### Fragmented Governance and Coordination

Coordination across government agencies, NGOs, and local stakeholders is limited, as identified in the NAPA, NAP, and GCF proposal leading to inefficiencies and overlapping responsibilities. Establishment of a National Adaptation Coordinating Committee to align adaptation actions, define roles, improve data-sharing, and ensure integration into national development plans. A centralized Climate Adaptation Coordination Office within the Department of Climate Change would facilitate streamlined communication and data exchange.

### 4.11.3 Financial Barriers

#### 4.11.3.1 *Dependence on External Funding*

Tuvalu relies heavily on international funds, which poses risks due to shifting donor priorities and potential delays. The national climate finance strategy outlines a need for more sustainable funding mechanisms, including green bonds, adaptation funds, and private-sector partnerships. The Framework for Resilient Development in the Pacific (FRDP) encourages regional collaboration to secure more predictable and diversified funding.

#### 4.11.3.2 *Budgetary Constraints*

With limited national budget resources, funding for critical adaptation measures like infrastructure resilience, water security, and agriculture remains insufficient. The NAP recommends setting aside dedicated national budget allocations for climate resilience and seeking co-financing opportunities with regional organizations. Alternative funding sources, such as climate bonds and partnerships with development banks, should be actively pursued to bridge financial gaps.

#### *4.11.3.3 Financial Gap Analysis*

Tuvalu's national adaptation needs assessment estimates that Tuvalu requires approximately \$50 million over the next five years to meet adaptation priorities. Currently available funds total \$15 million, leaving a gap of \$35 million. This shortfall underscores the importance of innovative financing and active engagement with the GCF, Adaptation Fund, and other global climate financing mechanisms.

### **4.11.4 Physical and Environmental Constraints**

#### *4.11.4.1 Geographic Isolation*

Tuvalu's remoteness increases the costs and complexities of delivering essential materials, technical expertise, and emergency supplies for adaptation projects. High transportation costs can affect the speed and efficiency of adaptation measures. Enhanced partnerships with regional allies could improve response times and resource availability during climate-related emergencies.

#### *4.11.4.2 Limited Land Availability*

As a small island nation, Tuvalu's limited land restricts relocation, infrastructure expansion, and agricultural development options. Efficient land-use planning can prevent resource degradation. Adaptation strategies should explore techniques like vertical farming, hydroponics, and multi-use infrastructure to maximize land utilization while ensuring resilience.

### **4.11.5 Socioeconomic Challenges**

#### *4.11.5.1 Community Engagement and Awareness*

Successful adaptation relies on strong community participation, but low awareness and varying educational levels pose challenges. Community engagement highlights the importance of participatory approaches, community-led initiatives, and culturally relevant communication to raise awareness. Training programs focusing on climate-resilient practices, water conservation, and agricultural adaptation will empower communities to contribute to adaptation goals.

#### *4.11.5.2 Migration Pressures*

Rising sea levels and climate impacts intensify migration pressures, leading to displacement and increased overseas migration. The Tuvalu's Climate Change and Migration Report of UNU advocates for a comprehensive resettlement strategy to support displaced populations. This includes enhancing urban infrastructure, developing support systems for migrants, and addressing cultural impacts related to relocation.

### **4.11.6 Future Actions Required for Advancing Adaptation Planning**

#### *4.11.6.1 Enhancing Institutional Capacity*

Continuous professional training and the establishment of a National Climate Change Training Center will foster resilience across government agencies, community organizations, and stakeholders. This capacity-building effort is essential for strengthening Tuvalu's ability to plan and implement adaptation initiatives effectively.

#### *4.11.6.2 Strengthening Governance and Coordination*

Establishing a Climate Adaptation Coordination Office will centralize adaptation planning and monitoring, improving coordination across agencies. A data-sharing platform will support real-time information exchange and decision-making, ensuring that adaptation efforts align with national and regional goals.



#### *4.11.6.3 Diversifying Funding Sources*

To reduce reliance on external funding, expanding to climate bonds, public-private partnerships, and regional funding mechanisms. Engaging with private sector investors and international foundations will also bring diversified funding to sustain adaptation efforts.

#### *4.11.6.4 Empowering Communities through Localized Adaptation Initiatives*

The NAP emphasizes the importance of community-based adaptation programs that integrate local knowledge and support livelihoods. Training programs focused on climate resilience, sustainable water use, and agriculture will enhance community capacity and promote long-term adaptation outcomes.

### **4.11.7 Summary of Capacity Gaps and Barriers**

Tuvalu's National Adaptation Plan (NAP) and associated climate adaptation frameworks, aligned with the Modalities, Procedures, and Guidelines (MPGs) for adaptation reporting, address a series of critical barriers that hinder effective climate resilience efforts across institutional, financial, environmental, and socio-economic fronts.

Institutional barriers, such as limited technical capacity and fragmented governance, restrict coordinated adaptation planning and community engagement, which is essential for successful adaptation strategies.

Financially, Tuvalu's reliance on international funding and limited national budget pose challenges to sustained financing, while it recommends sustainable funding mechanisms like climate bonds, regional cooperation, and dedicated resilience funds to close projected funding gaps.

Environmentally, geographic isolation and limited land availability complicate project logistics and infrastructure development, highlighting the need for land optimization and strengthened regional partnerships.

Socioeconomic barriers, including low community awareness and increasing migration due to climate pressures, underscore the importance of localized adaptation initiatives, participatory planning, and comprehensive resettlement plans for displaced populations.

Together, these insights form a roadmap for Tuvalu to build a climate-resilient future, empowering communities and enhancing institutional capabilities to manage and sustain adaptation efforts in a challenging environmental and financial landscape.

## **4.12 Adaptation Strategies, Policies, Plans, Goals and Actions**

Tuvalu is recognized as one of the nation's most vulnerable to the impacts of climate change, facing existential threats from sea level rise, extreme weather events, and ecological degradation. This section elaborates on Tuvalu's comprehensive adaptation strategies, policies, plans, goals, and actions in alignment with the Paris Agreement's Article 7 and the UNFCCC's Modalities, Procedures, and Guidelines (MPGs). The report provides a detailed account of Tuvalu's efforts to integrate climate change adaptation into national policies, outlining the scope and specifics of its initiatives.

### **4.12.1 Implementing Adaptation Actions to Meet the Paris Agreement's Global Goal on Adaptation**

Tuvalu, a small island nation highly vulnerable to climate change, has developed a comprehensive adaptation strategy aligned with the global goal of adaptation as set out in Article 7 of the Paris

Agreement. Key strategies include coastal zone management, ecosystem-based adaptation, water resource management, agriculture and food security, community-based adaptation, infrastructure development, early warning systems, health and climate change, energy security and climate change mitigation, capacity building and education, and monitoring and evaluation.

By implementing these strategies, Tuvalu aims to build resilience to climate change impacts, protect its vulnerable ecosystems, and ensure the well-being of its people. The country is actively engaging with international partners, seeking funding, and building capacity to effectively implement its adaptation plans.

#### 4.12.2 Coastal Zone Management (CZM)

**Objective:** To enhance coastal resilience by managing coastal resources sustainably and reducing vulnerability to climate impacts.

**Key Actions:**

- **Coastal Vulnerability Assessment:** Conduct detailed assessments of coastal areas to identify erosion hotspots and flood-prone regions. Use geographic information systems (GIS) to visualize risks and inform planning.
- **Coastal Ecosystem Restoration:** Implement restoration projects for mangroves, coral reefs, and other critical coastal ecosystems. Promote community-led initiatives for ecosystem conservation.
- **Sustainable Development Planning:** Integrate climate considerations into land-use planning, ensuring that new developments account for future climate risks.
- **Community-Based Coastal Management:** Empower coastal communities to participate in decision-making and implement adaptation measures.
- **Policy and Regulatory Framework:** Develop and implement policies and regulations to govern coastal development and resource use.
- **Monitoring and Evaluation:** Establish a monitoring system to track changes in coastal ecosystems, erosion rates, and the effectiveness of adaptation measures.

**Expected Outcomes:**

- Enhanced coastal resilience, protecting communities and infrastructure from climate impacts.
- Improved biodiversity and ecosystem services that support local livelihoods.
- Sustainable development of coastal areas.
- Reduced vulnerability to coastal hazards, such as erosion, flooding, and storm surges.

**Monitoring Mechanisms:**

- Develop a coastal monitoring program to track changes in coastal ecosystems, erosion rates, and the effectiveness of adaptation measures.
- Use remote sensing and GIS technologies to monitor coastal changes over time.
- Establish a network of coastal monitoring stations to collect data on water quality, sediment transport, and wave energy.



### Stakeholder Involvement:

- Collaborate with local fishing communities, tourism operators, and environmental organizations to ensure their knowledge and experiences shape coastal management strategies.
- Organize community workshops and consultations to gather input and build ownership.
- Establish local coastal management committees to oversee implementation and decision-making.

### Financing Strategies:

- Seek funding from international environmental organizations, such as the Global Environment Facility (GEF) and the Green Climate Fund (GCF).
- Utilize national budgets to allocate resources for coastal protection and restoration.
- Explore public-private partnerships to finance coastal development projects.
- Mobilize community-driven fundraising efforts to support local initiatives.
- Implement innovative financing mechanisms, such as payment for ecosystem services.

## 4.12.3 Island Ecology

**Objective:** Protect and restore island ecosystems to enhance resilience to climate change impacts.

### Key Actions:

- **Marine Protected Area Establishment:** Designate and manage marine protected areas to conserve biodiversity and critical habitats.
- **Invasive Species Control:** Implement effective measures to control and eradicate invasive species that threaten native ecosystems.
- **Ecosystem Restoration:** Restore degraded ecosystems, such as mangroves, coral reefs, and seagrass beds, through replanting, habitat rehabilitation, and pollution control.
- **Community-Based Conservation:** Engage local communities in conservation efforts, including monitoring, enforcement, and sustainable resource use.
- **Climate-Smart Fisheries:** Promote sustainable fishing practices, including size limits, catch quotas, and gear restrictions.

### Expected Outcomes:

- **Enhanced Biodiversity and Ecosystem Health:** Increased biodiversity, improved water quality, and enhanced ecosystem resilience.
- **Coastal Protection and Resilience:** Strengthened coastal protection against erosion, storm surges, and sea-level rise.
- **Sustainable Fisheries and Livelihoods:** Improved livelihoods for coastal communities through sustainable fishing practices.
- **Reduced Vulnerability to Natural Disasters:** Enhanced resilience to natural disasters such as hurricanes, cyclones, and tsunamis.

### Monitoring Mechanisms:

- **Regular Monitoring:** Conduct regular monitoring of key ecological indicators, such as coral reef health, fish populations, and water quality.
- **Citizen Science:** Engage local communities in data collection and monitoring efforts.
- **Remote Sensing:** Utilize remote sensing technologies to track changes in ecosystems over time.

#### **Stakeholder Involvement:**

- **Community Engagement:** Collaborate with local communities to develop and implement conservation plans.
- **Government Partnerships:** Work with government agencies to establish and enforce regulations and policies.
- **NGO Partnerships:** Partner with NGOs to provide technical expertise and financial support.
- **International Cooperation:** Seek international cooperation and funding to support conservation efforts.

#### **Financing Strategies:**

- **International Climate Finance:** Leverage international climate funds like the Green Climate Fund to finance conservation projects.
- **Domestic Funding:** Allocate government budgets for conservation and restoration efforts.
- **Public-Private Partnerships:** Partner with private sector organizations to invest in conservation initiatives.
- **Eco-tourism:** Promote eco-tourism to generate revenue for conservation.
- **Payment for Ecosystem Services:** Implement payment for ecosystem services schemes to incentivize conservation.

By implementing these strategies, Tuvalu can safeguard its unique island ecosystems, protect coastal communities, and ensure a sustainable future for generations to come.

### **4.12.4 Coral Reefs and Fisheries**

**Objective:** To protect and restore coral reefs and ensure sustainable fisheries to support livelihoods and ecosystem services.

#### **Key Actions:**

- **Marine Protected Area Establishment:** Designate and manage marine protected areas to safeguard coral reefs and associated biodiversity.
- **Coral Reef Restoration:** Implement coral reef restoration techniques, such as coral transplantation and micro fragmentation, to accelerate recovery from disturbances.
- **Climate-Smart Fisheries:** Promote sustainable fishing practices, including size limits, catch quotas, and gear restrictions, to ensure long-term fishery sustainability.
- **Community-Based Fisheries Management:** Empower fishers to participate in decision-making and management of fisheries resources through community-based fisheries management (CBFM) approaches.



- **Monitoring and Surveillance:** Conduct regular monitoring of coral reef health, fish populations, and water quality to inform management decisions and assess the effectiveness of conservation measures.

#### **Expected Outcomes:**

- **Healthy and Resilient Coral Reef Ecosystems:** Improved coral reef health, biodiversity, and resilience to climate change impacts.
- **Sustainable Fisheries:** Sustainable fisheries that support livelihoods and food security.
- **Reduced Overfishing and Destructive Fishing Practices:** Reduced pressure on fish stocks and marine ecosystems.
- **Community Empowerment:** Empowered coastal communities to participate in decision-making and resource management.

#### **Monitoring Mechanisms:**

- **Regular Monitoring:** Conduct regular monitoring of coral reef health, fish populations, and water quality using scientific methods and citizen science.
- **Assessment of Fisheries Management:** Evaluate the effectiveness of fisheries management measures, including catch quotas, size limits, and gear restrictions.
- **Socioeconomic Monitoring:** Track changes in fishers' livelihoods, income, and well-being.

#### **Stakeholder Involvement:**

- **Community Engagement:** Involve fishers, community leaders, and other stakeholders in decision-making and management processes.
- **Collaboration with Research Institutions:** Collaborate with research institutions and NGOs to conduct scientific research and monitoring.
- **Public Awareness and Education:** Raise public awareness about the importance of coral reefs and sustainable fisheries through education campaigns and outreach programs.

#### **Financing Strategies:**

- **International Climate Finance:** Seek funding from international climate funds, such as the Green Climate Fund, to support coral reef conservation and fisheries management.
- **Domestic Funding:** Mobilize domestic resources through government budgets and public-private partnerships.
- **User Fees and Levies:** Implement user fees and levies on fishing activities to generate revenue for fisheries management.
- **Eco-tourism:** Promote sustainable tourism to generate income for conservation and community development.

### **4.12.5 Agricultural and Food Security**

**Objective:** To enhance the resilience of the agricultural sector to climate impacts, ensuring food security and livelihoods.

#### **Key Actions:**

- **Climate-Resilient Crop Varieties:** Research and promote the use of climate-resilient crop varieties that can withstand drought, salinity, and flooding. Provide training and resources to farmers for seed adoption.
- **Sustainable Farming Practices:** Encourage sustainable agricultural practices, such as agroforestry, organic farming, and conservation agriculture, to improve soil health, reduce water use, and enhance biodiversity.
- **Diversification of Livelihoods:** Support farmers in diversifying their income sources through alternative livelihoods, such as eco-tourism, aquaculture, and non-farm activities.
- **Water Resource Management:** Implement efficient water management practices, such as rainwater harvesting, drip irrigation, and water-saving technologies.
- **Early Warning Systems:** Establish and strengthen early warning systems to alert farmers of impending droughts, floods, and pest outbreaks.
- **Agricultural Insurance:** Promote agricultural insurance schemes to mitigate financial losses due to climate-related disasters.
- **Knowledge Sharing and Capacity Building:** Organize training programs, workshops, and farmer field schools to enhance farmers' knowledge and skills in climate-resilient agriculture.

#### **Expected Outcomes:**

- Increased agricultural productivity and food security.
- Enhanced community resilience through diversified income sources.
- Reduced vulnerability to climate-related risks, such as droughts, floods, and pests.
- Improved soil health and water conservation.
- Increased adoption of sustainable agricultural practices.

#### **Monitoring Mechanisms:**

- **Track Key Indicators:** Monitor key indicators such as crop yields, livestock productivity, and food security indices.
- **Assess the Impact of Adaptation Measures:** Evaluate the effectiveness of climate-resilient technologies and practices.
- **Community Feedback:** Gather feedback from farmers and communities on the impact of adaptation interventions.

#### **Stakeholder Involvement:**

- **Farmer Participation:** Involve farmers in decision-making processes and the development of adaptation strategies.
- **Collaboration with Extension Services:** Work closely with agricultural extension services to provide technical assistance and training.
- **Partnerships with NGOs and Research Institutions:** Collaborate with NGOs and research institutions to access expertise and resources.
- **Public-Private Partnerships:** Foster partnerships with the private sector to invest in agricultural development and technology.



### Financing Strategies:

- **International Climate Finance:** Seek funding from international climate funds, such as the Green Climate Fund, to support climate-resilient agriculture.
- **Domestic Budget Allocation:** Increase government budget allocation for agriculture and rural development.
- **Innovative Financing Mechanisms:** Explore innovative financing mechanisms, such as climate-smart agriculture funds and carbon markets.
- **Public-Private Partnerships:** Encourage public-private partnerships to invest in agricultural infrastructure and technology.
- **Microfinance and Credit:** Provide access to credit and financial services to smallholder farmers.

### 4.12.6 Community-Based Adaptation

**Objective:** To empower communities to adapt to climate change and build resilience.

#### Key Actions:

- **Community-Based Disaster Risk Reduction:** Empower communities to develop and implement comprehensive disaster preparedness and response plans. This includes conducting vulnerability assessments, developing evacuation plans, and organizing community drills.
- **Capacity Building:** Provide training and education to communities on climate change impacts, adaptation strategies, and disaster risk reduction. This can be achieved through workshops, seminars, and community outreach programs.
- **Social Protection Programs:** Implement social protection programs, such as cash transfers, food assistance, and health insurance, to support vulnerable communities during and after climate-related disasters.
- **Community-Based Monitoring:** Involve communities in monitoring climate change impacts and adaptation efforts. This can be done through citizen science initiatives, where community members collect data on local climate conditions, water quality, and biodiversity.

#### Expected Outcomes:

- **Increased Community Resilience:** Enhanced ability of communities to cope with and recover from climate-related shocks and stresses.
- **Improved Disaster Preparedness and Response:** Effective early warning systems, evacuation plans, and emergency response procedures.
- **Enhanced Social Protection:** Reduced vulnerability of vulnerable groups, such as women, children, and the elderly.
- **Strengthened Community Ownership and Participation:** Increased community ownership and engagement in adaptation efforts.

#### Monitoring Mechanisms:

- **Track Community Participation:** Monitor the participation of community members in adaptation activities and decision-making processes.

- **Assess the Effectiveness of Community-Based Initiatives:** Evaluate the impact of community-based adaptation projects on community resilience and well-being.
- **Monitor Changes in Community Vulnerability:** Track changes in community vulnerability to climate change over time.

#### **Stakeholder Involvement:**

- **Engage Community Leaders:** Work closely with community leaders to identify local priorities and challenges.
- **Involve Women's Groups:** Empower women's groups to participate in decision-making and implementation of adaptation measures.
- **Collaborate with NGOs and CBOs:** Partner with NGOs and community-based organizations to provide technical assistance and support.
- **Facilitate Community-Based Planning:** Support community-based planning processes to develop and implement locally led adaptation strategies.

#### **Financing Strategies:**

- **Seek Funding from International Climate Funds:** Leverage international climate funds, such as the Green Climate Fund, to finance community-based adaptation projects.
- **Mobilize Domestic Resources:** Increase government budget allocations for community-based adaptation.
- **Explore Innovative Financing Mechanisms:** Utilize innovative financing mechanisms, such as community-based insurance schemes and social impact bonds.
- **Public-Private Partnerships:** Foster partnerships with the private sector to support community-based initiatives.

### **4.12.7 Energy**

**Objective:** To promote renewable energy and energy efficiency to reduce greenhouse gas emissions and enhance energy security in Tuvalu.

#### **Key Actions:**

- **Solar Energy:** Invest in solar photovoltaic (PV) systems to generate electricity for households, businesses, and government buildings.
- **Wind Energy:** Explore the potential for wind energy, particularly in coastal areas, to supplement solar power.
- **Energy Efficiency:** Implement energy efficiency measures in buildings, transportation, and industry to reduce energy consumption.
- **Energy Storage:** Invest in energy storage solutions, such as batteries, to ensure a reliable and sustainable energy supply, especially during periods of low solar or wind energy generation.
- **Community-Based Energy Solutions:** Empower communities to develop and manage their own renewable energy projects, such as solar home systems and community solar farms.

#### **Expected Outcomes:**



- Reduced reliance on fossil fuels and diesel generators.
- Reduced greenhouse gas emissions.
- Improved energy security and reliability.
- Lower energy costs for households and businesses.
- Increased energy access in rural and remote areas.

#### **Monitoring Mechanisms:**

- Track energy consumption and emissions.
- Monitor the performance of renewable energy systems.
- Assess the impact of energy efficiency measures.

#### **Stakeholder Involvement:**

- Engage government agencies, NGOs, and the private sector to promote renewable energy and energy efficiency.
- Collaborate with communities to develop and implement energy projects.
- Involve traditional knowledge holders in decision-making processes.

#### **Financing Strategies:**

- Seek funding from international climate funds, such as the Green Climate Fund.
- Explore public-private partnerships to finance renewable energy projects.
- Mobilize domestic resources through government budgets and community-based fundraising.
- Utilize innovative financing mechanisms, such as feed-in tariffs and renewable energy certificates.

By focusing on these key actions, Tuvalu can significantly reduce its reliance on fossil fuels, enhance energy security, and contribute to global efforts to mitigate climate change.

### **4.12.8 Water Resource Management**

**Objective:** To ensure the sustainable management of water resources, enhancing resilience to climate variability.

#### **Key Actions:**

- **Water Resource Assessment:** Conduct comprehensive assessments of freshwater resources, including surface water and groundwater, to identify vulnerabilities and seasonal variability. Use hydrological modelling to project future water availability and demand.
- **Rainwater Harvesting:** Promote rainwater harvesting systems in communities to enhance water supply during dry periods. Provide technical support, training, and subsidies to encourage the adoption of rainwater harvesting technologies.
- **Water Conservation and Efficiency:** Implement water conservation measures, such as efficient irrigation practices, water-saving technologies, and public awareness campaigns.

- **Water Quality Monitoring:** Implement regular monitoring of water quality to ensure the safety and availability of drinking water. Monitor water sources for pollutants and contaminants.
- **Integrated Water Resource Management (IWRM):** Adopt an integrated approach to water resource management, considering the interconnectedness of water resources and their impact on various sectors.
- **Climate-Resilient Infrastructure:** Invest in climate-resilient water infrastructure, such as dams, reservoirs, and pipelines, to ensure water security.

#### **Expected Outcomes:**

- Improved access to safe and reliable water sources for communities, particularly during climate-related droughts.
- Enhanced understanding of water resource vulnerabilities, leading to better planning and management.
- Reduced water scarcity and water stress.
- Improved water quality and reduced water pollution.
- Increased resilience to climate change impacts on water resources.

#### **Monitoring Mechanisms:**

- Establish a water quality monitoring system with regular reporting and community involvement in data collection.
- Monitor water levels in rivers, lakes, and reservoirs.
- Track the implementation of water conservation measures and their impact on water use.

#### **Stakeholder Involvement:**

- Engage local communities in water management decisions, ensuring their needs and traditional knowledge inform strategies.
- Collaborate with government agencies, NGOs, and other stakeholders to develop and implement water management plans.
- Promote public awareness and education on water conservation and sustainable water use.

#### **Financing Strategies:**

- Leverage national budgets to allocate funds for water resource management.
- Seek funding from international development banks and climate funds.
- Explore public-private partnerships to finance water infrastructure projects.
- Implement cost-recovery mechanisms for water services to ensure sustainability.

### **4.12.9 Disaster Risk Reduction (DRR)**

**Objective:** To reduce vulnerabilities and enhance preparedness for climate-related disasters through proactive measures.



### Key Actions:

- **Early Warning Systems:** Implement and enhance early warning systems for climate-related disasters, including cyclones and flooding. Utilize technology for real-time data collection, analysis, and dissemination of warnings to communities.
- **Community Preparedness Training:** Conduct regular training programs for communities on disaster preparedness, response strategies, and recovery planning. Engage youth and local leaders in these initiatives to ensure knowledge transfer and community ownership.
- **Infrastructure Resilience Assessment:** Assess the vulnerability of critical infrastructure, such as roads, bridges, schools, and hospitals, to climate-related hazards. Prioritize investments in resilient infrastructure design and construction.
- **Evacuation Planning:** Develop and implement evacuation plans for vulnerable areas, including coastal zones and low-lying areas.
- **Emergency Response and Recovery Planning:** Develop comprehensive emergency response and recovery plans, including coordination mechanisms, resource mobilization, and post-disaster reconstruction strategies.
- **International Cooperation:** Collaborate with international organizations and donor countries to access expertise, technology, and financial resources for disaster risk reduction.

### Expected Outcomes:

- Increased community preparedness and resilience to climate-related disasters.
- Reduced loss of life and property damage from disasters.
- Improved response and recovery efforts.
- Enhanced infrastructure resilience to climate change impacts.

### Monitoring Mechanisms:

- Establish a monitoring framework to assess the effectiveness of DRR initiatives and community preparedness levels.
- Track the implementation of early warning systems and emergency response plans.
- Monitor the vulnerability of critical infrastructure and the effectiveness of mitigation measures.
- Evaluate the impact of community-based disaster risk reduction initiatives.

### Stakeholder Involvement:

- Engage community members, local governments, and NGOs in DRR planning and training efforts.
- Establish community-based disaster management committees to coordinate local response and recovery efforts.
- Collaborate with international organizations and donor agencies to seek support for DRR initiatives.

### Financing Strategies:

- Access funding from disaster recovery funds, international aid, and partnerships with NGOs to support DRR initiatives.

- Explore innovative financing mechanisms, such as catastrophe bonds and insurance pools, to mitigate financial risks associated with disasters.
- Prioritize budget allocation for DRR activities in national and local budgets.

#### 4.12.10 Health and Climate Adaptation

**Objective:** To protect public health from climate-related risks through targeted adaptation strategies.

**Key Actions:**

- **Health Risk Assessments:** Conduct regular assessments to identify climate-related health risks, such as heat-related illnesses, vector-borne diseases, and waterborne diseases.
- **Surveillance and Early Warning Systems:** Establish robust surveillance systems to monitor the incidence of climate-sensitive diseases and implement early warning systems to alert health authorities.
- **Strengthening Health Systems:** Invest in healthcare infrastructure, including hospitals, clinics, and laboratories, to improve access to healthcare services, especially in vulnerable communities.
- **Capacity Building:** Provide training and capacity building to healthcare workers to enhance their skills in diagnosing, treating, and preventing climate-related health problems.
- **Community Health Education:** Implement public health campaigns to raise awareness about climate-related health risks and promote preventive measures, such as proper hygiene, vaccination, and safe water practices.
- **Adaptation of Health Services:** Adapt health services to address climate-related health challenges, including heat-related illnesses, vector-borne diseases, and mental health issues.
- **International Cooperation:** Collaborate with international organizations to share knowledge and best practices, and to secure funding for health adaptation initiatives.

**Expected Outcomes:**

- Improved public health resilience to climate change impacts.
- Reduced incidence of climate-related diseases.
- Enhanced capacity of health systems to respond to health emergencies.
- Increased awareness and proactive health-seeking behaviours in communities.

**Monitoring Mechanisms:**

- Establish health monitoring systems to track climate-related health outcomes and the effectiveness of adaptation strategies.
- Monitor trends in disease incidence, mortality rates, and healthcare utilization.
- Evaluate the impact of health interventions and programs.

**Stakeholder Involvement:**

- Collaborate with healthcare professionals, community leaders, and vulnerable populations to inform health adaptation strategies.



- Engage with non-governmental organizations and international health organizations to share experiences and best practices.
- Involve communities in planning and implementing health adaptation initiatives.

#### **Financing Strategies:**

- Secure funding from national health budgets, international health organizations, and climate finance mechanisms to support health adaptation initiatives.
- Explore innovative financing mechanisms, such as public-private partnerships and social impact bonds.
- Prioritize the allocation of resources for health adaptation in national budgets.

### **4.12.11 Capacity Building and Education**

**Objective:** To enhance the knowledge and skills of stakeholders in adaptation planning and implementation.

#### **Key Actions:**

- **Tailored Training Programs:** Develop and deliver targeted training programs for government officials, community leaders, and local NGOs on climate change impacts, vulnerability assessments, adaptation planning, and project implementation.
- **Curriculum Integration:** Integrate climate change education into school curricula at all levels, from primary to secondary education. Develop age-appropriate materials and teaching resources to raise awareness and promote climate-conscious behaviours among young people.
- **Community-Based Education and Awareness:** Conduct community-based education and awareness campaigns to raise awareness about climate change impacts and adaptation measures. Use local languages and culturally appropriate methods to ensure effective communication and engagement.
- **Knowledge Sharing Platforms:** Establish platforms for sharing best practices, lessons learned, and innovative approaches to climate change adaptation among stakeholders. Organize workshops, conferences, and webinars to facilitate knowledge exchange and networking.
- **International Collaboration:** Collaborate with international organizations and experts to access global knowledge and expertise.

#### **Expected Outcomes:**

- Increased capacity of stakeholders to implement effective adaptation strategies.
- Greater awareness and understanding of climate change issues among the general public.
- Enhanced community resilience and participation in adaptation efforts.
- A well-informed and engaged citizenry that can advocate for climate action.

#### **Monitoring Mechanisms:**

- Track participation in training programs and educational initiatives.
- Assess knowledge gain and behaviour change among participants.

- Monitor the implementation of adaptation actions informed by training and capacity building.
- Evaluate the effectiveness of educational materials and campaigns.

#### **Stakeholder Involvement:**

- Collaborate with educational institutions, NGOs, and community organizations to implement capacity-building initiatives.
- Involve local communities in the design and delivery of training programs to ensure relevance and cultural appropriateness.
- Partner with international organizations to access expertise and resources.

#### **Financing Strategies:**

- Identify funding opportunities from international organizations, such as the Green Climate Fund (GCF) and the Adaptation Fund.
- Seek support from bilateral donors, such as Australia, New Zealand, and the United Kingdom.
- Mobilize domestic resources through government budgets and public-private partnerships.
- Explore innovative financing mechanisms, such as climate bonds and carbon markets.

### **4.12.12 Monitoring and Evaluation Framework**

**Objective:** To establish a robust framework for monitoring and evaluating the effectiveness of adaptation strategies.

#### **Key Actions:**

- **Indicator Development:** Develop a set of specific indicators to measure progress in implementing adaptation actions and achieving resilience objectives. These indicators should be relevant to Tuvalu's context and align with the global goal on adaptation.
- **Data Collection and Analysis:** Implement regular data collection and analysis processes, utilizing both quantitative and qualitative methods. Engage communities in data collection efforts to foster ownership and ensure accuracy.
- **Monitoring and Evaluation Plan:** Develop a detailed monitoring and evaluation plan outlining the specific activities, timelines, and responsibilities for data collection, analysis, and reporting.
- **Reporting Mechanisms:** Establish regular reporting mechanisms to communicate progress and challenges to stakeholders, including government agencies, NGOs, and the public. Utilize diverse communication channels, such as reports, presentations, and social media.

#### **Expected Outcomes:**

- Enhanced accountability and transparency in adaptation efforts.
- Continuous improvement of adaptation strategies based on monitoring and evaluation findings.
- Informed decision-making and effective resource allocation.
- Increased public awareness and support for adaptation initiatives.

#### **Monitoring Mechanisms:**



- **Participatory Monitoring and Evaluation:** Involve local communities in monitoring and evaluation processes to ensure their perspectives are considered.
- **Key Performance Indicators:** Track key performance indicators, such as sea-level rise, coastal erosion, water quality, and agricultural productivity.
- **Impact Assessment:** Assess the impact of adaptation measures on vulnerable communities and ecosystems.
- **Lessons Learned:** Document and share lessons learned from monitoring and evaluation to inform future adaptation planning.

#### **Stakeholder Involvement:**

- Engage local communities, government agencies, and NGOs in the monitoring and evaluation process.
- Train stakeholders on data collection, analysis, and reporting techniques.
- Foster partnerships with research institutions to enhance technical capacity.

#### **Financing Strategies:**

- Identify funding sources for monitoring and evaluation efforts, including national budgets, international donors, and partnerships with research institutions.
- Allocate adequate resources for data collection, analysis, and reporting.
- Seek support from international organizations and climate funds for capacity building and technical assistance.

### **4.12.13 Conclusion**

The adaptation strategies outlined in this comprehensive framework provide a robust foundation for Tuvalu to enhance its resilience to climate change. By prioritizing stakeholder involvement, leveraging financing opportunities, and establishing a strong monitoring and evaluation framework, Tuvalu can successfully implement these strategies and contribute to global climate adaptation efforts. This document serves as a guiding tool for stakeholders across all sectors, promoting collaborative action and informed decision-making to protect Tuvalu's future.

## **4.13 Adaptation Goals, Actions, Plans, and Strategies**

Tuvalu became a party to the United Nations Framework Convention on Climate Change (UNFCCC) in June 1992, marking its commitment to addressing climate change at the international level. In 1998, it adopted the Kyoto Protocol, followed by the Doha Amendment to the Protocol in 2014. In April 2016, Tuvalu ratified the Paris Agreement, the major outcome of the twenty-first Conference of the Parties (COP) of the UNFCCC, which entered into force on 4 November 2016. Tuvalu has so far submitted two National Communications to the UNFCCC Secretariat, reporting on its climate actions, progress, and needs. Additionally, its intended Nationally Determined Contribution (NDC), submitted in 2015, focuses primarily on mitigation efforts and is currently being reviewed to align with Tuvalu's obligations under the Paris Agreement. While mitigation is the primary focus of the NDC, Tuvalu's adaptation needs and priorities are expected to be incorporated in the national climate change policy, which is currently under revision for Cabinet endorsement, and in the National Adaptation Plan (NAP) projected for development by 2021. Tuvalu's short-term adaptation priorities were initially identified



in its National Adaptation Programme of Action (NAPA), which was submitted to the UNFCCC Secretariat in May 2007.

Beyond these national efforts, Tuvalu actively participates in international climate adaptation frameworks. It is a member of the Executive Committee of the Warsaw International Mechanism on Loss and Damage associated with Climate Change Impacts and served as co-chair of this committee alongside the United States from September 2015 to November 2017. Additionally, Tuvalu chaired the Least Developed Countries Expert Group (LEG) from 2012 to 2013, a role that highlights its leadership in supporting adaptation efforts for the most vulnerable countries, including the development of National Adaptation Plans. Through these engagements, Tuvalu demonstrates its commitment to integrating adaptation into both national policies and international climate strategies.

#### 4.13.1 National Adaptation Legislative and Policy Framework

Tuvalu, a nation highly vulnerable to the adverse impacts of climate change, has crafted an intricate legislative and policy framework to address its unique challenges. These measures focus on building climate resilience, integrating traditional knowledge, fostering sustainable development, and ensuring community-wide involvement. This comprehensive framework supports adaptation across various sectors, ensuring that the country's approach is both holistic and aligned with international standards. Below are Tuvalu's key legislative acts and strategic policies that guide its climate change adaptation efforts.

The **Climate Change Resilience Act 2019** serves as a pivotal element in Tuvalu's climate legislation. This Act establishes the Climate Change Department (CCD), which is responsible for coordinating national efforts to combat and adapt to climate change. It outlines specific mandates for the CCD, including the development and implementation of climate policies, conducting risk assessments, and integrating adaptation strategies across critical sectors such as agriculture, coastal management, and water resources. The Act also assigns clear roles to the Minister of Climate Change, the Director of the CCD, and the National Advisory Council on Climate Change (NACCC). These roles are essential for ensuring effective leadership and accountability in driving adaptation initiatives. Notably, the Act mandates that all strategies incorporate local knowledge and align with the broader objectives outlined in the Paris Agreement. The emphasis on education, capacity building, and gender equality ensures that climate strategies are inclusive and community focused.

The **Tuvalu Climate Change and Disaster Survival Fund Act 2015** establishes a dedicated financial mechanism to support adaptation and disaster recovery efforts. This Act was a proactive step to safeguard the nation against the immediate and long-term consequences of climate-related disasters. The fund prioritizes community-driven projects, emphasizing local empowerment and participation in the adaptation process. By providing a financial safety net, the Act ensures that Tuvalu can respond rapidly to disasters while also investing in preventive measures that enhance community resilience. The fund has facilitated numerous projects, such as the construction of seawalls, climate-resilient housing, and early warning systems, all tailored to mitigate the impacts of extreme weather events and rising sea levels.

The **National Disaster Management (Amendment) Act 2021** further strengthens Tuvalu's legal framework for disaster risk reduction (DRR). This amendment enhances coordination between governmental agencies, non-governmental organizations, and local communities to ensure a unified response to natural disasters. It underscores the importance of leveraging scientific and traditional knowledge to develop effective adaptation and response strategies. Additionally, the Act incorporates gender-sensitive approaches, recognizing that women often play key roles in community resilience and disaster response. This emphasis on inclusivity is critical for building adaptive capacities across all segments of society.



Complementing these legislative acts are the **Tuvalu Climate Change and Disaster Survival Fund Regulations 2017**, which provide detailed guidelines on the management and distribution of the survival fund established in 2015. These regulations ensure that financial resources are allocated transparently and effectively, focusing on community-based adaptation projects and initiatives that strengthen disaster preparedness. The regulations support mechanisms for accountability and oversight, thus fostering trust in the government's ability to manage funds aimed at climate adaptation and resilience.

Tuvalu's policy framework also includes the **National Strategy for Sustainable Development 2016-2020**, commonly referred to as **Te Kakeega III (TKIII)**. This strategy was instrumental in integrating climate change as a cross-cutting theme across all 12 strategic areas of national development. Although initially set to expire in 2020, its review and update were delayed due to the COVID-19 pandemic. TKIII emphasized sustainable development practices that align with adaptation needs, such as improved water resource management, sustainable fisheries, and climate-smart agriculture. Of the 94 strategic actions outlined in TKIII, 62 were directly relevant to the National Adaptation Plan (NAP) process. This alignment reinforced a multi-sectoral approach to adaptation, recognizing that climate impacts touch every aspect of society and the economy. For instance, strategies under the "Oceans and Seas" strategic area focused entirely on adaptation, while the "Good Governance" area integrated climate considerations into its governance improvements.

Collectively, these legislative and policy instruments demonstrate Tuvalu's commitment to proactive climate action. They highlight the nation's understanding that adaptation requires not just a response to immediate threats but also long-term planning that considers social, economic, and environmental dimensions. The legislative framework supports partnerships with international organizations and aligns with global protocols, ensuring that Tuvalu's efforts are part of a coordinated global response to climate change. Moreover, the emphasis on gender, local knowledge, and community participation underscores the belief that adaptation must be inclusive and grounded in the lived realities of Tuvalu's people.

**Table 55: List of key national legislation, policies, and plans related to climate change adaptation.**

| Document/Policy                                                           | Type   | Status  | Description                                                                                                                                                                                                                                                                                                                                                                                               |
|---------------------------------------------------------------------------|--------|---------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Te Kete: Tuvalu National Strategy for Sustainable Development (2021-2030) | Policy | Current | A ten-year strategy aimed at achieving Tuvalu's national vision of "a peaceful, resilient, and prosperous Tuvalu." It provides a broad planning framework with strategic priority areas and national outcomes, guiding subordinate plans and aligning with sector and corporate plans, annual plans, and budgets. It also includes a framework for implementation, monitoring, evaluation, and reporting. |
| Te Vaka Fenua o Tuvalu: National Climate Change Policy (2020-2030)        | Policy | Current | Developed in response to Tuvalu's needs, this policy aligns with national priorities set in the National Strategy for Sustainable Development. It contributes to regional and international commitments on climate change, informed by assessments, consultations, and strategic guidance, incorporating inputs from island leaders, communities, women, youth, and people with disabilities.             |

|                                                                     |                 |         |                                                                                                                                                                                                                                                                    |
|---------------------------------------------------------------------|-----------------|---------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| National Adaptation Program of Action (NAPA)                        | Plan            | Current | The NAPA is a key policy guiding adaptation efforts in Tuvalu. It identifies priority adaptation projects that address the urgent needs of vulnerable communities. The NAPA was updated in 2023 to reflect changing priorities and needs.                          |
| National Adaptation Plan (NAP) Framework                            | Framework       | Current | Provides strategic guidance to Tuvalu's NAP process, drawing on assessments, including the integrated vulnerability assessment and stocktake of relevant legislation, policies, and plans for climate change adaptation.                                           |
| Climate Change Resilience Act (2019)                                | Legislation     | Current | It is an act aimed at building an effective climate change response and ensuring a long-term, just transition to a climate-resilient and lower carbon economy and society in Tuvalu.                                                                               |
| Tuvalu Climate Change and Disaster Survival Fund Act (2015)         | Legislation     | Current | An act that provides security for the people of Tuvalu against the impacts of climate change and natural disasters, establishing the framework for the Climate Change and Disaster Survival Fund.                                                                  |
| National Disaster Management (Amendment) Act (2021)                 | Legislation     | Current | An act currently being revised to enhance the management of pre- and post-effects of natural disasters in Tuvalu.                                                                                                                                                  |
| Tuvalu Climate Change and Disaster Survival Fund Regulations (2017) | Regulation      | Current | Regulations that outline the application for and assessment of requests for assistance from the Tuvalu Survival Fund. The adaptation component constitutes 20% of its allocation, focusing on enhancing resilience to climate change impacts.                      |
| National Climate Change Policy (2020-2030)                          | Policy Draft    | Current | A revised policy draft aligned with the UNFCCC Paris Agreement, the Framework for Resilient Development in the Pacific, and the Sustainable Development Goals. This policy will guide the implementation of the National Adaptation Plan (NAP).                    |
| Health and Climate Change Country Profile (2019)                    | Baseline Policy | Current | Provides a summary of available evidence on climate hazards, health vulnerabilities, health impacts, and progress toward achieving a climate-resilient health system, serving as a basis for integrating health considerations into climate adaptation strategies. |
| Tropical Cyclone Tino Recovery and                                  | Plan            | Current | A plan designed for post-Cyclone Tino recovery and building a more climate and disaster-resilient future for Tuvalu, including immediate, medium-term, and long-term                                                                                               |



|                                                                    |             |                          |                                                                                                                                                                                                                                                                                       |
|--------------------------------------------------------------------|-------------|--------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Vulnerability Reduction Plan (2020)                                |             |                          | priorities. The total cost of the listed priorities is approximately AU\$103 million.                                                                                                                                                                                                 |
| TKIII 2016-2020 Plan                                               | Policy      | Current (to be reviewed) | The overarching strategy for sustainable development in Tuvalu, outlining key areas of focus and action. It is set for review and revision in 2021.                                                                                                                                   |
| National Disaster Management Act (2008)                            | Legislation | Currently being revised  | An act to provide for the management of pre- and post-effects of natural disasters in Tuvalu, being updated to reflect current needs and enhance disaster response and resilience measures.                                                                                           |
| National Climate Change Policy (2012-2021) Te Kaniva               | Policy      | To be superseded         | The main policy for guiding climate change action in Tuvalu, which identifies 7 goals and 33 strategies, including Goal 1 on adaptation. It will be replaced by the revised National Climate Change Policy.                                                                           |
| National Energy Policy (2009-2020)                                 | Policy      | Currently being reviewed | This policy addresses supply, demand, and environmental considerations for energy security in Tuvalu, identifying 7 strategic areas and 37 strategies to enhance sustainable energy practices.                                                                                        |
| Sustainable and Integrated Water and Sanitation Policy (2012-2021) | Policy      | Current                  | An integrated national plan for water and sanitation that covers the period 2012-2021, outlining 7 goals and 76 strategies to improve access and quality of water and sanitation services in Tuvalu.                                                                                  |
| National Disaster Risk Management Arrangements (2012)              | Framework   | Current (to be updated)  | Provides a high-level framework for disaster risk reduction and disaster management in Tuvalu, consisting of context and structure, disaster management operation plan, and an incomplete audit. This will be updated following the revision of the National Disaster Management Act. |

**Long-Term Adaptation Plan (L-TAP):** The Government of Tuvalu, in collaboration with the United Nations Development Programme (UNDP), is working on a Long-Term Adaptation Plan (L-TAP) to address the severe threats posed by sea level rise (SLR) to the nation's future. This forward-looking plan, aimed at safeguarding Tuvalu's population and infrastructure well beyond 2100, envisions creating 3.6 square kilometres of raised, secure land to accommodate a gradual relocation of people and essential infrastructure over time. Tuvalu's capital, Funafuti, sits at an average elevation of just 0.5 meters above normal spring high tides, leaving it especially vulnerable to SLR. Currently, 46% of the central built area on Fongafale—the largest islet of Funafuti—is already below sea level. Projections suggest that by 2050, daily tidal waters will flood half of Fongafale's land area, and by 2100, routine high tides may submerge up to 95% of its land area. The L-TAP is Tuvalu's first scientifically grounded, long-term national adaptation strategy specifically designed to manage the impacts of ongoing SLR. It

includes the staged relocation of Tuvalu's population to raised land within Funafuti, along with new or upgraded housing, transport facilities, and water supply systems. L-TAP also plans for a possible second phase, allowing further land elevation based on future SLR conditions post-2100, ensuring a resilient, adaptable solution to Tuvalu's existential climate challenges.

**Tuvalu's Future Now Project:** The Ministry of Justice, Communication and Foreign Affairs officially launched Tuvalu's Future Now Project, also known as Te Ataeao Nei Project. This initiative addresses the potential worst-case scenario for Tuvalu under climate change—its possible disappearance due to rising sea levels. With a vision of resilience, the Future Now Project includes three major initiatives: values-based diplomacy, legal permanence of statehood and maritime boundaries, and building a digital nation. This project leverages Tuvaluan principles like *olaga fakafenua* (communal living) and *kaitasi* (shared responsibility), the project promotes a culture-driven approach to international relations, aiming to foster global solidarity for climate action. To safeguard sovereignty if Tuvalu's land is lost, the project seeks legal avenues to ensure Tuvalu's statehood and maritime boundaries remain recognized nationally, regionally, and internationally. To preserve governance and cultural heritage, this initiative focuses on creating a digital administrative system, enabling continuity of state functions and safeguarding Tuvalu's legacy even in worst-case scenarios. The Future Now Project underscores Tuvalu's proactive leadership in climate resilience, aligning immediate action with Pacific regional efforts and the broader vision to "prepare today to secure tomorrow."

#### 4.13.2 Categorizing Tuvalu's Adaptation Policies, Plans, Legislation, and Projects

Tuvalu's adaptation policies, plans, legislations, and projects are aligned with the global goal of adaptation as set out in Article 7 of the Paris Agreement and the Sustainable Development Goals (SDGs).

Below is a detailed categorization of Tuvalu's adaptation initiatives, aligning them with the specified categories and explaining the rationale for each categorization:

##### Overarching Policy and Planning Frameworks

- **Te Kete: Tuvalu National Strategy for Sustainable Development (2021-2030):**
  - A comprehensive framework that integrates climate change adaptation across various sectors, including coastal zone management, agriculture, fisheries, and energy.
  - **Categories:** Cross-sectoral, Coastal Zone Management, Island Ecology, Coral Reefs and Fisheries, Agricultural and Food Security, Energy, Water Resource Management, Disaster Risk Reduction, Capacity Building and Education
- **Te Vaka Fenua o Tuvalu: National Climate Change Policy 2020-2030:**
  - Outlines the country's national response to climate change, addressing both adaptation and mitigation.
  - **Categories:** Cross-sectoral, Coastal Zone Management, Island Ecology, Coral Reefs and Fisheries, Agricultural and Food Security, Energy, Water Resource Management, Disaster Risk Reduction, Capacity Building and Education.

##### Adaptation Planning and Implementation



- **National Adaptation Program of Action (NAPA) and its updates (NAPA-I, NAPA-I+, NAPA-II):**
  - Identifies immediate and urgent adaptation needs and priorities across various sectors, including coastal zone management, agriculture, fisheries, and water resources.
  - **Categories:** Cross-sectoral, Coastal Zone Management, Island Ecology, Coral Reefs and Fisheries, Agricultural and Food Security, Water Resource Management, Disaster Risk Reduction
- **National Adaptation Plan (NAP) Framework):**
  - Provides a framework for guiding adaptation actions across all sectors, including coastal zone management, island ecology, coral reefs, and fisheries, agriculture and food security, water resource management, disaster risk reduction, and capacity building and education.
  - **Categories:** Cross-sectoral, Coastal Zone Management, Island Ecology, Coral Reefs and Fisheries, Agricultural and Food Security, Water Resource Management, Disaster Risk Reduction, Capacity Building and Education
- **Tropical Cyclone Tino Recovery and Vulnerability Reduction Plan 2020:**
  - Outlines recovery and reconstruction efforts following a specific disaster, focusing on infrastructure, housing, and community resilience.
  - **Categories:** Disaster Risk Reduction, Community-Based Adaptation
- **Ridge to Reef (R2R):**
  - Promotes integrated management of land and marine ecosystems, including coral reefs, mangroves, and terrestrial ecosystems.
  - **Categories:** Island Ecology, Coral Reefs and Fisheries, Coastal Zone Management
- **Tuvalu Coastal Adaptation Project (TCAP):**
  - Enhances coastal protection and resilience through infrastructure development and community-based adaptation.
  - **Categories:** Coastal Zone Management, Community-Based Adaptation

## Legal and Institutional Framework

- **Climate Change Resilience Act 2019:**
  - Provides the legal framework for climate change adaptation and mitigation across various sectors.
  - **Categories:** Cross-sectoral, Coastal Zone Management, Island Ecology, Coral Reefs and Fisheries, Agricultural and Food Security, Water Resource Management, Disaster Risk Reduction, Capacity Building and Education
- **Tuvalu Climate Change and Disaster Survival Fund Act 2015:**
  - Establishes a fund to support climate change adaptation and disaster recovery efforts across various sectors.

- **Categories:** Cross-sectoral, Disaster Risk Reduction, Community-Based Adaptation
- **National Disaster Management (Amendment) Act 2021:**
  - Strengthens the legal framework for disaster risk reduction and management.
  - **Categories:** Disaster Risk Reduction, Community-Based Adaptation
- **Tuvalu Climate Change and Disaster Survival Fund Regulations 2017:**
  - Provides guidelines for the management and disbursement of funds from the disaster survival fund.
  - **Categories:** Disaster Risk Reduction, Community-Based Adaptation

## Sector-Specific Adaptation

- **Health and Climate Change Country Profile 2019:**
  - Assesses the health impacts of climate change and outlines strategies to address these challenges.
  - **Categories:** Health, Cross-sectoral

By categorizing Tuvalu's adaptation initiatives in this way, we can better understand the comprehensive approach taken by the country to address climate change challenges. This categorization highlights the importance of a multi-sectoral approach that considers the interconnectedness of various adaptation actions.

## 4.13.3 Tuvalu's adaptation policy, plan, legislation, and projects

### 4.13.3.1 Te Kete: Tuvalu National Strategy for Sustainable Development (2021-2030)

**Objective:** The primary objective of Te Kete is to establish a unified framework for sustainable development that aligns with Tuvalu's vision for a resilient future. It aims to integrate social, economic, and environmental considerations into national policies and practices, thereby promoting the well-being of current and future generations.

**Description:** Te Kete serves as a guiding document for Tuvalu's development agenda over the next decade. It recognizes the unique challenges faced by Tuvalu, particularly its vulnerability to climate change and sea-level rise, and emphasizes the need for sustainable resource management, economic diversification, and community engagement. The strategy promotes a holistic approach, encouraging collaboration among various stakeholders, including government, civil society, and the private sector. It integrates the Sustainable Development Goals (SDGs) into local planning processes, ensuring that development is equitable, inclusive, and environmentally sustainable.

#### Key Actions and Activities:

- **Integrated Planning:** This involves cross-sectoral collaboration to ensure that all government departments consider sustainability in their planning and implementation. Workshops and training sessions will be conducted to enhance understanding of integrated approaches.
- **Community Empowerment:** Initiatives will be launched to engage local communities in decision-making processes, ensuring that development reflects their needs and values. This includes capacity-building workshops and the establishment of community advisory committees.



- **Monitoring and Evaluation Framework:** Establish a system to track progress against the strategy's objectives, utilizing indicators aligned with national and global targets.

**Achievements:** Te Kete has laid the groundwork for a strategic approach to sustainable development in Tuvalu. Notable achievements include the development of a comprehensive framework that aligns local actions with international sustainability commitments, such as the SDGs. The strategy has fostered dialogue among stakeholders and has begun to inform policy decisions across various sectors.

**Gaps and Needs:** Despite its successes, the strategy faces challenges related to implementation capacity, particularly at the local government level. There is a pressing need for increased funding and technical assistance to facilitate the rollout of initiatives outlined in Te Kete. Additionally, the strategy recognizes gaps in public awareness and engagement concerning sustainable development practices.

**Way Forward:** To address these gaps, a concerted effort is required to enhance stakeholder engagement through community forums and participatory planning processes. Strengthening partnerships with international development agencies will be crucial for securing additional funding and technical support. Ongoing monitoring and adaptive management will ensure that the strategy remains responsive to changing circumstances.

**Implementing Agency:** The Ministry of Finance is leading the implementation of Te Kete, in collaboration with other ministries, local governments, and civil society organizations.

**Funding Received & Needed:** N/A

**Funding Source:** Funding sources include international development partners, bilateral aid agencies, and regional organizations focused on sustainability and climate resilience.

**Action Type & Category:** Te Kete encompasses a sustainable development strategy, with a focus on community engagement, policy integration, and resilience building.

**Key Sectors and Aspects Covered:** The strategy addresses key sectors such as sustainable economic development, environmental protection, social equity, and community resilience, recognizing the interdependencies among these areas.

#### 4.13.3.2 Te Vaka Fenua O Tuvalu: National Climate Change Policy 2020-2030

**Objective:** The objective of Te Vaka Fenua is to create a robust policy framework that guides Tuvalu's response to climate change, focusing on both adaptation and mitigation strategies. It aims to enhance the resilience of communities, ecosystems, and economies to the adverse impacts of climate change while promoting sustainable development.

**Description:** This policy document articulates Tuvalu's commitment to addressing the multifaceted challenges posed by climate change. It outlines strategic actions designed to mitigate greenhouse gas emissions and enhance adaptive capacity across all sectors. The policy emphasizes a proactive approach to climate change, integrating scientific knowledge and traditional practices to build resilience. It promotes sustainable practices in agriculture, fisheries, and tourism, which are critical to Tuvalu's economy and food security.

##### Key Actions and Activities

- **Adaptation Initiatives:** The policy outlines specific projects aimed at protecting vulnerable communities, including the construction of seawalls, restoration of coastal ecosystems, and development of drought-resistant agricultural practices.
- **Mitigation Strategies:** It promotes the transition to renewable energy sources, including solar and wind, and encourages energy efficiency measures across all sectors.

- **Capacity Building:** Initiatives to strengthen local capacities for climate adaptation and mitigation are a key focus, including training programs and workshops for government officials and community leaders.

**Achievements:** Since its endorsement by the Tuvalu Cabinet, Te Vaka Fenua has facilitated greater coherence in climate action across government agencies. Noteworthy achievements include increased funding for climate resilience projects and improved engagement with international climate forums, enhancing Tuvalu's visibility and influence in global discussions on climate change.

**Gaps and Needs:** Implementation challenges remain, particularly regarding resource allocation and capacity constraints at the local level. There is also a need for improved public understanding of climate issues and the importance of individual actions in addressing climate change.

**Way Forward:** To advance the policy objectives, Tuvalu will focus on enhancing community awareness through educational campaigns and increasing collaboration with international partners to secure technical and financial support for implementation. A dedicated task force may be established to monitor progress and facilitate adaptive management.

**Implementing Agency:** The Ministry of Home Affairs, Climate Change and Environment will spearhead the implementation of this policy, coordinating efforts across all relevant ministries and stakeholders.

**Funding Received & Needed:** N/A

**Funding Source:** Funding will come from international climate finance mechanisms, donor agencies, and partnerships with regional organizations dedicated to climate action.

**Action Type & Category:** This policy represents a climate change action plan focused on both adaptation and mitigation strategies.

**Key Sectors and Aspects Covered:** Te Vaka Fenua encompasses a wide range of sectors, including agriculture, fisheries, energy, health, and infrastructure, highlighting the interconnected nature of climate resilience and sustainable development.

#### 4.13.3.3 National Adaptation Program of Action (NAPA)

**Objective:** NAPA aims to identify and prioritize urgent and immediate adaptation needs in Tuvalu, particularly for sectors most vulnerable to climate change impacts, ensuring a strategic approach to enhancing resilience.

**Description:** NAPA serves as a critical tool for Tuvalu in articulating its climate adaptation priorities. It outlines specific actions designed to address the immediate impacts of climate change on communities, ecosystems, and infrastructure. The program focuses on enhancing adaptive capacity through targeted interventions that protect livelihoods, enhance food security, and safeguard natural resources.

##### Key Actions and Activities:

- **Vulnerability Assessments:** Comprehensive assessments are conducted to determine the most vulnerable sectors, guiding the prioritization of adaptation initiatives.
- **Project Prioritization:** A prioritized list of adaptation projects has been developed, focusing on immediate actions needed to address climate impacts, such as the restoration of mangrove ecosystems and the development of climate-resilient infrastructure.
- **Stakeholder Engagement:** Local communities are actively involved in the planning and implementation of adaptation projects to ensure that initiatives reflect their needs and knowledge.



**Achievements:** NAPA has successfully identified several priority projects that have received funding and are currently in the implementation phase. The program has strengthened community awareness of climate issues and facilitated partnerships with international organizations for technical and financial support.

**Gaps and Needs:** While NAPA has achieved significant milestones, challenges remain in securing sustainable funding for long-term adaptation projects. Additionally, there is a need for ongoing capacity-building initiatives to equip local stakeholders with the skills necessary for effective project implementation.

**Way Forward:** To enhance the effectiveness of NAPA, future efforts will focus on strengthening collaboration with regional and international partners, securing additional funding sources, and promoting knowledge-sharing among stakeholders to foster innovative solutions to adaptation challenges.

**Implementing Agency:** The Government of Tuvalu, The Climate Change Department (CCD), in collaboration with local governments and community organizations, is leading the implementation of NAPA.

**Funding Received & Needed:** N/A

**Funding Source:** Funding sources include the Global Environment Facility (GEF), Global Climate Fund (GCF), bilateral aid, and contributions from international NGOs.

**Action Type & Category:** NAPA is classified as an adaptation framework focusing on immediate climate resilience needs.

**Key Sectors and Aspects Covered:** The program encompasses sectors such as agriculture, fisheries, water resources, and coastal management, ensuring a comprehensive approach to climate adaptation.

#### 4.13.3.4 National Adaptation Plan (NAP) Framework

**Objective:** The NAP Framework aims to provide a systematic approach to climate change adaptation in Tuvalu, ensuring that adaptation strategies are integrated into national and local development planning.

**Description:** The NAP Framework builds upon the foundations laid by NAPA, outlining a long-term strategy for enhancing resilience across various sectors. It provides guidelines for assessing vulnerabilities, prioritizing actions, and implementing adaptation measures that align with national development objectives and international commitments.

##### Key Actions and Activities

- **Vulnerability and Risk Assessments:** Conducting comprehensive assessments to identify and analyze climate risks across key sectors, informing the prioritization of adaptation actions.
- **Integration into Planning:** Ensuring that adaptation measures are integrated into national and local development plans, budgets, and policies to promote coherence and effectiveness.
- **Capacity Building:** Developing training programs and resources for government officials and community leaders to enhance understanding and implementation of adaptation strategies.

**Achievements:** The NAP Framework has facilitated a more coordinated approach to climate adaptation in Tuvalu. Notable achievements include the establishment of inter-ministerial committees to oversee adaptation efforts and the incorporation of climate considerations into national budgeting processes.

**Gaps and Needs:** While progress has been made, challenges remain in fully integrating adaptation strategies into all levels of planning and decision-making. There is a need for greater public awareness and engagement in the adaptation process to ensure that communities are active participants.

**Way Forward:** Future efforts will focus on enhancing stakeholder engagement through community workshops and public consultations. Strengthening partnerships with international organizations will be vital for securing technical assistance and funding for implementation.

**Implementing Agency:** The Government of Tuvalu, The Climate Change Department (CCD), in collaboration with local governments and community organizations, is leading the implementation of NAPA.

**Funding Received & Needed:** US\$186 million has been allocated or expended through donor-funded projects for the five years.

**Funding Source:** Funding sources include the Global Environment Facility (GEF), Global Climate Fund (GCF), bilateral aid, and contributions from international NGOs.

**Action Type & Category:** The NAP Framework is categorized as a long-term adaptation strategy, focusing on systemic integration of climate resilience into national planning.

**Key Sectors and Aspects Covered:** The framework encompasses key sectors such as agriculture, fisheries, water management, and infrastructure, promoting a comprehensive approach to climate adaptation.

#### 4.13.3.5 Climate Change Resilience Act 2019

**Objective:** The primary objective of the Climate Change Resilience Act 2019 is to establish a legal framework for promoting resilience to climate change impacts in Tuvalu. The Act aims to enhance the country's adaptive capacity, ensuring the protection of vulnerable communities, ecosystems, and infrastructure from the adverse effects of climate change.

**Description:** The Climate Change Resilience Act 2019 provides a comprehensive approach to climate change adaptation and resilience-building in Tuvalu. It outlines the responsibilities of various stakeholders, including government agencies, local communities, and private sector actors, in implementing climate resilience measures. The Act emphasizes the integration of climate change considerations into national and local planning processes, thereby promoting a whole-of-government and whole-of-society approach to resilience.

##### **Key components of the Act include:**

- **Policy Framework:** Establishing a clear policy framework that guides the implementation of climate resilience initiatives across sectors.
- **Institutional Arrangements:** Designating responsibilities for different government entities, facilitating inter-agency collaboration and coordination.
- **Community Engagement:** Encouraging the involvement of local communities in resilience-building efforts, recognizing their role in adapting to climate change.

##### **Key Actions and Activities:**

- **Establishment of Climate Resilience Committees:** The Act mandates the formation of committees at various levels (national, regional, and local) to oversee the implementation of climate resilience strategies and actions.
- **Regular Climate Risk Assessments:** Conduct assessments to identify and analyze climate risks to inform policy-making and resource allocation.



- **Development of Adaptation Plans:** Creating sector-specific adaptation plans that outline strategies and actions to enhance resilience in critical areas such as agriculture, water management, and coastal protection.
- **Capacity Building Initiatives:** Implementing training programs and workshops to enhance the knowledge and skills of stakeholders involved in climate resilience efforts.

**Achievements:** Since its enactment, the Climate Change Resilience Act has facilitated a more coordinated approach to climate resilience in Tuvalu. Notable achievements include:

- The establishment of multi-sectoral climate resilience committees that have successfully engaged local communities in identifying vulnerabilities and developing adaptive strategies.
- Integration of climate change considerations into national development plans and budgets, promoting more resilient infrastructure development.

**Gaps and Needs:** Despite progress, several challenges remain:

- **Limited Resources:** There is a need for increased financial and human resources to effectively implement the Act's provisions and support local resilience initiatives.
- **Data Gaps:** Inadequate data and information on climate risks hinder effective planning and decision-making processes.
- **Public Awareness:** There is a need for greater public awareness and understanding of climate resilience issues to foster community engagement and support.

**Way Forward:** To strengthen the implementation of the Climate Change Resilience Act, future efforts will focus on:

- **Enhancing Stakeholder Engagement:** Increasing community involvement in resilience-building initiatives through awareness campaigns and participatory planning processes.
- **Strengthening Partnerships:** Building partnerships with regional and international organizations to access technical assistance and funding for climate resilience projects.
- **Monitoring and Evaluation:** Establishing a robust monitoring and evaluation framework to assess progress and adapt strategies based on emerging challenges.

**Implementing Agency:** The Government of Tuvalu, the Climate Change Department (CCD) is responsible for overseeing the implementation of the Climate Change Resilience Act. It collaborates closely with other government ministries, local governments, NGOs, and community organizations to ensure a coordinated response to climate change.

**Funding Received & Needed:** N/A

**Funding Source:** Funding sources include international climate finance mechanisms such as the Green Climate Fund (GCF), bilateral aid, and contributions from NGOs and private sector investments.

**Action Type & Category:** The Climate Change Resilience Act represents a legislative framework for climate adaptation and resilience, focusing on long-term strategic planning and inter-agency collaboration.

**Key Sectors and Aspects Covered:** The Act encompasses key sectors such as agriculture, fisheries, health, infrastructure, and disaster risk management, ensuring a holistic approach to building resilience against climate change impacts.

#### 4.13.3.6 Tuvalu Climate Change and Disaster Survival Fund Act 2015

**Objective:** The primary objective of the Tuvalu Climate Change and Disaster Survival Fund Act 2015 is to establish a dedicated financial mechanism aimed at enhancing Tuvalu's resilience to climate

change and disaster impacts. The Act seeks to mobilize resources for effective disaster preparedness, response, and recovery while addressing long-term climate adaptation needs.

**Description:** The Tuvalu Climate Change and Disaster Survival Fund Act 2015 was enacted to create a structured approach to managing financial resources allocated for climate change adaptation and disaster risk reduction. This Fund serves as a pivotal instrument for channelling both domestic and international financial support towards projects that enhance the country's capacity to cope with climate-induced disasters.

**Key features of the Act include:**

- **Establishment of the Fund:** The Act formally establishes the Climate Change and Disaster Survival Fund (CCDSF) as a statutory fund under the Ministry of Finance, managed in accordance with specified guidelines.
- **Funding Sources:** The Fund is intended to receive contributions from government budgets, international donors, non-governmental organizations, and private sector entities.
- **Allocation of Resources:** The Act stipulates how funds can be allocated, prioritizing projects that strengthen climate resilience and disaster preparedness in vulnerable communities and sectors.

**Key Actions and Activities:**

- **Project Financing:** The Fund supports financing for various climate adaptation and disaster response projects, including infrastructure improvements, community awareness programs, and disaster risk assessments.
- **Capacity Building:** Initiatives funded by the CCDSF include training programs aimed at enhancing the skills of local authorities and communities in disaster risk management and climate adaptation techniques.
- **Monitoring and Evaluation:** Establishing a framework for monitoring the effectiveness of funded projects and assessing their impact on community resilience to climate change and disasters.

**Achievements:** Since its inception, the Tuvalu Climate Change and Disaster Survival Fund Act has enabled several key achievements:

- The successful allocation of over AUD 1 million towards various climate adaptation initiatives, including coastal protection projects and water resource management efforts.
- Enhanced community awareness and participation in disaster risk management activities through funded training workshops and public campaigns.

**Gaps and Needs:** Despite its successes, the Act faces certain challenges:

- **Limited Funding:** While the Fund has facilitated several projects, ongoing financial contributions remain insufficient to address the escalating impacts of climate change.
- **Administrative Capacity:** There is a need for improved administrative capacity within the Ministry of Finance and other relevant agencies to manage the Fund effectively and ensure timely project implementation.
- **Integration with National Plans:** Ensuring that funded projects align with broader national development and climate strategies remains a challenge.

**Way Forward:** To enhance the effectiveness of the Tuvalu Climate Change and Disaster Survival Fund, future strategies will focus on:

- **Diversifying Funding Sources:** Actively seeking additional funding from bilateral and multilateral sources, including climate finance initiatives, to expand the Fund's resource base.
- **Strengthening Institutional Capacity:** Investing in capacity-building initiatives for personnel involved in the management and oversight of the Fund to improve operational efficiency.



- **Enhancing Stakeholder Engagement:** Fostering partnerships with local communities, NGOs, and the private sector to leverage additional resources and expertise for resilience projects.

**Implementing Agency:** The Ministry of Finance is responsible for the administration of the Tuvalu Climate Change and Disaster Survival Fund. It works closely with other Ministries and relevant agencies to ensure the alignment of funded projects with national climate resilience goals.

**Funding Received & Needed:** N/A

**Funding Source:** Funding sources for the CCDSF include government allocations, international donor contributions, and support from various NGOs and private sector entities involved in climate and disaster risk reduction initiatives.

**Action Type & Category:** The Tuvalu Climate Change and Disaster Survival Fund Act represents a legislative framework aimed at resource mobilization for climate adaptation and disaster resilience, categorized under financial governance and climate action.

**Key Sectors and Aspects Covered:** The Act addresses key sectors such as water management, coastal protection, health, agriculture, and disaster risk management, ensuring a comprehensive approach to enhancing resilience against climate change impacts.

#### 4.13.3.7 National Disaster Management (Amendment) Act 2021

**Objective:** The National Disaster Management (Amendment) Act 2021 aims to enhance the existing legal framework for disaster management in Tuvalu. The amendment focuses on improving the effectiveness of disaster preparedness, response, recovery, and mitigation strategies in the face of increasing climate-related disasters and other emergencies.

**Description:** The National Disaster Management (Amendment) Act 2021 modifies the original National Disaster Management Act to address emerging challenges and incorporate lessons learned from past disaster events. The amendments provide clearer roles and responsibilities for various stakeholders, strengthen coordination mechanisms, and integrate community-based approaches into disaster management practices.

**Key features of the Act include:**

- **Clarification of Roles:** The amendment clarifies the roles and responsibilities of national and local authorities, emphasizing the importance of coordination among different levels of government and non-governmental organizations.
- **Community Involvement:** It emphasizes community participation in disaster management planning and implementation, recognizing local knowledge and capacities.
- **Enhanced Funding Provisions:** The amendment introduces provisions for improved funding mechanisms to support disaster preparedness and response initiatives.

**Key Actions and Activities:**

- **Establishment of Disaster Management Committees:** The Act mandates the establishment of national and local disaster management committees to enhance coordination and oversight of disaster management activities.
- **Development of Community-Based Plans:** The Act requires the formulation of community-based disaster risk management plans that incorporate local risk assessments and adaptation strategies.
- **Training and Capacity Building:** The Act promotes training programs for government officials, community leaders, and volunteers in disaster response and recovery efforts.

**Achievements:** Since the implementation of the National Disaster Management (Amendment) Act 2021, several achievements have been noted:

- **Improved Coordination:** Enhanced collaboration between national and local authorities, leading to more efficient disaster response efforts during emergencies such as cyclones and flooding.



- **Increased Community Engagement:** The establishment of local disaster management committees has fostered greater community involvement in preparedness and response initiatives, leading to increased resilience.

**Gaps and Needs:** Despite notable progress, there are existing gaps and needs:

- **Resource Limitations:** Many local disaster management committees lack sufficient resources to implement effective disaster risk management strategies, hindering their ability to respond adequately to emergencies.
- **Awareness and Training:** There is a need for ongoing training and awareness programs to ensure that community members are well-informed about disaster risks and preparedness measures.
- **Integration with Development Plans:** Ensuring that disaster risk management strategies are fully integrated into national and local development plans remains a challenge.

**Way Forward:** To build on the successes of the Amendment Act and address its limitations, the following strategies are proposed:

- **Strengthening Funding Mechanisms:** Identifying and securing additional funding sources, including international assistance, to support disaster preparedness initiatives and community resilience projects.
- **Enhancing Training Programs:** Developing comprehensive training modules for all stakeholders involved in disaster management to ensure consistency in response efforts and community preparedness.
- **Promoting Public Awareness:** Launching awareness campaigns to educate the public about disaster risks, response strategies, and the importance of community participation in disaster management.

**Implementing Agency:** The Ministry of Public Works, Infrastructure, Environment, Labor, Meteorology & Disaster is responsible for overseeing the implementation of the National Disaster Management (Amendment) Act 2021. It collaborates with other government agencies, local authorities, and non-governmental organizations to ensure effective disaster management practices are adopted nationwide.

**Funding Received & Needed:** N/A

**Funding Source:** Potential funding sources for disaster management activities include government budget allocations, international development assistance, and contributions from local businesses and civil society organizations.

**Action Type & Category:** The National Disaster Management (Amendment) Act 2021 falls under legislative action aimed at improving disaster management frameworks and processes, categorized as disaster risk reduction and climate adaptation.

**Key Sectors and Aspects Covered:** The Act addresses critical sectors such as emergency response, community development, health and safety, and environmental management, aiming to create a comprehensive disaster management approach that enhances the resilience of communities and infrastructure in Tuvalu.

#### 4.13.3.8 Tuvalu Climate Change and Disaster Survival Fund Regulations 2017

**Objective:** The Tuvalu Climate Change and Disaster Survival Fund Regulations 2017 aims to establish a structured framework for the management and utilization of funds specifically allocated for climate change adaptation and disaster response initiatives in Tuvalu. The primary objective is to enhance the resilience of vulnerable communities and support effective disaster management through strategic funding.

**Description:** The Tuvalu Climate Change and Disaster Survival Fund Regulations provide guidelines for the governance, administration, and operational procedures of the Climate Change and Disaster Survival Fund (CCDSF). The regulations are designed to ensure that the funds are allocated



transparently, effectively, and efficiently in response to climate-related challenges and disasters faced by the nation.

**Key features of the regulations include:**

- **Funding Allocation:** The regulations stipulate the criteria for project selection, prioritizing initiatives that address urgent climate adaptation needs and enhance community resilience.
- **Governance Structure:** The establishment of a governance body to oversee the fund's operations, ensuring accountability and adherence to established policies.
- **Reporting and Accountability:** Requirements for regular reporting on fund utilization and project outcomes to ensure transparency and community involvement.

**Key Actions and Activities:**

- **Fund Establishment:** The regulations led to the formal establishment of the CCDSF, which serves as a crucial financial resource for climate adaptation and disaster risk reduction initiatives.
- **Project Identification and Approval:** A structured process for identifying, evaluating, and approving projects that meet the fund's objectives, ensuring alignment with national climate and disaster management strategies.
- **Capacity Building Initiatives:** The regulations emphasize the importance of training and capacity building for local communities and stakeholders to effectively manage and implement funded projects.

**Achievements:** Since the implementation of the Tuvalu Climate Change and Disaster Survival Fund Regulations 2017, several significant achievements have been recorded:

- **Fund Disbursement:** Approximately AUD 1.5 million has been disbursed to various projects aimed at enhancing climate resilience and disaster preparedness in vulnerable communities.
- **Community Projects:** The fund has supported numerous community-driven projects, such as rainwater harvesting systems, improved agricultural practices, and coastal protection measures, which have demonstrated positive impacts on local resilience.

**Gaps and Needs:** Despite these achievements, several gaps and needs persist:

- **Sustainability of Projects:** Many funded projects lack long-term sustainability plans, resulting in challenges in maintaining their benefits post-funding.
- **Awareness and Engagement:** There is a need for greater awareness and engagement of local communities regarding the fund's availability and application processes, as some potential beneficiaries remain uninformed.
- **Monitoring and Evaluation:** Limited mechanisms for comprehensive monitoring and evaluation of funded projects hinder the assessment of their long-term effectiveness and impact.

**Way Forward:** To enhance the effectiveness of the Tuvalu Climate Change and Disaster Survival Fund, the following strategies are recommended:

- **Sustainability Planning:** Integrating sustainability planning into project proposals to ensure long-term viability and benefits for communities after project completion.
- **Community Outreach Programs:** Implementing outreach and awareness programs to inform communities about the fund and support them in navigating the application process.
- **Strengthening M&E Frameworks:** Developing robust monitoring and evaluation frameworks to track project impacts and ensure accountability in fund utilization.

**Implementing Agency:** The Ministry of Finance is the primary agency responsible for implementing the Tuvalu Climate Change and Disaster Survival Fund Regulations. This ministry collaborates with

local governments, non-governmental organizations, and community groups to identify priority projects and oversee fund disbursement.

**Funding Received & Needed:** N/A

**Funding Source:** The fund is financed through a combination of government allocations, international donor contributions, and climate financing mechanisms, such as the Green Climate Fund (GCF) and the Global Environment Facility (GEF).

**Action Type & Category:** The Tuvalu Climate Change and Disaster Survival Fund Regulations 2017 fall under legislative action aimed at financial resource mobilization for climate adaptation and disaster management, categorized as disaster risk reduction and climate adaptation.

**Key Sectors and Aspects Covered:** The regulations cover critical sectors such as agriculture, water management, disaster preparedness, and community development, aiming to provide comprehensive support for climate resilience and disaster risk reduction efforts in Tuvalu.

#### 4.13.3.9 Tuvalu Climate Change Policy (2012)

**Objective:** The primary objective of the Tuvalu Climate Change Policy is to provide a comprehensive framework for addressing climate change challenges through adaptation, mitigation, and sustainable development strategies.

**Description:** This policy document outlines Tuvalu's commitment to combating climate change and its impacts on vulnerable communities and ecosystems. It emphasizes the importance of integrating climate considerations into national development planning and highlights the need for international cooperation in addressing climate change. The policy sets forth specific goals and strategies to enhance resilience, reduce greenhouse gas emissions, and promote sustainable development.

##### Key Actions and Activities

- **Adaptation Initiatives:** The policy emphasizes the importance of developing adaptation strategies that are tailored to local contexts, focusing on community engagement and capacity building.
- **Mitigation Measures:** It promotes the use of renewable energy sources and energy efficiency measures to reduce reliance on fossil fuels and lower greenhouse gas emissions.
- **International Collaboration:** The policy highlights the need for Tuvalu to actively engage in international climate negotiations and seek support for its climate initiatives.

**Achievements:** The Tuvalu Climate Change Policy has served as a foundation for subsequent climate actions and initiatives in the country. Achievements include increased awareness of climate issues among policymakers and the successful implementation of adaptation and mitigation projects funded by international partners.

**Gaps and Needs:** While the policy has laid a strong foundation, challenges remain in effectively implementing its provisions. There is a need for enhanced coordination among government agencies and stakeholders, as well as increased funding for climate initiatives.

**Way Forward:** To strengthen the implementation of the policy, future efforts will focus on enhancing stakeholder engagement and collaboration among government agencies. Continuous monitoring and evaluation of progress will be essential to ensure that the policy remains responsive to emerging climate challenges.

**Implementing Agency:** The Climate Change Department will oversee the implementation of the Tuvalu Climate Change Policy, collaborating with other ministries and stakeholders.

**Funding Received & Needed:** N/A



**Funding Source:** Funding sources include international climate finance mechanisms, bilateral aid, and contributions from NGOs focused on climate action.

**Action Type & Category:** The Tuvalu Climate Change Policy represents a comprehensive climate action strategy focused on adaptation and mitigation.

**Key Sectors and Aspects Covered:** The policy addresses key sectors such as agriculture, fisheries, water resources, and energy, ensuring a holistic approach to climate resilience and sustainable development.

#### 4.13.3.10 Health and Climate Change Country Profile 2019

**Objective:** The objective of the Health and Climate Change Country Profile 2019 is to assess the impacts of climate change on health outcomes in Tuvalu and to identify adaptation strategies that can mitigate these effects. This profile aims to inform policymakers and stakeholders about the vulnerabilities faced by Tuvalu's population due to climate-related health risks and to guide the development of effective health interventions.

**Description:** This profile presents a comprehensive analysis of the linkages between climate change and health in Tuvalu, recognizing that climate-related factors such as rising temperatures, extreme weather events, and changing rainfall patterns significantly affect public health. The profile highlights key health issues exacerbated by climate change, including waterborne diseases, food security challenges, and mental health impacts. It serves as a vital resource for understanding the health implications of climate change and supports the integration of health considerations into climate adaptation planning.

##### Key Actions and Activities:

- **Vulnerability Assessment:** Conducting assessments to identify the most vulnerable populations and communities in Tuvalu, particularly focusing on those at risk from climate-related health impacts.
- **Data Collection and Monitoring:** Establishing systems for the ongoing collection of health data and climate-related health indicators to monitor trends and inform public health responses.
- **Public Awareness Campaigns:** Implementing campaigns to educate communities about the health risks associated with climate change, including preventive measures to reduce exposure to these risks.
- **Capacity Building:** Strengthening the capacity of healthcare providers and local authorities to respond effectively to climate-related health challenges through training and resource allocation.

**Achievements:** The Health and Climate Change Country Profile has facilitated several notable achievements, including:

- **Policy Integration:** The profile has led to the integration of climate and health considerations into national health policies and plans, ensuring a more holistic approach to public health in the context of climate change.
- **Collaborative Initiatives:** The report has fostered collaboration among various stakeholders, including government agencies, non-governmental organizations, and international partners, to address health and climate challenges collectively.
- **Improved Health Outcomes:** Initiatives informed by the profile have contributed to improved health outcomes, particularly in the areas of water safety and disease prevention, reducing the incidence of climate-related health issues.

**Gaps and Needs:** Despite the achievements, several gaps and needs remain:

- **Limited Data:** There is a need for more comprehensive data on the health impacts of climate change, particularly in relation to specific diseases and health outcomes.

- **Resource Constraints:** Limited financial and human resources hinder the implementation of effective health interventions and adaptation strategies at the community level.
- **Public Health Infrastructure:** The existing public health infrastructure may require strengthening to adequately respond to the increasing health challenges posed by climate change.

**Way Forward:** To enhance the effectiveness of health interventions in the context of climate change, the following strategies are recommended:

- **Investment in Research:** Prioritizing research on the health impacts of climate change to inform evidence-based policies and interventions.
- **Strengthening Partnerships:** Building partnerships with international organizations, NGOs, and local communities to leverage resources and expertise for climate and health initiatives.
- **Developing Action Plans:** Creating specific action plans that outline clear objectives, strategies, and responsibilities for addressing climate-related health risks in Tuvalu.

**Implementing Agency:** The Ministry of Health is the primary agency responsible for implementing the recommendations and actions outlined in the Health and Climate Change Country Profile 2019. The ministry collaborates with various stakeholders, including local governments, healthcare providers, and international organizations, to promote health resilience against climate impacts.

**Funding Received & Needed:** N/A

**Funding Source:** Funding sources for initiatives include government allocations, support from international health organizations (e.g., WHO), and climate financing mechanisms such as the Green Climate Fund (GCF).

**Action Type & Category:** The Health and Climate Change Country Profile 2019 encompasses legislative, and policy actions aimed at health promotion and climate adaptation, categorized as public health and climate resilience.

**Key Sectors and Aspects Covered:** The profile covers critical sectors such as public health, environmental health, water and sanitation, nutrition, and disaster preparedness. It emphasizes the interconnectedness of climate change and health outcomes, providing a comprehensive framework for addressing these challenges in Tuvalu.

#### 4.13.3.11 Tropical Cyclone Tino Recovery and Vulnerability Reduction Plan 2020

**Objective:** The primary objective of the Tropical Cyclone Tino Recovery and Vulnerability Reduction Plan 2020 is to provide a comprehensive framework for the recovery efforts following the impact of Tropical Cyclone Tino, which struck Tuvalu in January 2020. The plan aims to restore and enhance the resilience of affected communities, reduce vulnerability to future climate-related events, and integrate disaster risk management into national development planning.

**Description:** Tropical Cyclone Tino caused significant damage to infrastructure, housing, and agricultural sectors in Tuvalu, resulting in the displacement of families and disruption of essential services. The Recovery and Vulnerability Reduction Plan outlines strategies to address immediate recovery needs while focusing on long-term resilience building. It emphasizes a community-centered approach, promoting participation from local stakeholders in recovery efforts and the prioritization of sustainable practices.

**Key Actions and Activities:**

- **Damage and Needs Assessment:** Conducting comprehensive assessments to evaluate the extent of damage caused by the cyclone, identifying immediate needs for recovery and rehabilitation.



- **Infrastructure Reconstruction:** Implementing programs for the reconstruction of critical infrastructure, including roads, schools, and health facilities, ensuring that they are resilient to future climate events.
- **Livelihood Restoration:** Developing initiatives to restore livelihoods affected by the cyclone, including support for farmers and small businesses, along with providing technical assistance and training.
- **Disaster Risk Reduction Training:** Conducting training programs for community members and local government officials on disaster preparedness and risk reduction strategies.
- **Community Engagement:** Engaging communities in the planning and implementation of recovery efforts to ensure local needs and knowledge are incorporated into resilience-building measures.

**Achievements:** The implementation of the Recovery and Vulnerability Reduction Plan has led to several achievements, including:

- **Infrastructure Rehabilitation:** Successful restoration and strengthening of key infrastructure, contributing to improved access to services and facilities for affected communities.
- **Increased Community Resilience:** Enhanced community capacity to respond to future disasters through training programs and awareness campaigns focused on disaster risk reduction.
- **Support for Livelihood Recovery:** Provision of financial and technical support to local farmers and businesses, enabling them to recover from losses sustained during the cyclone.

**Gaps and Needs:** Despite the progress made, several gaps and needs remain:

- **Limited Resources:** Insufficient funding to fully implement all recovery activities and ensure the long-term sustainability of recovery initiatives.
- **Data Limitations:** Need for improved data collection and monitoring systems to assess the impact of recovery efforts and inform future planning.
- **Capacity Challenges:** Limited capacity among local institutions to manage and implement comprehensive recovery and disaster risk reduction strategies.

**Way Forward:** To strengthen the ongoing recovery process and build resilience, the following strategies are recommended:

- **Resource Mobilization:** Actively seeking additional funding sources, including international aid and private sector partnerships, to support recovery and resilience initiatives.
- **Monitoring and Evaluation:** Establishing robust monitoring and evaluation frameworks to assess the effectiveness of recovery efforts and inform adaptive management strategies.
- **Integrated Planning:** Promoting integrated planning approaches that consider climate change impacts in all aspects of national and local development strategies.

**Implementing Agency:** The Department of Environment, Government of Tuvalu serves as the lead agency for implementing the Tropical Cyclone Tino Recovery and Vulnerability Reduction Plan. This ministry collaborates closely with local governments, non-governmental organizations (NGOs), and international partners to ensure coordinated recovery efforts.

**Funding Received & Needed:** N/A

**Funding Source:** Funding sources include government allocations, support from international organizations (such as the United Nations Development Programme (UNDP) and the World Bank), and humanitarian aid from bilateral partners.

**Action Type & Category:** The plan encompasses a mix of recovery and resilience-building actions categorized under disaster risk management and climate adaptation.

**Key Sectors and Aspects Covered:** The Tropical Cyclone Tino Recovery and Vulnerability Reduction Plan addresses critical sectors such as infrastructure, agriculture, disaster preparedness, community health, and education. It underscores the need for a holistic approach to recovery that encompasses social, economic, and environmental dimensions to strengthen overall resilience against future climate threats.

#### **4.13.3.12 NAPA-I: Increasing Resilience of Coastal Areas and Community Settlements to Climate Change in Tuvalu**

**Objective:** The primary objective of the NAPA-I project was to enhance the resilience of Tuvalu's coastal areas and community settlements against the adverse effects of climate change. The project aimed to implement urgent and immediate adaptation measures identified in Tuvalu's National Adaptation Programme of Action (NAPA), which was submitted to the UNFCCC Secretariat in 2007. By focusing on vulnerable coastal communities, the project sought to protect lives, livelihoods, and the environment from climate change impacts, particularly sea-level rise, increased flooding, and erosion.

**Description:** Launched in March 2010 and concluding in June 2016, the NAPA-I project was the first initiative funded under Tuvalu's NAPA framework. It received financial support from the Global Environment Facility (GEF) and was implemented by the United Nations Development Programme (UNDP) in partnership with the Tuvalu government. The project addressed key areas of concern identified in the NAPA, including infrastructure resilience, community engagement, and sustainable resource management.

**Key Actions and Activities:** The project comprised several critical actions aimed at building resilience:

- **Coastal Protection Infrastructure:**
  - Construction of protective barriers and revetments to shield vulnerable shorelines from erosion and flooding.
  - Implementation of natural infrastructure solutions, such as mangrove restoration and rehabilitation to provide natural buffers against storm surges.
- **Community Engagement and Education:**
  - Conducting workshops and awareness campaigns to educate local communities on climate change impacts and adaptation strategies.
  - Establishing community-based monitoring systems to engage residents in ongoing assessments of environmental changes and risks.
- **Livelihood Diversification:**
  - Promoting sustainable livelihoods through training programs that emphasized climate-resilient agricultural practices and alternative income sources.
  - Supporting small-scale fisheries and aquaculture initiatives that enhance food security and economic resilience.
- **Research and Data Collection:**
  - Conducting scientific assessments to establish baseline data on coastal erosion, marine biodiversity, and climate variability.
  - Collaborating with academic institutions and regional organizations to share knowledge and best practices.

**Achievements:** The NAPA-I project yielded several significant achievements:

- **Infrastructure Improvements:** Successful construction of coastal protection structures in key vulnerable areas, significantly reducing flooding risks during extreme weather events.



- **Community Empowerment:** Increased awareness and engagement among local populations regarding climate adaptation, with numerous community members actively participating in resilience-building activities.
- **Sustainable Practices Adoption:** Enhanced adoption of sustainable agricultural practices, leading to improved food security and reduced dependence on external food sources.
- **Data-Driven Insights:** Generation of valuable data and insights regarding climate impacts, which informed future adaptation planning and policy development.

**Gaps and Needs:** Despite its successes, the NAPA-I project faced several challenges:

- **Limited Financial Resources:** The project required more funding than was initially available to fully implement all intended adaptation measures.
- **Data Limitations:** Gaps in baseline data hindered some aspects of monitoring and evaluation, emphasizing the need for ongoing research and data collection efforts.
- **Capacity Constraints:** Local capacity for managing and maintaining new infrastructure and practices remained limited, necessitating further training and support.

**Way Forward:** To sustain the momentum created by NAPA-I and further enhance resilience in Tuvalu, the following strategies are recommended:

- **Continued Funding Support:** Seeking additional financial resources from international donors, NGOs, and the private sector to expand and sustain adaptation initiatives.
- **Strengthening Local Capacities:** Implementing comprehensive training programs for local government and community leaders to enhance their ability to manage and maintain adaptation efforts.
- **Integrating Climate Considerations:** Promoting the integration of climate resilience measures into local and national development planning to ensure long-term sustainability and impact.

**Implementing Agency:** The NAPA-I project was implemented by the Tuvalu Department of Environment in collaboration with other Ministries. UNDP provided technical support and facilitated coordination among stakeholders.

**Funding Received & Needed:** The project received approximately USD 3.3 million in funding from the Global Environment Facility (GEF) and LDCF.

**Funding Source:** Global Environment Facility (GEF), and Contributions from UNDP and partnerships with local NGOs and community organizations.

**Action Type & Category:** The NAPA-I project falls under the category of climate change adaptation, focusing specifically on enhancing resilience in coastal areas and vulnerable community settlements.

**Key Sectors and Aspects Covered:** NAPA-I addresses critical sectors such as:

- **Coastal Management:** Implementing protection measures and restoring natural ecosystems to mitigate climate impacts.
- **Community Development:** Empowering communities through education and sustainable livelihood initiatives.
- **Disaster Risk Reduction:** Integrating disaster risk management strategies into community planning to enhance preparedness and response capabilities.

#### 4.13.3.13 NAPA-I+: Scaling Up Adaptation Initiatives in Tuvalu

**Objective:** The NAPA-I+ project aimed to build upon the successes of the initial NAPA-I project by scaling up effective adaptation initiatives in the areas of agriculture, water management, and coastal

protection. The objective was to enhance the resilience of communities in Tuvalu to the adverse effects of climate change by implementing additional, targeted actions that addressed key vulnerabilities identified in the previous phase.

**Description:** Implemented from July 2011 to December 2013, the NAPA-I+ project focused on expanding the adaptation strategies initially piloted under NAPA-I. The project sought to improve the adaptive capacity of vulnerable communities by implementing innovative solutions in three critical areas:

- **Agriculture:** Enhancing food security and resilience to climate variability through the introduction of climate-smart agricultural practices, crop diversification, and improved irrigation techniques.
- **Water Management:** Implementing effective water conservation and management strategies to ensure sustainable access to clean water in the face of increasing droughts and changing rainfall patterns.
- **Coastal Protection:** Strengthening coastal defenses through the restoration of natural habitats, such as mangroves, and the construction of additional protective infrastructure.

**Key Actions and Activities:** Key actions undertaken during the NAPA-I+ project included:

- **Agricultural Initiatives:**
  - Training sessions for farmers on climate-resilient practices, including crop rotation and organic farming techniques.
  - Distribution of drought-resistant and salt-tolerant crop varieties to enhance food security.
  - Establishment of community gardens to promote local food production and self-sufficiency.
- **Water Management Strategies:**
  - Implementation of rainwater harvesting systems to increase water availability during dry periods.
  - Development of community-based water management plans to ensure sustainable use and conservation of water resources.
  - Installation of water quality monitoring systems to ensure safe drinking water access.
- **Coastal Protection Measures:**
  - Restoration of mangrove ecosystems to enhance natural coastal defenses and improve biodiversity.
  - Construction of seawalls and revetments in vulnerable areas to protect communities from storm surges and erosion.
  - Conducting awareness campaigns on the importance of coastal ecosystems for climate resilience.

**Achievements:** The NAPA-I+ project achieved several notable outcomes:

- **Improved Food Security:** Increased adoption of climate-resilient agricultural practices led to enhanced food production and reduced vulnerability among farmers.
- **Sustainable Water Access:** The introduction of rainwater harvesting systems significantly improved water availability, particularly in drought-prone areas.
- **Enhanced Coastal Resilience:** Successful restoration of mangrove habitats contributed to improved coastal protection and increased community awareness of ecosystem services.

**Gaps and Needs:** Despite the project's successes, some gaps and needs were identified:

- **Need for Extended Funding:** Additional financial support was required to sustain and expand the successful initiatives beyond the project's duration.
- **Capacity Building:** Continued training and capacity-building efforts were necessary to ensure local communities could effectively manage and maintain adaptation practices.



- **Monitoring and Evaluation:** Establishing a robust monitoring framework to assess the long-term impacts of implemented strategies was crucial for future adaptation planning.

**Way Forward:** To ensure the sustainability of the NAPA-I+ initiatives, the following actions are recommended:

- **Ongoing Funding Support:** Actively seek new funding sources to maintain and expand adaptation efforts across agriculture, water management, and coastal protection.
- **Community Engagement:** Foster ongoing community involvement in decision-making processes related to climate adaptation to ensure ownership and long-term commitment.
- **Knowledge Sharing:** Establish platforms for sharing best practices and lessons learned from the NAPA-I+ project with other Pacific nations facing similar climate challenges.

**Implementing Agency:** The Tuvalu Department of Environment was the primary implementing partner for the NAPA-I+ project, overseeing all activities and coordination with stakeholders.

**Funding Received & Needed:** Global Environment Facility (GEF) Least Developed Countries Fund (LDCF): USD 3.3 million for NAPA-I and USD 1.1 million for NAPA-I+. An estimated USD 500,000 is required for continued support of successful adaptation initiatives.

**Funding Source:** Global Environment Facility (GEF) Least Developed Countries Fund (LDCF), contributions from the Australian Government.

**Action Type & Category:** NAPA-I+ is categorized as a climate change adaptation initiative, specifically focusing on agriculture, water management, and coastal protection measures.

**Key Sectors and Aspects Covered:** The project addressed crucial sectors, including:

- **Agriculture:** Enhancing food production and resilience to climate impacts.
- **Water Management:** Improving access to clean water and ensuring sustainable usage.
- **Coastal Management:** Strengthening defenses against climate change-related threats.

#### 4.13.3.14 **NAPA-II: Effective and Responsive Island-Level Governance for Climate Resilient Marine-Based Coastal Livelihoods**

**Objective:** The NAPA-II project aimed to enhance the resilience of Tuvalu's coastal communities by improving governance structures that support climate-responsive livelihoods and disaster response mechanisms. Specifically, the project focused on securing and diversifying marine-based livelihoods while increasing the adaptive capacity of communities to climate hazards.

**Description:** Implemented from August 2013 to June 2019, the NAPA-II project sought to address the vulnerabilities of Tuvalu's coastal communities, which heavily rely on marine resources for their livelihoods. The project emphasized the importance of effective governance and community engagement in developing climate adaptation strategies. It aimed to:

- **Strengthen Local Governance:** Improve the capacity of local governance structures to respond to climate change impacts and enhance community participation in decision-making processes.
- **Diversify Coastal Livelihoods:** Promote alternative livelihoods that are less vulnerable to climate change, ensuring food security and economic stability for coastal communities.
- **Enhance Climate Hazard Response:** Build capacity for disaster risk management and response to climate-related hazards through training and the establishment of early warning systems.

**Key Actions and Activities:** Key actions undertaken during the NAPA-II project included:

- **Capacity Building for Governance:**

- Workshops and training sessions for local leaders and community members on climate governance and disaster risk management.
- Development of participatory planning processes to ensure community voices are integrated into local governance structures.
- **Livelihood Diversification Initiatives:**
  - Introduction of sustainable aquaculture practices to reduce overfishing and enhance food security.
  - Support for alternative livelihood projects, such as handicrafts and eco-tourism, to provide income sources less dependent on marine resources.
- **Disaster Preparedness and Response:**
  - Establishment of community-based disaster risk management (CBDRM) committees to facilitate local preparedness and response efforts.
  - Implementation of an early warning system to alert communities about impending climate hazards, such as tropical cyclones and storm surges.

**Achievements:** The NAPA-II project achieved several significant outcomes:

- **Improved Governance:** Local governance structures became more responsive and accountable, leading to better community engagement in climate adaptation planning.
- **Increased Livelihood Resilience:** Communities diversified their income sources, reducing dependency on traditional marine resources and enhancing food security.
- **Enhanced Disaster Preparedness:** The establishment of disaster management committees and early warning systems significantly improved local capacity to respond to climate-related hazards.

**Gaps and Needs:** While the NAPA-II project made important strides, some gaps and needs were identified:

- **Sustained Community Engagement:** Ongoing efforts were needed to maintain community involvement in governance and adaptation planning.
- **Funding for Long-Term Projects:** Additional financial support was required to continue and expand livelihood diversification initiatives.
- **Integration of Traditional Knowledge:** Greater emphasis on integrating traditional knowledge into climate adaptation strategies was necessary for sustainable practices.

**Way Forward:** To build on the successes of the NAPA-II project, the following actions are recommended:

- **Ongoing Capacity Development:** Provide continuous training and support for local governance bodies and community members to sustain engagement in climate adaptation efforts.
- **Funding for Diversification:** Actively seek new funding opportunities to support the scaling up of alternative livelihoods and disaster preparedness initiatives.
- **Community Awareness Campaigns:** Implement awareness campaigns to educate communities about the importance of sustainable practices and disaster readiness.

**Implementing Agency:** The Tuvalu Department of Environment, in collaboration with various local organizations and community groups, was responsible for overseeing the implementation of the NAPA-II project.

**Funding Received & Needed:** The project received USD 3.5 million from the Global Environment Facility (GEF) through the Least Developed Countries Fund (LDCF). An estimated USD 600,000 is required for ongoing support of livelihood diversification and governance initiatives.

**Funding Source:** Global Environment Facility (GEF) Least Developed Countries Fund (LDCF). Contributions from regional development partners and non-governmental organizations.



**Action Type & Category:** NAPA-II is categorized as a climate adaptation initiative focusing on governance, livelihood diversification, and disaster risk management.

**Key Sectors and Aspects Covered:** The project addressed crucial sectors, including:

- **Marine and Coastal Livelihoods:** Fostering sustainable practices to secure livelihoods dependent on marine resources.
- **Disaster Risk Management:** Enhancing community resilience to climate-related hazards through preparedness and response strategies.
- **Local Governance:** Strengthening the institutional frameworks that facilitate effective climate adaptation planning.

#### 4.13.3.15 Ridge to Reef (R2R) Program

**Objective:** The Ridge to Reef (R2R) program aims to enhance the resilience of Tuvalu's ecosystems and communities by promoting integrated management of land, freshwater, and marine resources. This holistic approach seeks to ensure that the benefits of natural resources are maintained while addressing the challenges posed by climate change and human activities.

**Description:** The R2R program operates under the broader concept of ecosystem-based management, recognizing that the health of terrestrial and marine ecosystems is interconnected. Implemented in various Pacific island nations, including Tuvalu, the program focuses on:

- **Integrated Resource Management:** Encouraging collaborative management of ridge (land), freshwater, and reef (marine) environments to maximize resource efficiency and sustainability.
- **Ecosystem Resilience:** Strengthening the resilience of ecosystems to climate change impacts, such as rising sea levels, increased storm intensity, and changes in ocean temperature and acidity.
- **Community Engagement:** Involving local communities in decision-making processes and encouraging sustainable practices that benefit both people and the environment.

**Key Actions and Activities:** Key actions undertaken as part of the R2R program include:

- **Capacity Building:**
  - Training local stakeholders in sustainable land use practices, marine resource management, and biodiversity conservation.
  - Workshops aimed at enhancing local governance capabilities in environmental management.
- **Ecosystem Restoration:**
  - Implementation of restoration projects to rehabilitate degraded areas, including reforestation and coral reef rehabilitation efforts.
  - Promotion of sustainable agriculture and land-use practices that mitigate soil erosion and improve watershed management.
- **Integrated Monitoring:**
  - Development of integrated monitoring systems to assess the health of ecosystems across ridge, freshwater, and reef environments.
  - Collecting data to inform adaptive management strategies and decision-making processes.
- **Community-Led Initiatives:**
  - Supporting community-led projects that focus on sustainable fishing practices, agroecology, and biodiversity conservation.
  - Facilitating community awareness programs to promote understanding of ecosystem interconnections and the importance of conservation.

**Achievements:** The R2R program has led to several significant achievements in Tuvalu:

- **Strengthened Ecosystem Management:** Enhanced capacity among local governance structures and communities to manage natural resources sustainably.
- **Increased Community Involvement:** Greater community participation in conservation and management efforts, leading to increased awareness and advocacy for sustainable practices.
- **Biodiversity Conservation:** Successful implementation of restoration initiatives, contributing to the recovery of critical habitats and species.

**Gaps and Needs:** While the R2R program has made notable progress, several gaps and needs have been identified:

- **Long-Term Funding:** Ongoing financial support is necessary to sustain the initiatives beyond the program's lifecycle.
- **Continued Capacity Development:** Further training and resources are needed to ensure local communities can effectively manage ecosystems.
- **Integration of Traditional Knowledge:** There is a need to incorporate traditional ecological knowledge into modern management practices for more culturally relevant and effective outcomes.

**Way Forward:** To build on the successes of the R2R program, the following actions are recommended:

- **Sustained Community Engagement:** Continued support for community-led initiatives and decision-making processes to maintain local involvement in ecosystem management.
- **Funding Strategies:** Development of diversified funding strategies, including partnerships with private sectors and NGOs, to ensure financial sustainability.
- **Monitoring and Evaluation:** Implementation of robust monitoring and evaluation frameworks to assess progress and adapt strategies as needed.

**Implementing Agency:** The program is coordinated by the Tuvalu Department of Environment, in collaboration with regional and international partners, including the Global Environment Facility (GEF) and various non-governmental organizations.

**Funding Received & Needed:** The R2R program in Tuvalu has received funding from various sources, including USD 4 million from the Global Environment Facility (GEF) and contributions from regional partners. An estimated USD 2 million is required for continued implementation of R2R initiatives, particularly for community capacity building and ecosystem restoration projects.

**Funding Source:** Global Environment Facility (GEF). Regional development organizations and philanthropic contributions.

**Action Type & Category:** The R2R program falls under the categories of ecosystem-based management, climate adaptation, and community development, emphasizing a multi-faceted approach to environmental sustainability.

**Key Sectors and Aspects Covered:** The program addresses several critical sectors, including:

- **Biodiversity Conservation:** Fostering the protection and recovery of diverse species and habitats.
- **Sustainable Land Management:** Promoting practices that reduce land degradation and enhance agricultural productivity.
- **Marine Resource Management:** Ensuring the sustainable use of marine resources and the health of coral reef ecosystems.
- **Disaster Risk Reduction:** Enhancing community resilience to climate-related hazards through improved environmental management.



#### 4.13.3.16 Tuvalu Coastal Adaptation Project (TCAP)

**Objective:** The Tuvalu Coastal Adaptation Project (TCAP) aims to enhance the resilience of coastal communities in Tuvalu against the impacts of climate change and sea-level rise. The project focuses on implementing effective coastal protection measures, improving the adaptive capacity of local populations, and safeguarding critical infrastructure and livelihoods.

**Description:** Launched in August 2017 and running until September 2023, TCAP was one of the first projects in the Pacific to receive funding from the Green Climate Fund (GCF). This project specifically targets coastal adaptation efforts on three islands: **Funafuti, Nanumea, and Nanumaga**. The project is designed to implement innovative coastal protection techniques, improve community engagement in adaptation planning, and establish sustainable management practices for coastal resources.

**Key Actions and Activities:** The TCAP encompasses a variety of key actions and activities aimed at achieving its objectives, including:

- **Coastal Protection Infrastructure Development:**
  - Construction and enhancement of physical infrastructure such as sea walls, revetments, and other protective measures to mitigate erosion and flooding risks.
  - Utilization of nature-based solutions, including mangrove restoration and reef rehabilitation, to bolster natural defenses against coastal hazards.
- **Community Engagement and Capacity Building:**
  - Conducting workshops and training sessions to empower local communities in disaster preparedness, response planning, and sustainable resource management.
  - Involving community members in the planning and implementation phases of coastal protection measures to ensure local knowledge and needs are integrated.
- **Monitoring and Evaluation:**
  - Establishing a framework for ongoing monitoring and evaluation of coastal adaptation initiatives to assess their effectiveness and inform future strategies.
  - Collecting data on environmental changes, community vulnerability, and the performance of adaptation measures.
- **Policy Development:**
  - Supporting the government in formulating and implementing policies that promote sustainable coastal management and adaptation strategies.
  - Enhancing collaboration between governmental, non-governmental, and community stakeholders to align efforts in climate adaptation.

**Achievements:** The TCAP has successfully achieved several milestones, including:

- **Improved Coastal Resilience:** The implementation of protective infrastructure has significantly reduced the vulnerability of coastal communities in Funafuti, Nanumea, and Nanumaga.
- **Community Involvement:** Increased awareness and active participation of local communities in adaptation efforts, fostering a sense of ownership and responsibility towards coastal management.
- **Innovative Practices:** Successful incorporation of nature-based solutions into coastal protection strategies, demonstrating the effectiveness of sustainable practices in enhancing resilience.

**Gaps and Needs:** Despite its achievements, TCAP has identified several gaps and ongoing needs:

- **Funding for Expansion:** There is a critical need for additional funding to extend coastal protection measures to other outer islands in Tuvalu.
- **Enhanced Capacity:** Continued investment in training and capacity-building efforts is necessary to ensure communities can sustain and manage adaptation initiatives effectively.
- **Integration of Local Knowledge:** More emphasis is needed on integrating traditional ecological knowledge with modern scientific approaches to improve project outcomes.

**Way Forward:** To build on the successes of TCAP and address the identified gaps, the following actions are recommended:

- **Future GCF Funding Applications:** The Government of Tuvalu should actively pursue further funding from the GCF to expand coastal protection initiatives to additional islands, ensuring comprehensive coverage of vulnerable communities.
- **Long-term Community Engagement:** Ongoing community engagement strategies should be developed to maintain momentum and encourage continued participation in adaptation activities.
- **Research and Development:** Invest in research to evaluate the long-term effectiveness of coastal adaptation measures and to explore innovative approaches to resilience-building.

**Implementing Agency:** The Tuvalu Department of Environment is the lead implementing agency for TCAP, collaborating closely with international partners, local communities, and stakeholders to ensure successful project delivery.

**Funding Received & Needed:** TCAP has received approximately USD 36 million in funding from the Green Climate Fund (GCF) for its implementation. Future initiatives to extend coastal protection measures require an estimated USD 10 million to cover additional infrastructure and community engagement efforts.

**Funding Source:** Green Climate Fund (GCF). Future collaborations with international development agencies, NGOs, and private sector investments.

**Action Type & Category:** The TCAP primarily falls under the categories of climate adaptation, disaster risk reduction, and coastal resource management, emphasizing a multifaceted approach to enhancing community resilience.

**Key Sectors and Aspects Covered:** The TCAP addresses several critical sectors, including:

- **Coastal and Marine Resource Management:** Implementing strategies to sustainably manage and protect coastal ecosystems.
- **Infrastructure Resilience:** Developing robust infrastructure to withstand climate-related impacts.
- **Community Development:** Empowering local communities through education and capacity-building initiatives.

#### 4.14 Integration of Best Available Science, Gender Perspectives, and Indigenous Knowledge

Tuvalu, a small island nation composed of nine coral atolls, is uniquely vulnerable to the impacts of climate change, particularly sea-level rise and extreme weather events. To address these existential threats, Tuvalu has developed a comprehensive adaptation strategy that integrates the best available science, gender perspectives, and Indigenous, Traditional, and Local Knowledge (ITLK). This integrated approach aligns with international standards and guidelines, such as the Paris Agreement, to strengthen national resilience and sustainable development. Key national documents, including the Tuvalu Gender Equity Policy 2024, National Adaptation Plan (NAP), National Adaptation Program of Action (NAPA), Climate Change Resilience Act 2019, and specific adaptation projects like the Tuvalu Coastal Adaptation Project (TCAP), guide and inform these efforts. By combining scientific knowledge, traditional wisdom, and gender-inclusive approaches, Tuvalu aims to build resilience and secure a sustainable future in the face of climate change.



#### 4.14.1 Best Available Science

Tuvalu, a small island nation, is at the forefront of climate change impacts. To address these challenges, Tuvalu leverages the best available science to inform its adaptation strategies. This scientific approach is crucial for understanding the complex nature of climate change and developing effective and sustainable solutions.

- **Climate Modeling and Projections:**
  - **Advanced Climate Models:** Tuvalu utilizes advanced climate models to project future climate scenarios, including sea-level rise, temperature increase, and changes in precipitation patterns, under various emissions scenarios. These models provide crucial insights into the potential impacts of climate change on Tuvalu's coastal zones, ecosystems, and infrastructure.
  - **Vulnerability Assessments:** By identifying vulnerable areas, sectors, and communities, Tuvalu can prioritize adaptation efforts and allocate resources effectively.
  - **Risk Assessments:** Evaluating the potential risks and impacts of climate change on infrastructure, ecosystems, and livelihoods helps inform decision-making and prioritize adaptation actions.
- **Remote Sensing and Geographic Information Systems (GIS):**
  - **Monitoring Coastal Changes:** Tuvalu employs satellite imagery and aerial photography to track changes in coastline, shoreline retreat, and coastal erosion. This data is essential for understanding coastal dynamics and informing coastal protection measures.
  - **Mapping Vulnerable Areas:** GIS is used to identify areas at high risk of flooding, inundation, and saltwater intrusion. This information helps prioritize adaptation interventions, such as seawall construction and mangrove restoration.
  - **Assessing Ecosystem Health:** Remote sensing techniques are used to monitor the health of coral reefs, mangroves, and other ecosystems. This information is crucial for assessing the impact of climate change on ecosystems and informing conservation and management efforts.
- **Oceanographic Research:**
  - **Understanding Ocean Dynamics:** Tuvalu collaborates with regional and international organizations to study ocean currents, tides, and waves. This information is essential for understanding the impacts of sea-level rise, coastal erosion, and marine ecosystems.
  - **Monitoring Sea-Level Rise:** Tuvalu utilizes tide gauges and satellite altimetry to monitor sea-level rise and its impact on coastal communities, infrastructure, and ecosystems.
  - **Assessing Marine Ecosystem Health:** Monitoring the health of coral reefs, seagrass beds, and fisheries to inform sustainable management practices and conservation efforts.

By leveraging these scientific tools and techniques, Tuvalu can make informed decisions about its adaptation strategies, ensuring that resources are allocated effectively and that interventions are tailored to the country's specific needs.

- **Application in Policies and Projects:**
  - **National Adaptation Plan (NAP):** The NAP integrates scientific data to identify priority adaptation measures, such as flood prevention infrastructure and climate-resilient agriculture.
  - **Tuvalu Coastal Adaptation Project (TCAP):** Supported by the Green Climate Fund (GCF), TCAP utilizes wave modeling and erosion studies to inform the design and construction of protective structures, such as seawalls and storm surge barriers. This ensures that adaptation measures are resilient to projected future conditions.

- **Disaster Risk Reduction (DRR) Initiatives:** In alignment with the National Disaster Management (Amendment) Act 2021, DRR initiatives employ predictive climate models to strengthen early warning systems and community disaster preparedness.

#### 4.14.2 Strengthening Information and Knowledge Management

An effective National Adaptation Plan (NAP) process for Tuvalu relies on an integrative approach that uses scientific, technical, traditional, and local knowledge. Tuvalu has developed several key information systems to support the NAP, including the **Tuvalu Climate Change Portal**, **TIVA Database**, **Tuvalu Environment Data Portal**, **Pacific Climate Change Portal – Tuvalu Country Profile**, and **Tuvalu Meteorological Service**, which provide essential climate and vulnerability data. Additional resources, like standardized climate change scenarios piloted by CSIRO and SPREP, and TCAP's 2019 Light Detection and Ranging (LiDAR) survey, further enhance the capacity to assess climate risks such as sea level rise and coastal erosion.

To optimize these resources and strengthen knowledge management within the NAP process, the following actions are recommended:

1. **Establish Data Standards and Procedures:** Define common standards for data access, storage, cataloging (e.g., metadata), and disposal to ensure consistent data management from the beginning.
2. **Map Resources and Identify Needs:** Conduct a mapping exercise to assess governance, resources, and technology needs, identifying data gaps, potential redundancies, and opportunities for information sharing across sectors.
3. **Maintain and Update Data Portals:** Regularly update the Climate Change Portal and TIVA database. Assigning these responsibilities to a Data and Information Officer or creating a dedicated Information and Knowledge Management role within the Climate Change Department (CCD) could ensure data continuity.
4. **Build Local Research and Technical Capacity:** Advocate for increased investment in in-country scientific research and enhance the Tuvalu Meteorological Services' capacity to produce user-centered climate data. This will provide critical information for decision-making and strengthen local expertise.
5. **Engage the Public Through Accessible Media:** Use radio, TV, and other local communication channels to inform the public on NAP progress, fostering community engagement and support.

Implementing these actions will create a robust, data-driven foundation for Tuvalu's NAP, empowering communities and enhancing resilience across key sectors.

The list of available and most recent datasets for the National Adaptation Plan process, as identified is provided in the below table. It is worthwhile noting that various departments and organizations in Tuvalu also maintain their project databases and libraries, however, they may not be up-to-date or accessible to external users.

**Table 56: Available Datasets for the National Adaptation**

| Data Type & Description                                         | Year                                     | Format      | Custodian                   |
|-----------------------------------------------------------------|------------------------------------------|-------------|-----------------------------|
| Aerial imagery for all islands                                  | 1943,<br>1971,<br>1984,<br>2004-<br>2015 | Raster data | Lands and Survey Department |
| Bathymetric and topographic data for all islands (LiDAR survey) | 2019                                     | Laser file  | TCAP                        |



|                                                                                                                                                                                                                                                        |                     |                                                                    |                                                                                                                                  |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|--------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------|
| Biodiversity rapid assessment – conservation status of marine and terrestrial biodiversity for all islands                                                                                                                                             | 2020                | Pdf report and GIS files                                           | R2R                                                                                                                              |
| Building exposure maps of residential, commercial, public, and industrial buildings, consisting of their location, structural characteristics that affect their exposure to the effects of natural disasters, and their replacement cost (all islands) | 2017                | Vector data                                                        | Pacific Community (SPC) (pcrafi.spc.int)                                                                                         |
| Climate change and disaster risk reduction project database – project title, description, duration, donor, funding amount                                                                                                                              | 2016-Present        | Excel                                                              | CCD                                                                                                                              |
| Drone images for all islands                                                                                                                                                                                                                           | 2017                | Image and video files                                              | CCD (post-TC Pam) Lands and Survey Department                                                                                    |
| CMIP5 Updated Climate Change Projections for Tuvalu – average annual temperature (up to 2040), average annual rainfall (up to 2080), sea level rise (up to 2090), and future occurrence of tropical cyclones                                           | 2020                | PowerPoint slides                                                  | CSIRO and SPREP as part of the Australian government-funded NextGen Climate Projections for the Western Tropical Pacific project |
| Census population data from the Mini Census                                                                                                                                                                                                            | 2017                | Excel tables<br>PDF reports                                        | Tuvalu Central Statistics Division                                                                                               |
| Fisheries creel report card- percentage of undersized fish caught by species and catch of fish per unit of effort for all islands except for Niulakita                                                                                                 | 2016, 2018 and 2020 | PDF report                                                         | Fisheries Department                                                                                                             |
| Hospital information system – episodes and visits data for outpatients and inpatients at the Princess Margaret Hospital (not connected to outer island clinics)                                                                                        | 2013-Present        | Internet-based system installed at Princess Margaret Hospital only | Ministry of Health                                                                                                               |
| Tuvalu Integrated vulnerability assessment data, disaggregated by human security and livelihoods sector, island/community (total: 14 communities) and group (male/female/youth)                                                                        | 2020                | Tabulated dashboard<br>Excel (raw data)                            | Online at CCD has log in access for protected data                                                                               |
| Land cover map – physical and biological cover over the surface of land, including water, vegetation, bare soil and/or artificial structures. This map is suitable for assessing wind and flood hazards and for establishing a crop exposure database  | 2017                | Vector data                                                        | SPC (pcrafi.spc.int)                                                                                                             |

|                                                                                                                                                                                                                                                                                                             |                                          |                 |                                |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------|-----------------|--------------------------------|
| Meteorological data (historical and seasonal outlooks) – rainfall (from 1927), temperature (from 1933), wind, swells, ENSO, sea level (from 1977), cyclone risk, coral bleaching risk. Weather stations are situated in Funafuti, Nanumea, Nui and Niulakita (rainfall gauges are available in all islands) | Current, historical and future forecasts | Various formats | Tuvalu Meteorological Services |
| Property registration system - location, owner, tenant, total area, construction type, year, estimated value, details on foundation/flooring, walls, ceiling, windows, roofing, gutters, toilet and water tanks of residential, government and communal properties in all islands                           | 2017                                     | Excel           | CCD                            |
| Water quality – coastal waters in Funafuti and the outer islands                                                                                                                                                                                                                                            | In progress                              |                 | R2R                            |
| Water quality – groundwater assessment in Nanumea and Nukufetau                                                                                                                                                                                                                                             | 2019                                     | PDF report      | R2R                            |

#### 4.14.3 Gender Perspectives

In Tuvalu, gender perspectives play a critical role in shaping climate adaptation strategies, recognizing the differing impacts of climate change on men and women and their adaptive capacities. This focus aligns with the principles outlined in the Cancun Agreement, which calls for gender-responsive and participatory adaptation processes. Tuvalu's commitment to gender equity is enshrined in multiple national policies and supported by dedicated institutions like the Gender Affairs Department (GAD) and the Tuvalu National Council of Women (TNCW). These bodies drive initiatives that empower women and promote gender equality, ensuring that adaptation strategies are comprehensive and inclusive.

- **Institutional Framework for Gender and Social Inclusion:**
  - **Key Institutions and Mandates**
    - **Gender Affairs Department (GAD):** Tasked with coordinating and promoting gender equality and women's empowerment across Tuvalu. Initially situated in the Office of the Prime Minister (2014-2019), GAD was relocated to the Ministry of Health, Social Welfare, and Gender Affairs following the 2019 general elections. With the new government in place, the GAD is again situated under the Office of the Prime Minister. The department plays a pivotal role in guiding policy implementation and ensuring that gender considerations are integrated into all adaptation efforts.
    - **Tuvalu National Council of Women (TNCW):** A grassroots organization that represents women's voices across all islands. TNCW supports women's economic empowerment through initiatives that foster entrepreneurship in sectors like food services and handicrafts, strengthening community resilience and adaptive capacity.



- **National Gender Policy (NGP) and Strategic Plan of Action:** The National Gender Policy (NGP) 2014-2018, currently under revision, provides a policy framework for fulfilling Tuvalu's international, regional, and national commitments to gender equality. The NGP outlines five strategic priority outcomes that are vital for embedding gender considerations in climate adaptation:
  - **Capacity Building in Government Sectors:** Enhancing the ability of government departments to address gender issues in climate change adaptation and other areas.
  - **Legislation and Policy Alignment:** Ensuring that government commitments to gender equality are reflected in laws and sectoral policies.
  - **Economic Participation:** Creating opportunities for women's active participation in economic development, critical for building adaptive capacity at the household and community levels.
  - **Decision-Making and Governance:** Promoting equal access for women and men to leadership roles and decision-making processes, fostering inclusive governance.
  - **Elimination of Gender-Based Violence:** Addressing violence as a barrier to gender equity and resilience, thus enhancing women's ability to participate fully in adaptation measures.
- **Gender and Climate Change Linkages:** The Strategic Plan of Action 2014-2016 highlights the intersection of gender and climate change, incorporating targeted actions to ensure women's engagement and leadership in climate adaptation and disaster resilience. Specific measures include:
  - **Monitoring Implementation:** Overseeing gender commitments within the National Strategic Action Plan for Climate Change and Disaster Risk Management (a precursor to the updated Tuvalu National Climate Change Policy).
  - **Capacity Building:** Ensuring women have equitable access to training in disaster risk management, climate change adaptation, and natural resource management. This involves workshops and training sessions led by the GAD, often in partnership with NGOs and international organizations.
  - **Participation in Decision-Making:** Promoting women's participation in community and national-level decisions related to climate adaptation and resource management. This aspect is supported by initiatives like the Tuvalu Coastal Adaptation Project (TCAP), which engages women in project planning and execution.
  - **Gender-Inclusive Policies and Implementation:**
    - **Empowerment Through Participation:** Adaptation projects incorporate gender mainstreaming, ensuring that women participate actively in decision-making and leadership roles. This aligns with the Te Kete: Tuvalu National Strategy for Sustainable Development (2021-2030), which promotes inclusive growth and resilience.
    - **Capacity-Building Programs:** Under the NAPA-I and NAPA-II frameworks, capacity-building workshops and training sessions have been held to equip women with skills in sustainable agriculture, disaster response, and water resource management. Such programs not only empower women but also contribute to household and community-level resilience.
    - **Economic Support and Livelihood Projects:** Adaptation projects often prioritize support for women-led businesses and initiatives to foster economic stability, such as climate-resilient crop production and alternative income sources like eco-tourism.
- **Achievements and Current Progress:**
  - **Capacity Enhancement:** The GAD and TNCW have successfully facilitated gender-sensitive workshops that build women's skills in climate-resilient practices, such as sustainable farming and water conservation.

- **Increased Representation:** There has been notable progress in including women in climate change committees and local governance structures, ensuring their perspectives influence policy decisions.
- **Economic Empowerment:** Support for women-led enterprises has strengthened economic resilience, allowing women to contribute to family and community stability during climate-induced disruptions.
- **Gaps and Needs:** Despite significant progress, challenges persist, including:
  - **Capacity Gaps:** Limited resources for comprehensive gender mainstreaming across all sectors.
  - **Cultural Barriers:** Traditional gender roles may still limit women's participation in certain communities.
  - **Data Deficiency:** A lack of gender-disaggregated data to inform targeted interventions.
- **Way Forward:** To address these gaps, Tuvalu's adaptation strategy will focus on:
  - **Strengthening Institutional Capacities:** Enhancing the GAD's ability to coordinate gender-focused adaptation programs effectively.
  - **Improving Data Collection:** Establishing mechanisms for collecting gender-specific data on climate impacts and adaptation outcomes.
  - **Expanding Women's Leadership Programs:** Supporting initiatives that prepare women for leadership roles in community and national-level climate action.
  - **Fostering Partnerships:** Collaborating with regional and international organizations, such as UN Women and the Pacific Women Shaping Pacific Development (PWSPD), to leverage resources and technical expertise.

#### 4.14.4 Indigenous, Traditional, and Local Knowledge (ITLK) in Tuvalu's Adaptation Strategies

Integrating Indigenous, traditional, and local knowledge (ITLK) into adaptation measures is a crucial part of Tuvalu's approach to climate resilience. This type of knowledge is embedded in the daily practices and cultural heritage of Tuvaluan communities, offering time-tested strategies for environmental stewardship and adaptation. When combined with gender-responsive policies, ITLK enriches adaptation measures by ensuring they are culturally relevant, practical, and aligned with local values. Women, in their roles as primary caregivers and resource managers, play a significant part in maintaining and transmitting ITLK, making their inclusion essential for comprehensive and effective adaptation planning.

- **Importance of ITLK in Climate Adaptation:** Indigenous knowledge in Tuvalu is rooted in centuries-old practices that have enabled communities to thrive in an environment prone to natural challenges such as cyclones, droughts, and coastal erosion. This knowledge includes traditional agricultural techniques, water conservation practices, and coastal management methods that are inherently sustainable. The integration of ITLK with modern science provides a dual approach that enhances the effectiveness of adaptation strategies and ensures community buy-in.
  - **Key Aspects of ITLK in Tuvalu:**
    - **Sustainable Resource Management:** Indigenous practices focus on the sustainable use of natural resources, such as rotational farming and fishing practices that maintain ecological balance.
    - **Community Cohesion:** ITLK emphasizes collective action and communal decision-making, strengthening community bonds and cooperative responses to environmental challenges.



- **Resilience Building:** Traditional knowledge includes coping mechanisms for extreme weather events, such as building cyclone shelters using locally available materials and implementing drought-resistant farming techniques.
    - **Key Projects Integrating ITLK and Gender Perspectives:** Several projects in Tuvalu have successfully integrated ITLK with gender-responsive approaches to ensure that adaptation strategies are inclusive and effective. The active participation of women in these projects highlights the value of gender perspectives in ITLK-based adaptation.
  - **Ridge to Reef (R2R) Project:** This initiative employs ecosystem-based management practices, blending traditional ecological knowledge with scientific methodologies to sustain land and marine biodiversity. The R2R project actively involves local communities, with women participating in conservation activities and decision-making processes. By incorporating ITLK, the project reinforces sustainable practices, such as traditional fishing zones and crop diversity, to maintain ecological balance and promote resilience.
  - **Community-Based Adaptation Workshops:** These workshops facilitate the sharing and documentation of local practices that enhance resilience. Women often contribute vital knowledge about crop management, water conservation, and sustainable resource use. Programs like these ensure that adaptive measures are informed by lived experiences and community practices, creating a platform where gender perspectives and traditional knowledge intersect.
- **Traditional Practices in Coastal Management:** Coastal protection is a priority for Tuvalu, where rising sea levels pose an existential threat. Traditional practices have long included nature-based solutions such as mangrove planting and coral reef preservation. These strategies have been integrated into modern projects to create hybrid approaches that strengthen coastal resilience.
    - **Examples of Traditional Practices in Coastal Management:**
      - **Mangrove Planting:** Mangroves serve as natural barriers against storm surges and coastal erosion. Community-led planting initiatives, supported by projects like the Tuvalu Coastal Adaptation Project (TCAP), combine ITLK with engineering solutions to protect vulnerable coastlines.
      - **Coral Reef Maintenance:** Preserving coral reefs, which reduce wave energy and prevent coastal damage, is a practice rooted in traditional marine stewardship. Initiatives under TCAP and similar projects incorporate this practice with modern marine conservation techniques to create robust coastal defense systems.
  - **Cultural Knowledge Preservation and Policy Support:** Recognizing the critical role of ITLK, Tuvalu's policy framework actively promotes the documentation and integration of this knowledge into formal adaptation strategies. The Climate Change Resilience Act 2019 emphasizes the importance of preserving traditional coping mechanisms and cultural practices. This Act supports community-led efforts to document traditional knowledge, ensuring that it is available for future generations and can be used alongside scientific advancements.
    - **Key Legislative and Policy Measures:**
      - **Climate Change Resilience Act 2019:** Mandates the inclusion of traditional practices in climate adaptation and disaster response planning. This Act formalizes the role of ITLK in building resilience, ensuring that adaptation strategies reflect local practices and heritage.
      - **Tuvalu National Adaptation Program of Action (NAPA):** The NAPA framework highlights the importance of community-driven adaptation initiatives that leverage ITLK to address climate vulnerabilities.
      - **National Climate Change Policy 2020-2030:** This policy underscores the role of ITLK in fostering sustainable, culturally relevant climate actions. It advocates for



participatory approaches where community knowledge, including women's contributions, is valued and integrated.

- **Challenges and Way Forward:** While Tuvalu has made significant strides in incorporating ITLK into adaptation measures, challenges remain. These include limited documentation of traditional knowledge, generational shifts that may lead to the erosion of ITLK, and the need for enhanced policy alignment to support ITLK systematically.
  - **Key Challenges:**
    - **Documentation and Preservation:** Ensuring that ITLK is properly recorded and maintained for future use.
    - **Intergenerational Knowledge Transfer:** Encouraging the transmission of traditional practices to younger generations to maintain cultural continuity.
    - **Policy Implementation:** Strengthening the integration of ITLK into formal policies and programs to ensure consistency and comprehensive application.
  - **Way Forward:**
    - **Capacity Building:** Expand training programs that teach community members how to document and apply traditional knowledge in contemporary adaptation projects.
    - **Collaborative Research:** Foster partnerships between local knowledge holders and scientific researchers to co-create adaptation solutions.
    - **Policy Enhancement:** Strengthen legislative frameworks to mandate the inclusion of ITLK and provide resources for community-led initiatives that preserve and apply traditional knowledge.
- **Conclusion:** The integration of Indigenous, traditional, and local knowledge (ITLK) in Tuvalu's climate adaptation is a multifaceted approach that enhances resilience through culturally appropriate strategies. By combining ITLK with gender-responsive measures and scientific insights, Tuvalu can develop robust, inclusive, and sustainable adaptation practices. Continued support from policies like the Climate Change Resilience Act 2019 and community-driven projects such as Ridge to Reef ensures that this vital knowledge is preserved, celebrated, and effectively used to confront the ongoing challenges of climate change.

#### 4.14.4.1 Educational and Collaborative Platforms in Tuvalu's Climate Adaptation

Tuvalu's climate change adaptation strategies are significantly bolstered by a comprehensive array of educational programs and collaborative platforms that seamlessly integrate traditional, Indigenous, and local knowledge (ITLK) with modern scientific insights. These initiatives are essential for promoting community-driven solutions that resonate with the socio-cultural fabric of Tuvalu while addressing the multifaceted challenges posed by climate change.

- **Community Workshops and Dialogues:** The Department of Environment plays a pivotal role in facilitating community workshops and dialogues that unite various stakeholders, including elders, scientists, policymakers, and community leaders. These workshops serve as platforms for co-creating climate adaptation strategies that are not only scientifically sound but also culturally rooted.
  - **Key Components of Community Engagement:**
    - **Traditional Ecological Knowledge (TEK):** Community elders share invaluable traditional practices such as sustainable fishing methods, crop rotation, and natural water conservation techniques, which have been developed and refined over generations.



- **Interactive Learning:** Workshops include participatory sessions where younger generations learn from elders, creating a bridge for knowledge transfer and reinforcing the importance of ITLK.
- **Integration of Science and Culture:** Scientists contribute contemporary climate models and data, which are discussed alongside local experiences to validate and adapt strategies that align with both environmental realities and cultural practices.

These workshops are crucial for instilling a sense of ownership among community members, ensuring that adaptation measures are embraced and sustained at the local level.

- **Partnerships with NGOs and International Bodies:** Collaborative efforts with international organizations significantly enhance Tuvalu's capacity to implement effective climate adaptation strategies. Partnerships with **GIZ**, **SPREP**, and other international and regional bodies have supported the development and execution of programs aimed at blending ITLK with cutting-edge scientific knowledge.
- **Capacity-Building Initiatives:**
  - **Training Programs:** Joint training sessions facilitated by NGOs like SPREP focus on disaster preparedness, ecosystem management, and climate change mitigation. These programs ensure that local leaders and community members are equipped with both traditional skills and modern technical expertise.
  - **Knowledge Exchange Platforms:** Initiatives such as cross-community exchanges allow Tuvaluans to learn from other Pacific Island nations that face similar climate challenges, fostering a sense of regional solidarity and shared learning.
  - **Financial and Technical Support:** Partnerships with organizations such as the Green Climate Fund (GCF) and UNDP provide crucial funding and technical resources for comprehensive projects that prioritize community involvement and resilience.

These collaborative efforts amplify the reach and effectiveness of local adaptation strategies, helping to embed sustainable practices across the islands.

- **Legislative and Policy Frameworks Supporting Integration:** Tuvalu's legislative and policy landscape reflects a strong commitment to incorporating ITLK and scientific data into adaptation planning. The following frameworks underscore the nation's dedication to comprehensive, inclusive, and sustainable climate resilience:
  - **Climate Change Resilience Act 2019:** This act mandates the use of both traditional and scientific knowledge in the development and implementation of adaptation strategies. It ensures that community voices, especially those of knowledge holders, are central to national planning and decision-making processes.
  - **Tuvalu Climate Change and Disaster Survival Fund Act 2015:** Establishes a financial safety net to facilitate rapid response to climate events, with a focus on community-driven adaptation initiatives that prioritize ITLK.
  - **National Disaster Management (Amendment) Act 2021:** Enhances the coordination of disaster response and recovery by integrating gender-sensitive and traditional knowledge approaches. This act specifically emphasizes the involvement of women and elders as critical contributors to disaster resilience and preparedness.
- **Achievements:**
  - **Enhanced Resilience Infrastructure:** Projects like the Tuvalu Coastal Adaptation Project (TCAP) have integrated nature-based solutions and traditional coastal management practices, such as the strategic planting of mangroves, to mitigate the effects of sea-level rise and coastal erosion.

- **Gender-Inclusive Policy Implementation:** The Gender Affairs Department (GAD) and TNCW have championed increased female participation in climate adaptation initiatives. Programs aimed at economic empowerment and leadership training have empowered women to contribute meaningfully to national resilience efforts.
- **Knowledge Preservation and Utilization:** The integration of ITLK into formal policies has promoted the preservation of cultural practices. This incorporation has been pivotal in fostering community ownership, ensuring that adaptation measures are sustainable and locally relevant.
- **Challenges:**
  - **Funding Gaps:** While international aid from bodies such as the GCF has provided substantial financial support, there remains a need for continuous funding to scale up existing programs and develop new initiatives.
  - **Capacity Constraints:** Limited technical expertise within local institutions can hinder the full utilization of scientific data and ITLK. Strengthening local capacity through training and partnerships with research institutions is essential.
  - **Climate Variability and Data Limitations:** The unpredictable nature of climate impacts necessitates ongoing data collection and adaptive management strategies. Ensuring access to up-to-date climate data remains a challenge for comprehensive planning.
- **Way Forward:**
  - **Strengthen and Expand Partnerships:** Building new alliances with international research institutions and NGOs will enhance technical expertise and facilitate continuous capacity building within local institutions.
  - **Empower Women and Marginalized Groups:** Expanding gender-focused programs and ensuring equitable representation in leadership roles will promote inclusive decision-making processes.
  - **Preserve and Promote ITLK:** Continued documentation of traditional practices and their integration into national policies will help maintain cultural identity while addressing climate risks.
  - **Invest in Education and Knowledge Sharing:** Enhancing community workshops and training programs will ensure that adaptation strategies are widely understood and supported across generations.
  - **Sustain Funding Sources:** Securing long-term financial commitments from both international and regional partners will help bridge funding gaps and support comprehensive, community-led adaptation measures.
- **Conclusion:** Tuvalu's integrated approach, which brings together science, gender perspectives, and ITLK, creates a robust framework for climate adaptation. This holistic strategy aligns with global standards outlined by the UNFCCC MPGs while being deeply rooted in Tuvalu's cultural and environmental context. Moving forward, the reinforcement of partnerships, capacity-building, and community-led initiatives will be critical to sustaining resilience and safeguarding Tuvalu's future in the face of escalating climate challenges.

#### 4.14.5 Climate Change Adaptation and Development Integration

Tuvalu, a low-lying island nation in the Pacific, faces severe vulnerabilities due to climate change, including rising sea levels, increased frequency of extreme weather events, and threats to biodiversity and livelihoods. To address these challenges, the government of Tuvalu has established a comprehensive framework that integrates climate change adaptation into national development



strategies. This commitment is reflected in key policy documents such as **Te Kete: Tuvalu National Strategy for Sustainable Development (2021-2030)** and the **National Climate Change Policy 2020-2030**. These policies are designed to align with the Sustainable Development Goals (SDGs), reinforcing Tuvalu's dedication to building resilience and ensuring sustainable development pathways.

Central to these efforts was the **National Strategy for Sustainable Development 2016-2020**, also known as **Te Kakeega III (TKIII)**, which served as the overarching development plan for Tuvalu. Climate change adaptation, mitigation, and resilience were not only designated as priority areas but were also embedded as cross-cutting themes throughout all 12 strategic areas of TKIII (please refer to the below table). This comprehensive integration aimed to ensure that climate change considerations were factored into all sectors, from infrastructure and health to education and environmental management, promoting a holistic approach to sustainable development and enhanced community resilience.

**Table 57: Integration of Climate Change in Te Kakeega III**

| Strategic Area & Goal                                                                                                                                                                  | Strategies & KPIs       | Strategies relevant to NAP                                                                                                                                                                                          |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. Climate change: Protect Tuvalu from the impacts of climate change: resilience, mitigation, adaptation                                                                               | 7 strategies & 14 KPIs  | All                                                                                                                                                                                                                 |
| 2.. Good governance: Strengthen institutional capacity to service the public interest with competence and justice                                                                      | 9 strategies & 18 KPIs  | Law reform and constitutional review; strengthen public sector management; foreign relations                                                                                                                        |
| 3. The economy: growth and stability: Sound macroeconomic management and policy                                                                                                        | 7 strategies & 11 KPIs  | Sound macroeconomic management; revival of copra industry; development of eco-tourism industry                                                                                                                      |
| 4. Health and social development: Provide high standards of health care, social opportunity, and social protection free of hardship and gender discrimination                          | 10 strategies & 22 KPIs | Non-Communicable Diseases; health infrastructure upgrade; information technology; gender equality, capacity building and training; research and feasibility studies; operational and strategic plans implementation |
| 5. Falekaupule and island development: Provide quality services and create more opportunities for development                                                                          | 7 strategies & 5 KPIs   | Capacity building; transport and communications; research and feasibility studies; waste management; operational and strategic plans                                                                                |
| 6. Private sector development, employment and trade: To be the engine of economic growth, employment and export trade                                                                  | 5 strategies & 13 KPIs  | Private sector development; business skills and awareness; overseas employment                                                                                                                                      |
| 7. Education and human resources: Provide high quality education; equip people with knowledge and skills to develop more self-reliance; promote Tuvalu's cultural and spiritual values | 21 strategies & 9 KPIs  | Human resource priorities; scholarship management; pre-service scholarship scheme; youth unemployment; quality of education; learning outcomes; technical and vocational skills development;                        |

|                                                                                                                                                                        |                                     |                                                                                                                                                                                                                                            |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                                                                                                                                        |                                     | inclusive education; library and archives                                                                                                                                                                                                  |
| 8. Natural resources: Maximise social and economic returns from the management and sustainable use of Tuvalu's natural resources                                       | 10 strategies & 13 KPIs             | Fisheries management; surveillance of EEZ; agricultural development; institutional strengthening for agriculture; farming productivity; local agriculture; community participation in agriculture; awareness of nutrition; land management |
| 9. Infrastructure and support services: Provide efficient, high-quality infrastructure and support services                                                            | 9 strategies and 17 KPIs            | Sustainable energy; renewable energy; power generation; energy legislation; transport services; energy development plans; sanitation; building design                                                                                      |
| 10. Environment: Protect, restore, and promote sustainable use of terrestrial ecosystems; halt and reverse land degradation; protect and prevent biodiversity loss     | 4 strategies & 7 KPIs               | Climate change integration; environmental legislation; environmental protection; biodiversity                                                                                                                                              |
| 11. Migration and urbanization: Mitigate the adverse impacts of internal migration and urbanization; capitalize on opportunities offered by migration and urbanization | 3 strategies & 8 KPIs               | Migration; service delivery for the urban population; service delivery for the outer islands                                                                                                                                               |
| 12. Ocean and seas: Conserve the oceans, seas, and marine resources for sustainable development                                                                        | 2 strategies & 5 KPIs               | Protection of coastal ecosystems; maritime surveillance                                                                                                                                                                                    |
| <b>Total:</b>                                                                                                                                                          | <b>94 strategies &amp; 142 KPIs</b> | <b>61 strategies</b>                                                                                                                                                                                                                       |

#### 4.14.5.1 Strategic Framework

**Te Kete** serves as a comprehensive national strategy that maps out key development priorities and outlines proposed developments across the islands. It is structured around five strategic priority areas:

- 1. Enabling Environment:** Creating a supportive framework for sustainable development, which includes enhancing governance structures and stakeholder engagement.
- 2. Economic Development:** Fostering diversified economic growth while promoting sustainable resource management, particularly in sectors vulnerable to climate change.
- 3. Social Development:** Ensuring social equity and resilience, focusing on health, education, and community engagement to support vulnerable populations.
- 4. Island and Culture Development:** Protecting and promoting Tuvalu's unique cultural heritage and identity, integrating traditional knowledge into development initiatives.
- 5. Infrastructure:** Building and upgrading climate-resilient infrastructure to protect communities and critical assets from climate impacts.



Under these five priority areas, **20 national development outcomes** have been defined, of which **17 align with the SDGs**. This alignment underscores Tuvalu's commitment to sustainable development in the face of climate challenges.

#### 4.14.5.2 Alignment with the United Nations Sustainable Development Cooperation Framework

The development interventions of the United Nations System are closely aligned with **Te Kete**. The table below provides a broad overview of how the UN System's interventions, through the four pillars of the United Nations Sustainable Development Cooperation Framework, align with the priorities and outcomes of **Te Kete**. For further details on how specific UN interventions align with **Te Kete**, refer to Section 6 c).

| UN Cooperation Framework Pillars     | Alignment with Te Kete Priorities                                          |
|--------------------------------------|----------------------------------------------------------------------------|
| <b>Pillar 1: Human Rights</b>        | Supports social development and cultural preservation initiatives.         |
| <b>Pillar 2: Sustainability</b>      | Enhances economic development and environmental resilience projects.       |
| <b>Pillar 3: Peace and Security</b>  | Promotes stability and governance in the face of climate challenges.       |
| <b>Pillar 4: Global Partnerships</b> | Facilitates collaboration for resource mobilization and knowledge sharing. |

Tuvalu's comprehensive framework for climate change adaptation and sustainable development represents a proactive response to the challenges posed by a changing climate. By prioritizing resilience across various sectors and aligning its strategies with international frameworks like the SDGs, Tuvalu demonstrates its commitment to safeguarding its future. The innovative approach of becoming a Digital Nation not only addresses immediate climate vulnerabilities but also secures the cultural and national identity of Tuvalu for generations to come.

### Enabling Environment for Climate Adaptation

A robust policy framework is essential for creating an enabling environment that promotes climate resilience. This includes enhancing governance structures, stakeholder participation, and aligning national legislation with international climate commitments.

#### Key Policies and Legislation:

- **Climate Change Resilience Act 2019:** This foundational legislation integrates climate resilience into all national and sectoral planning. It mandates climate risk assessments for public and private investment projects and encourages climate-smart practices across sectors.
- **Te Vaka Fenua o Tuvalu: National Climate Change Policy 2020-2030:** This policy serves as the cornerstone of Tuvalu's climate action framework, focusing on sustainable resource management, the incorporation of traditional knowledge, and community engagement. The policy emphasizes a whole-of-government approach to climate change adaptation and mitigation.

- **National Adaptation Plan (NAP) Framework:** The NAP framework outlines strategic actions and priorities for enhancing adaptive capacity across all sectors, ensuring coordinated and comprehensive responses to climate challenges.

#### Detailed Actions:

- **Institutional Capacity Building:** Continuous training programs for public officials are essential for effective climate governance. In 2023, the majority of civil servants participated in specialized training focused on disaster risk management and climate resilience, facilitated by partnerships with regional organizations such as the **Pacific Islands Forum**.
- **Public Engagement Initiatives:** A series of community consultations are planned, aiming to engage a maximum number of residents across all atolls in discussions about climate adaptation strategies and priorities. Feedback from these sessions will inform policy adjustments and project designs.

**Table 58: Stakeholder Engagement Activities**

| Activity                    | Target Audience      | Expected Outcome                         |
|-----------------------------|----------------------|------------------------------------------|
| Community Consultations     | Local residents      | Gather input for climate action plans    |
| Capacity Building Workshops | Government officials | Enhance knowledge on climate resilience  |
| Stakeholder Roundtables     | NGOs, private sector | Foster partnerships for climate projects |

## Economic Development and Climate Resilience

Diversifying the economy and managing natural resources sustainably are critical for enhancing resilience to climate impacts. Tuvalu seeks to reduce reliance on vulnerable sectors and foster sustainable livelihoods.

#### Key Initiatives:

- **Ridge to Reef (R2R):** This initiative promotes integrated ecosystem management, addressing land-based and marine resource management. The project focuses on protecting biodiversity, enhancing food security, and supporting sustainable livelihoods through community-led activities.
- **Tuvalu Climate Change and Disaster Survival Fund Act 2015:** This fund provides financial support for disaster risk reduction and climate adaptation initiatives, ensuring that vulnerable communities have access to necessary resources for preparedness and recovery.

#### Detailed Actions:

- **Sustainable Fisheries Management:** The Fisheries Department will launch the Marine Spatial Planning initiative, aiming to improve fisheries management practices protect marine biodiversity, and support fishing households by promoting sustainable fishing practices and enhancing fish stocks through ecosystem-based management.
- **Economic Diversification Projects:** In response to the economic impacts of climate change, Tuvalu is investing in eco-tourism and renewable energy. The Tuvalu Renewable Energy in alignment with the NDC targets, set to increase the share of renewable energy to 100% by 2030, involves installing solar panels and enhancing energy efficiency in public buildings and homes.



**Table 59: Economic Development Initiatives and Expected Outcomes**

| Initiative                                | Year Launched | Expected Outcome                    | Funding Source                                                  |
|-------------------------------------------|---------------|-------------------------------------|-----------------------------------------------------------------|
| Ridge to Reef Initiative                  | 2015          | Improved ecosystem resilience       | UNDP, GEF, GCF                                                  |
| Tuvalu Renewable Energy                   | 2023          | 100% renewable energy share by 2030 | Government, GCF, WB, ADB, Bilateral agencies and Other Agencies |
| Climate Change and Disaster Survival Fund | 2015          | Enhanced disaster preparedness      | Government, International Partners                              |

### Social Development and Climate Resilience

Promoting social equity and well-being is essential for building resilience against climate impacts. This priority includes strategies to enhance health, education, and community engagement to support vulnerable populations.

#### Key Policies and Frameworks:

- **Health and Climate Change Country Profile 2019:** This document identifies vulnerabilities in health systems and outlines necessary adaptations to improve health resilience, such as enhancing healthcare infrastructure and increasing access to services.
- **Tropical Cyclone Tino Recovery and Vulnerability Reduction Plan 2020:** Following the impacts of Cyclone Tino, this plan emphasizes recovery efforts and building community resilience through improved infrastructure and services.

#### Detailed Actions:

- **Health Infrastructure Development:** The proposed new climate-resilient health center in Funafuti, is expected to serve residents and withstand extreme weather events. The project will be funded through International partners and donors.
- **Educational Programs:** The proposed Tuvalu Climate Smart Schools initiative is expected to integrate climate education into the national curriculum. The program will aim to reach students, providing them with knowledge about climate change and sustainable practices. Teacher training workshops can enhance educators' capacity to deliver climate-related education effectively.

### Cultural Heritage and Identity in the Face of Climate Change

Protecting Tuvalu's cultural heritage is critical in the context of climate adaptation. This priority emphasizes the importance of integrating cultural values into development initiatives and ensuring the continuity of traditional practices.

#### Key Projects:

- **Cultural Digitization Project:** This initiative aims to digitize Tuvalu's cultural heritage, including traditional stories, crafts, and practices, in response to the potential loss due to climate change. Cultural artifacts have been digitized, ensuring their preservation for future generations.
- **Cultural Council Act:** This legislation protects traditional knowledge and practices, ensuring their consideration in national policies and planning processes.

### Detailed Actions:

- **Community-Driven Cultural Initiatives:** Engaging local communities in cultural preservation efforts fosters resilience. Include traditional craft workshops and the revival of cultural festivals, which serve to strengthen community identity and promote social cohesion.
- **Integration of Traditional Ecological Knowledge:** The government recognizes the importance of local knowledge in managing natural resources. Efforts are underway to incorporate traditional ecological practices into modern resource management strategies, enhancing sustainability and community involvement.

### Infrastructure Resilience

Building and upgrading resilient infrastructure is vital for protecting communities from climate impacts. This priority focuses on enhancing the resilience of critical physical assets and services to withstand climate-related hazards.

### Key Policies and Initiatives:

- **Tuvalu Coastal Adaptation Project (TCAP):** This significant infrastructure project focuses on enhancing coastal resilience through the construction of seawalls, improved drainage systems, and upgraded water supply facilities. The TCAP aims to protect vulnerable communities from flooding and erosion, with an investment from GCF and International Partners.
- **National Disaster Management (Amendment) Act 2021:** This act enhances the legal framework for disaster preparedness and response, ensuring infrastructure resilience and improving emergency management capabilities.

### Detailed Actions:

- **Resilient Infrastructure Development:** The TCAP includes the construction of critical infrastructure such as elevated roads and stormwater management systems. By the end of 2030, these infrastructure improvements are expected to significantly reduce flooding in key urban areas.
- **Smart Urban Planning:** The government is revising urban planning strategies to incorporate climate resilience measures. A comprehensive review of existing plans is expected to be completed in near future, focusing on integrating climate adaptation into land-use planning and infrastructure development.

**Table 60: Infrastructure Development Projects and Timelines**

| Project                                  | Start Year | Purpose                                   |
|------------------------------------------|------------|-------------------------------------------|
| Tuvalu Coastal Adaptation Project (TCAP) | 2017       | Enhance coastal resilience                |
| Urban Planning Review                    | NA         | Update urban plans for climate resilience |
| Smart Water Management Systems           | NA         | Improve water resource management         |

### 4.14.6 Summary

In conclusion, Tuvalu is committed to addressing the multifaceted challenges posed by climate change through a comprehensive approach that integrates policy, legislation, and practical projects. By



prioritizing climate adaptation across economic, social, cultural, and infrastructure domains, Tuvalu aims to build resilience and safeguard its unique heritage and communities. The ongoing commitment to stakeholder engagement and continuous improvement will be essential as the nation navigates the complexities of climate adaptation and strives for sustainable development.

## 4.15 Adaptation Actions and Plans Leading to Mitigation Co-benefits

Tuvalu has established a robust framework of adaptation actions and economic diversification plans aimed at enhancing resilience while also contributing to global mitigation efforts. This comprehensive analysis draws from key national policy documents and specific projects that underscore Tuvalu's commitment to sustainable development and climate resilience.

### 4.15.1 Policy Framework Guiding Adaptation Actions

The foundation of Tuvalu's adaptation strategies is grounded in an array of national policies and frameworks designed to ensure long-term sustainability. The **Tuvalu National Strategy for Sustainable Development (Te Kete) 2021-2030** emphasizes integrated approaches across sectors such as economic development, social welfare, infrastructure enhancement, cultural preservation, and environmental sustainability. This strategic document prioritizes the incorporation of climate adaptation measures in development planning, recognizing that addressing climate change is crucial for achieving broader Sustainable Development Goals (SDGs).

Complementing this strategy is the **National Climate Change Policy (Te Vaka Fenua o Tuvalu) 2020-2030**, which articulates a clear vision for climate resilience through specific adaptation and mitigation goals. This policy emphasizes the need to incorporate climate change considerations into national development frameworks, thereby ensuring that all sectors contribute to climate resilience and sustainability.

Furthermore, Tuvalu's **National Adaptation Program of Action (NAPA)** and its subsequent updates (NAPA-I, NAPA-I+, NAPA-II) outline immediate adaptation needs and actions necessary to address the vulnerabilities faced by communities. These documents serve as critical blueprints for identifying priority areas for intervention and aligning local actions with national and international climate goals.

The **National Adaptation Plan (NAP) Framework** further extends this commitment by providing a long-term roadmap for implementing adaptation actions that address climate-related challenges over a sustained period. The **Climate Change Resilience Act (2019)** establishes a legal framework to support the implementation of these policies, ensuring that climate resilience is integrated into national governance and decision-making processes.

Additionally, the **Tuvalu Climate Change and Disaster Survival Fund Act (2015)** creates a financial mechanism to support climate adaptation projects, enabling local communities to effectively respond to climate-related challenges. The establishment of the **National Disaster Management (Amendment) Act (2021)** strengthens disaster response capabilities, integrating climate adaptation measures into disaster management strategies. Together, these policy instruments provide a comprehensive approach to managing climate risks while facilitating sustainable development.

### 4.15.2 Specific Climate Change Adaptation Actions

#### Coastal Protection Initiatives

Coastal protection is paramount for Tuvalu, where the impacts of sea-level rise are keenly felt. The ongoing construction and rehabilitation of seawalls are vital adaptation measures aimed at preventing coastal erosion and safeguarding vulnerable areas. These seawalls, particularly in Funafuti, protect homes and agricultural lands from storm surges and flooding. Funding from the **Tuvalu Coastal Adaptation Project (TCAP)** has been instrumental in these efforts, with an estimated **coastline** receiving reinforced protective measures.

In addition to traditional hard infrastructure, Tuvalu is actively engaged in mangrove restoration projects under the **Ridge to Reef (R2R)** initiative. Mangroves are critical for coastal ecosystems, serving as natural barriers against storm surges while also providing essential habitats for marine biodiversity. Studies indicate that healthy mangrove ecosystems can sequester **carbon**. Current restoration efforts focus on rehabilitating an area of mangroves, enhancing both coastal resilience and carbon sequestration capacity.

### **Sustainable Agriculture Practices**

Recognizing the link between food security and climate resilience, Tuvalu has adopted sustainable agricultural practices that bolster local food production while reducing vulnerability to climate impacts. The introduction of climate-resilient crops, including **salt-tolerant varieties of taro, cassava, and breadfruit**, has been prioritized to adapt to changing climatic conditions. These crops are better suited to the saline soils that result from rising sea levels, thereby enhancing food availability and reducing reliance on imported goods. By integrating these crops into local diets, it is projected that food security for households will improve significantly.

To further enhance agricultural resilience, the government has initiated organic farming training programs aimed at minimizing chemical inputs and promoting soil health. These organic practices not only improve the quality and yield of crops but also enhance carbon sequestration in soils. With expectations of an increase in crop yields, these initiatives align agricultural practices with climate mitigation objectives.

### **Water Resource Management**

The scarcity of freshwater resources is a pressing concern for Tuvalu, driven by altered rainfall patterns and increased evaporation rates. To address this issue, Tuvalu is implementing rainwater harvesting systems across communities to bolster water security. The initiative targets the installation of rainwater tanks that will enable households to collect and store rainwater, reducing reliance on imported freshwater and minimizing energy usage associated with desalination processes.

Moreover, improvements to wastewater management facilities aim to enhance water efficiency by allowing treated wastewater to be reused for irrigation. This initiative not only conserves freshwater resources but also promotes sustainable agricultural practices, thereby supporting both food production and climate adaptation efforts.

## **4.15.3 Economic Diversification Plans**

To build resilience against climate impacts, Tuvalu is pursuing economic diversification initiatives aimed at reducing reliance on vulnerable sectors.

### **4.15.3.1 Renewable Energy Initiatives**

Transitioning to renewable energy sources is vital for reducing greenhouse gas emissions and enhancing energy security. Tuvalu has set an ambitious goal of achieving **100% renewable energy** by 2030 through the expansion of solar energy projects. By 2023, the installation of over 14% Renewable energy



mix into the overall Tuvalu national electricity production, and initiatives around energy efficiency measures across public buildings, schools, and households is anticipated, which is expected to yield CO<sub>2</sub> emissions reductions annually. Additionally, the government plans to launch a community solar project that engages local stakeholders in energy production, thereby fostering community ownership and participation.

Training programs for local technicians are also being developed to ensure the sustainable operation and maintenance of renewable energy systems. By building local capacity, these initiatives create job opportunities while enhancing the sustainability of renewable projects, contributing to the broader economic diversification strategy.

#### **4.15.3.2 Fisheries Management and Marine Conservation**

Sustainable fisheries management is crucial for ensuring food security and economic stability in Tuvalu. The implementation of community-based fisheries management practices under the National Climate Change Policy promotes sustainable fishing and protects fish stocks. Recent initiatives will lead to an increase in fish populations in local waters due to better management practices, which are essential for both livelihoods and ecological health.

The expansion of Marine Protected Areas (MPAs) under the R2R initiative aims to enhance marine biodiversity and restore fish stocks. Current efforts are underway to designate new MPAs, which not only contribute to conservation but also enhance carbon sequestration by preserving critical marine ecosystems.

#### **4.15.3.3 Eco-Tourism Development**

Tuvalu recognizes the potential of eco-tourism as an alternative source of income that promotes environmental stewardship. The government is actively developing eco-friendly tourism that highlights the nation's natural beauty while minimizing ecological impact. Plans are in motion to establish eco-lodges that aim to attract environmentally conscious tourists, thereby providing economic opportunities for local communities and promoting sustainable practices.

To support this initiative, local guides will be trained in sustainable tourism practices, creating jobs while enhancing environmental awareness. This approach is expected to boost the local economy while fostering a culture of conservation and sustainability.

#### **4.15.4 Mitigation Co-Benefits**

The adaptation actions and economic diversification plans being implemented in Tuvalu yield significant co-benefits for climate mitigation. The shift towards renewable energy, sustainable agricultural practices, and community-based fisheries management collectively contributes to substantial reductions in greenhouse gas emissions. For instance, the transition to 100% renewable energy by 2030 is projected to reduce GHG emissions by almost zero, aligning with Tuvalu's commitments under the NDC.

Furthermore, the restoration of mangroves and the adoption of sustainable land management practices enhance the nation's capacity for carbon sequestration, making a meaningful contribution to Tuvalu's overall emissions reduction targets. By improving energy efficiency across various sectors, Tuvalu is not only reducing its carbon footprint but also fostering a resilient economy that is less susceptible to climate impacts.

#### 4.15.5 Monitoring and Reporting

To ensure the effectiveness of adaptation and economic diversification efforts, Tuvalu employs comprehensive monitoring and evaluation frameworks. The establishment of a National Greenhouse Gas Inventory allows for regular updates on emissions, helping track the success of implemented strategies and informing policy adjustments. Specific performance indicators will be developed to measure the outcomes of adaptation initiatives, ensuring that they align with Tuvalu's climate commitments and objectives.

#### 4.15.6 Summary of Economic Diversification

Tuvalu's strategic approach to climate adaptation and economic diversification is vital not only for enhancing resilience but also for generating significant mitigation co-benefits. By integrating sustainable practices, investing in renewable energy, and engaging local communities, Tuvalu is paving the way for a sustainable future while protecting its cultural and environmental heritage. These comprehensive efforts are crucial for the survival of Tuvalu and contribute meaningfully to global climate action initiatives. The integration of adaptation actions with economic diversification plans illustrates Tuvalu's commitment to building a resilient, sustainable nation in the face of climate change challenges.

#### 4.15.7 Nature-Based Solutions (NbS) to Climate Change Adaptation

Nature-based solutions (NbS) leverage natural ecosystems to enhance resilience against climate change impacts while promoting biodiversity and ecosystem services. Given Tuvalu's unique vulnerabilities—its geographic characteristics as low-lying atolls, limited freshwater resources, and reliance on climate-sensitive sectors such as agriculture and fisheries—NbS plays a critical role in the country's adaptation strategy. This section aligns with Tuvalu's Nationally Determined Contributions (NDC) under the Paris Agreement and adheres to the Modalities, Procedures, and Guidelines (MPGs) for reporting on adaptation efforts.

##### Overview of Nature-Based Solutions in Tuvalu

Tuvalu faces significant challenges from climate change, including rising sea levels, increased intensity of tropical storms, coastal erosion, and saltwater intrusion into freshwater aquifers. Implementing NbS provides a multi-faceted approach to adaptation that not only addresses these impacts but also enhances local livelihoods and biodiversity. By utilizing natural processes, Tuvalu can build resilience cost-effectively and sustainably.

##### 4.15.7.1 Key Nature-Based Solutions Implemented in Tuvalu

###### 1. Coastal Ecosystem Restoration and Management:

###### o Mangrove Restoration Projects:

- **Description:** Mangroves serve as natural barriers against coastal erosion and flooding, filter pollutants, and provide critical habitat for marine species. They are instrumental in carbon sequestration, playing a significant role in climate mitigation.
- **Implementation:** Community-led initiatives involve identifying suitable sites for restoration, engaging local populations in planting native mangrove species (*Bruguiera*, *Rhizophora*, and *Avicennia*), and implementing conservation measures to protect existing mangrove forests from degradation.
  - **Partnerships:** Collaboration with NGOs, such as the Mangrove Restoration Project, and academic institutions provides technical expertise and funding for restoration activities.



- **Monitoring:** Establishing baseline ecological assessments to monitor growth and survival rates of planted mangroves, as well as ongoing assessments of ecosystem health.
    - **Outcomes:** Enhanced coastal protection from storm surges and erosion, increased fishery yields from improved habitat and strengthened community engagement in conservation efforts.
  - **Coral Reef Conservation and Restoration:**
    - **Description:** Coral reefs act as essential barriers to wave action, providing critical protection for coastal communities and supporting local fisheries and tourism.
    - **Implementation:** Establishing Marine Protected Areas (MPAs) to safeguard critical reef habitats, coupled with coral gardening initiatives that focus on the propagation of resilient coral species.
      - **Community Involvement:** Training local fishers in sustainable fishing practices and coral conservation, along with regular community workshops on the importance of reef health.
      - **Scientific Research:** Partnering with research institutions to monitor coral health, assess biodiversity changes, and adapt restoration strategies based on findings.
    - **Outcomes:** Improved resilience of coral ecosystems to climate stressors, increased biodiversity, sustainable fisheries management, and enhanced local tourism opportunities.
- 2. **Integrated Watershed Management:**
  - **Rainwater Harvesting Systems:**
    - **Description:** Given Tuvalu's vulnerability to freshwater scarcity, rainwater harvesting systems are crucial for ensuring access to potable water.
    - **Implementation:** Projects include installing cisterns and rainwater collection systems in homes and community buildings, supported by educational campaigns on water conservation.
      - **Capacity Building:** Training local technicians on the maintenance and efficiency of these systems, ensuring long-term sustainability and effectiveness.
    - **Outcomes:** Increased water security for households, reduced pressure on limited groundwater resources, and enhanced community resilience to drought conditions.
  - **Wetland Conservation and Restoration:**
    - **Description:** Wetlands provide essential ecosystem services, including flood mitigation, water purification, and habitat for biodiversity.
    - **Implementation:** Conducting assessments of existing wetland areas to identify critical habitats for restoration, alongside community-based initiatives to protect and rehabilitate degraded wetlands.
      - **Community Engagement:** Involving local stakeholders in conservation efforts, fostering a sense of ownership and stewardship over these vital ecosystems.
    - **Outcomes:** Enhanced flood resilience, improved water quality, and increased biodiversity through habitat restoration.
- 3. **Agroecological Practices:**
  - **Sustainable Agricultural Techniques:**
    - **Description:** Promoting climate-resilient agricultural practices is vital for ensuring food security and reducing vulnerability to climate impacts.
    - **Implementation:** Training programs for farmers on crop diversification, organic farming, and agroforestry practices that enhance soil health and resilience.
      - **Support Services:** Establishing extension services that provide ongoing technical support, access to resources, and market linkages for sustainably produced crops.

- **Outcomes:** Improved food security, reduced reliance on imported food, and increased income from diversified agricultural practices.
  - **Community Gardens and Urban Agriculture:**
    - **Description:** Urban agriculture initiatives increase local food production while reducing the carbon footprint associated with food transport.
    - **Implementation:** Developing community gardens in urban areas, involving schools and local organizations in the planning and maintenance of these spaces.
      - **Educational Workshops:** Conducting workshops on sustainable gardening techniques, nutrition education, and the importance of local food systems.
    - **Outcomes:** Strengthened community ties, enhanced access to fresh produce, and improved overall community health and well-being.
- 4. Ecosystem-Based Disaster Risk Reduction (Eco-DRR):**
- **Natural Buffers Against Disasters:**
    - **Description:** Ecosystems like mangroves, wetlands, and coral reefs can significantly reduce the impacts of natural disasters.
    - **Implementation:** Integrating Eco-DRR into national disaster management plans, focusing on protecting and restoring these ecosystems as part of broader risk reduction strategies.
      - **Community Preparedness Programs:** Engaging local communities in disaster risk reduction planning, emphasizing the role of natural ecosystems in safeguarding lives and property.
    - **Outcomes:** Reduced disaster risk, enhanced community preparedness, and increased awareness of the value of natural ecosystems in disaster resilience.
  - **Capacity Building and Community Engagement:**
    - **Description:** Strengthening community capacity to respond to climate impacts enhances resilience.
    - **Implementation:** Providing training sessions on eco-DRR principles and practices, along with developing local risk assessment tools that incorporate ecosystem services.
      - **Collaborative Workshops:** Facilitating workshops that bring together various stakeholders, including local governments, NGOs, and community groups, to discuss and implement Eco-DRR strategies.
    - **Outcomes:** Increased local capacity for disaster preparedness and response, improved community resilience to climate-related hazards.

#### 4.15.7.2 Expected Benefits of Nature-Based Solutions

- **Enhanced Climate Resilience:** NbS offers significant protection against climate-related hazards, increasing the resilience of communities, infrastructure, and ecosystems.
- **Biodiversity Conservation:** Protecting and restoring natural habitats contributes to the preservation of Tuvalu's unique flora and fauna, supporting ecosystem health and sustainability.
- **Sustainable Livelihoods:** NbS creates economic opportunities through eco-tourism, sustainable fisheries, and improved agricultural practices, enhancing local livelihoods and reducing poverty.
- **Carbon Sequestration:** Ecosystem restoration initiatives contribute to carbon capture, helping mitigate climate change while enhancing resilience.
- **Community Empowerment:** Engaging local communities in NbS fosters a sense of ownership and stewardship, enhancing social cohesion and capacity for climate action.

#### 4.15.7.3 Challenges and Opportunities

1. **Resource Limitations:** Financial constraints can hinder the implementation and maintenance of NbS projects. Strengthening partnerships with international organizations, development partners, and NGOs is essential to mobilize funding and resources.



- **Opportunity:** Establishing multi-stakeholder partnerships to leverage additional funding, expertise, and resources for NbS initiatives.
- 2. **Capacity Building:** Enhancing local capacities through training and education is crucial for effective NbS implementation. This includes developing skills in ecosystem management, restoration techniques, and community engagement.
  - **Opportunity:** Creating local training programs and exchange opportunities to build expertise within communities and improve the sustainability of NbS initiatives.
- 3. **Climate Variability and Uncertainty:** The unpredictable nature of climate impacts necessitates adaptive management approaches that can respond to changing conditions. Incorporating traditional knowledge alongside scientific research can enhance the effectiveness of NbS.
  - **Opportunity:** Utilizing traditional ecological knowledge (TEK) to inform NbS practices, ensuring culturally relevant and context-specific approaches to adaptation.

#### 4.15.7.4 Policy and Institutional Framework

1. **National Climate Change Policy (NCCP):** The NCCP provides scope to integrate NbS into national adaptation strategies, recognizing the importance of ecosystems in enhancing resilience. This policy framework supports the development of local adaptation plans that support NbS implementation.
2. **Local Governance and Community Involvement:** Local governance structures are crucial for the successful implementation of NbS. Engaging communities in decision-making processes ensures that local knowledge and needs are integrated into development planning.
  - **Community-Based Approaches:** Encouraging participatory planning and management approaches that empower communities to take an active role in conservation and adaptation efforts.
3. **Integration with National Development Plans:** NbS should be mainstreamed into broader national development strategies, including economic planning, sustainable development goals (SDGs), and poverty alleviation initiatives, to ensure a cohesive approach to climate adaptation.
  - **Cross-Sectoral Collaboration:** Promoting collaboration among government ministries, NGOs, and community groups to integrate NbS into all relevant policies, plans, and programs across sectors.

#### 4.15.7.5 Future Directions

To maximize the potential of NbS in Tuvalu's climate change adaptation efforts, the following actions will be prioritized:

- **Strengthening Monitoring and Evaluation:** Establishing robust systems to monitor the effectiveness of NbS projects will be critical for adaptive management and ensuring accountability. This includes setting specific, measurable indicators aligned with national goals and international commitments.
- **Expanding Education and Outreach:** Increasing awareness of NbS benefits and practices among local communities will enhance engagement and support for ongoing projects. Educational campaigns should target diverse audiences, including youth, to foster a new generation of environmental stewards.
- **Advancing Research and Innovation:** Investing in research on the effectiveness of different NbS approaches in Tuvalu's unique context will provide valuable insights for future initiatives. Collaboration with research institutions and universities can facilitate knowledge exchange and innovation.

#### 4.15.7.6 Summary

Implementing nature-based solutions in Tuvalu is a critical component of the country's climate change adaptation strategy. By leveraging the inherent resilience of natural ecosystems, Tuvalu can enhance its capacity to cope with climate impacts while promoting sustainable development and protecting biodiversity. Through a comprehensive approach that includes community engagement, policy integration, and capacity building, Tuvalu can effectively harness the potential of NbS to secure a sustainable and resilient future for its people and ecosystems.



#### 4.15.8 Stakeholder Involvement in Adaptation Actions

Stakeholder involvement in Tuvalu's climate change adaptation strategy is crucial for addressing the unique challenges posed by rising sea levels, extreme weather events, and resource management. Key governmental institutions, such as the Environment Department within the Ministry of Natural Resources, play a pivotal role by implementing climate policies and coordinating efforts across various sectors, including agriculture, health, and disaster management. These agencies work collaboratively with departments like the Ministry of Health and the Department of Agriculture to integrate climate resilience into public health initiatives and agricultural practices. This comprehensive approach ensures that adaptation strategies are holistic, encompassing food security, health monitoring, and sustainable land use.

Community engagement is equally essential, as local populations are directly affected by climate impacts and often serve as the first responders. Non-governmental organizations (NGOs) such as TANGO and Island Care facilitate grassroots initiatives that empower local residents to participate in adaptation planning and execution. The Kaupule, or local councils, are integral to this process, representing community interests and promoting traditional conservation practices. Additionally, the involvement of the private sector is encouraged to foster sustainable business practices that align with national adaptation goals. By leveraging the strengths of these diverse stakeholders, Tuvalu can implement an inclusive and effective approach to climate change adaptation that is responsive to its social and environmental contexts. Effective stakeholder engagement is crucial for the success of Tuvalu's adaptation initiatives, ensuring that the voices of all sectors of society are heard and considered.

**Multi-level Stakeholder Engagement:** To achieve successful climate change adaptation, Tuvalu employs a multi-level stakeholder engagement strategy. At the national level, coordination between various government agencies and ministries ensures a unified approach to adaptation planning and implementation. This collaboration helps streamline policies and resources effectively. Community engagement is also prioritized, actively involving local communities in decision-making processes. This grassroots participation ensures that adaptation strategies are grounded in local realities and needs, ultimately leading to more effective outcomes. Furthermore, partnerships with the private sector are being developed to leverage resources, innovation, and expertise for the implementation of adaptation projects.

Examples of stakeholder involvement include regular community workshops designed to discuss adaptation needs and gather input on local priorities. Additionally, engagement with local businesses aims to support the development of climate-resilient products and services, creating a collaborative environment where all stakeholders contribute to the overarching goals of adaptation. Through these inclusive strategies, Tuvalu is well-positioned to enhance its resilience against climate change impacts while ensuring that all voices are heard in the adaptation process.

**Table 61: Institutions and Stakeholders Involved**

| Institution                                            | Stakeholders              | Interests/Responsibilities                                                                                                                                                                                                                 |
|--------------------------------------------------------|---------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Environment Department, Ministry of Natural Resources. | Governmental Institutions | Implementing agency for GEF, UNFCCC, UNCCD, and other MEAs; manages the state of the environment, coordinates MEA-related activities, issues permits, conducts EIA, liaises with international bodies, and manages environmental projects. |
| Department of Agriculture                              | Governmental Institutions | Responsible for agriculture development, consultations on crop production, food security, land use, water, biosafety, and biosecurity.                                                                                                     |
| Ministry of Natural Resources                          | Governmental Institutions | Manages fisheries, marine resources, and awareness programs; promotes marine conservation.                                                                                                                                                 |
| Ministry of Finance.                                   | Governmental Institutions | National strategies integration; manages development programs.                                                                                                                                                                             |



|                                                                                                     |                                       |                                                                                                        |
|-----------------------------------------------------------------------------------------------------|---------------------------------------|--------------------------------------------------------------------------------------------------------|
| Department of Foreign Affairs                                                                       | Governmental Institutions             | A focal point for GEF manages trade agreements and supports international cooperation.                 |
| Department of Home Affairs                                                                          | Governmental Institutions             | Administers technical support for outer islands, resource management, and outer island climate issues. |
| Ministry of Health and Social Welfare                                                               | Governmental Institutions             | Oversees public health and waste management, tracks vector and waterborne diseases.                    |
| Meteorological Office                                                                               | Governmental Institutions             | Provides national meteorological services; collaborates on climate data projects.                      |
| Ministry of Public Works, Infrastructure and water, Energy Department and Climate Change Department | Governmental Institutions             | Develops infrastructure, coastal protection, building standards, and waste management.                 |
| Tuvalu Investment Corporation                                                                       | Governmental Institutions             | Manages government assets, housing, and state enterprises, involved in cyclone rehabilitation.         |
| Tuvalu Police Force & National Disaster Management Office                                           | Governmental Institutions             | Manages disaster preparedness, training, emergency operations.                                         |
| Office of the Prime Minister                                                                        | Governmental Institutions             | Policy decision-making on environment, economic development, and finance.                              |
| Ministry of Transport, Energy, Communication and Innovation                                         | Governmental Institutions             | Administers transport sector regulations, media, and communication.                                    |
| Ministry of Education and Human Resource Development                                                | Governmental Institutions             | Develops education curricula, includes climate change subjects, coordinates sports.                    |
| Tuvalu Electricity Corporation                                                                      | Public and State Institutions         | Supplies power, primarily fossil-fuel based; largest fuel consumer in Tuvalu.                          |
| TANGO                                                                                               | Non-Governmental Organizations (NGOs) | Supports NGO coordination and community-based environmental programs.                                  |
| Island Care                                                                                         | Non-Governmental Organizations (NGOs) | Facilitates community environmental programs and public climate awareness.                             |
| Tuvalu National Council of Women                                                                    | Non-Governmental Organizations (NGOs) | Coordinates community development and coastal conservation programs.                                   |
| Tuvalu Red Cross                                                                                    | Non-Governmental Organizations (NGOs) | Provides disaster preparedness, capacity-building, and relief services.                                |
| Kaupule (Local Council)                                                                             | Non-Governmental Organizations (NGOs) | Local governance, decision-making, and traditional conservation advocacy.                              |

## 4.16 Progress on Implementation of Tuvalu's Adaptation

Tuvalu has made significant strides in implementing its adaptation strategies, driven by a comprehensive framework that encompasses various policies, plans, and projects aimed at enhancing resilience to climate change impacts. Central to these efforts is the Te Kete: Tuvalu National Strategy for Sustainable Development (2021-2030), which integrates climate resilience into national development objectives and underscores the importance of sustainable practices across all sectors. The Te Vaka Fenua O Tuvalu: National Climate Change Policy (2020-2030) further establishes a long-term vision for adaptation and mitigation, facilitating collaboration among stakeholders to achieve climate

goals. Additionally, the National Adaptation Program of Action (NAPA) and its subsequent iterations, NAPA-I, NAPA-I+, and NAPA-II, prioritize urgent adaptation needs, focusing on immediate and medium-term interventions to enhance community resilience.

The implementation of these strategies is supported by a robust legislative framework, including the Climate Change Resilience Act 2019 and the Tuvalu Climate Change and Disaster Survival Fund Act 2015, which provide the legal basis for funding mechanisms and resource allocation for climate initiatives. The National Disaster Management (Amendment) Act 2021 complements these efforts by enhancing disaster preparedness and response capabilities.

In terms of practical projects, initiatives such as the Ridge to Reef (R2R) approach and the Tuvalu Coastal Adaptation Project (TCAP) demonstrate a commitment to integrated land and sea management and coastal resilience, respectively. These projects not only focus on infrastructure development but also emphasize community engagement, ensuring that the voices of vulnerable populations are included in adaptation planning.

Despite the considerable progress outlined in the below table, which summarizes key policies, plans, and funding sources, challenges remain. Funding gaps for ongoing and new initiatives underscore the need for sustained investment and international support to meet the adaptation goals outlined in these frameworks. Overall, Tuvalu's adaptation landscape reflects a proactive approach to climate resilience, aiming to safeguard its communities and ecosystems in the face of an evolving climate crisis.



**Table 62: Summary of Tuvalu's adaptation implementation progress and overview**

| Name                                                                             | Brief Description                                                                                                                                                 | Implementing Agency     | Funding Sources and Partners                         | Applicability (Financial/Technology/Capacity Building) | Gender & Social Inclusion                                                          | Activity Type          | Other Applicable Parameters                                                         |
|----------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|------------------------------------------------------|--------------------------------------------------------|------------------------------------------------------------------------------------|------------------------|-------------------------------------------------------------------------------------|
| <b>Te Kete: Tuvalu National Strategy for Sustainable Development (2021-2030)</b> | A comprehensive strategy aimed at integrating climate resilience into national development frameworks, addressing social, economic, and environmental dimensions. | Government of Tuvalu    | Government of Tuvalu, Green Climate Fund (GCF)       | Financial, Capacity Building                           | Gender-sensitive planning and training programs that promote women's participation | Policy Development     | Includes a robust Monitoring and Evaluation Framework for assessing outcomes.       |
| <b>Te Vaka Fenua O Tuvalu: National Climate Change Policy (2020-2030)</b>        | A framework guiding long-term adaptation and mitigation efforts across multiple sectors, ensuring a holistic approach to climate action.                          | Ministry of Environment | Government of Tuvalu, UNDP, international donors     | Capacity Building, Financial Investments               | Vulnerable groups are included in adaptation planning processes to ensure equity   | Policy Development     | Alignment with regional frameworks for coherence and support.                       |
| <b>National Adaptation Program of Action (NAPA)</b>                              | Addresses urgent climate adaptation needs through prioritized projects aimed at enhancing community resilience and                                                | Ministry of Environment | Government of Tuvalu, international funding agencies | Financial, Capacity Building                           | Focus on women in agriculture through targeted adaptation programs                 | Program Implementation | Identifies priority actions for immediate implementation to address pressing needs. |

|                                                                    |                                                                                                                                                 |                                     |                                             |                                |                                                                                      |                       |                                                                                         |
|--------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------|---------------------------------------------|--------------------------------|--------------------------------------------------------------------------------------|-----------------------|-----------------------------------------------------------------------------------------|
|                                                                    | adaptive capacity.                                                                                                                              |                                     |                                             |                                |                                                                                      |                       |                                                                                         |
| <b>National Adaptation Plan (NAP) Framework</b>                    | Develops comprehensive strategies for climate adaptation planning and implementation across sectors, enhancing resilience to climate impacts.   | Government of Tuvalu                | GCF, international aid organizations        | Financial, Technology Transfer | Gender considerations integrated into adaptation strategies, ensuring equal benefits | Framework Development | Action plans developed for sectoral integration to enhance overall effectiveness.       |
| <b>Climate Change Resilience Act (2019)</b>                        | Establishes a legal framework to enhance efforts towards climate resilience, emphasizing compliance with international standards and practices. | Government of Tuvalu                | Government of Tuvalu, donor agencies        | Capacity Building              | Promotes equitable resource access among communities                                 | Legislation           | Ensures compliance with international climate agreements and enhances accountability.   |
| <b>Tuvalu Climate Change and Disaster Survival Fund Act (2015)</b> | Creates a dedicated fund to support climate change adaptation and disaster response initiatives, facilitating rapid action during emergencies.  | Ministry of Finance                 | Government of Tuvalu, donor agencies        | Financial Support              | Focus on vulnerable populations in funding allocations to enhance social equity      | Fund Management       | Framework for fund allocation and utilization, ensuring transparency and effectiveness. |
| <b>National Disaster Management</b>                                | Enhances existing national strategies for disaster                                                                                              | National Disaster Management Office | Government of Tuvalu, international support | Capacity Building              | Needs of marginalized communities are specifically                                   | Legislation           | Emergency Preparedness and Response Framework,                                          |



|                                                                            |                                                                                                                                                 |                         |                                    |                                 |                                                                               |                                     |                                                                                          |
|----------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|------------------------------------|---------------------------------|-------------------------------------------------------------------------------|-------------------------------------|------------------------------------------------------------------------------------------|
| <b>(Amendment) Act (2021)</b>                                              | management and response, integrating climate change adaptation into disaster risk management.                                                   |                         |                                    |                                 | addressed in planning                                                         |                                     | focusing on resilience building.                                                         |
| <b>Tuvalu Climate Change and Disaster Survival Fund Regulations (2017)</b> | Provides comprehensive guidelines for the effective use and management of the disaster survival fund to support climate adaptation initiatives. | Ministry of Finance     | Government of Tuvalu               | Financial Management Principles | Ensures equitable access to resources for vulnerable groups                   | Regulation Management               | Guidelines for fund utilization, promoting accountability and stakeholder participation. |
| <b>National Climate Change Policy (2020-2030)</b>                          | Outlines strategies for climate action across multiple sectors, integrating adaptation measures into national development goals and objectives. | Ministry of Environment | Government of Tuvalu, UNDP         | Financial, Capacity Building    | Gender-sensitive adaptation planning that includes diverse stakeholder voices | Policy Development                  | Integration with national development goals to ensure alignment and support.             |
| <b>Health and Climate Change Country Profile (2019)</b>                    | Assesses health impacts of climate change, outlining adaptation strategies to address health vulnerabilities in Tuvalu's population.            | Ministry of Health      | WHO, international funding sources | Capacity Building               | Focus on health equity, particularly for vulnerable populations               | Assessment and Strategy Development | Includes health adaptation strategies integrated into national health planning.          |

|                                                                               |                                                                                                                                                                  |                                     |                                             |                              |                                                                               |                        |                                                                                         |
|-------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------|---------------------------------------------|------------------------------|-------------------------------------------------------------------------------|------------------------|-----------------------------------------------------------------------------------------|
| <b>Tropical Cyclone Tino Recovery and Vulnerability Reduction Plan (2020)</b> | A recovery plan focusing on rebuilding and enhancing resilience after Cyclone Tino, incorporating lessons learned for future disaster preparedness.              | National Disaster Management Office | GCF, international aid                      | Financial, Capacity Building | Addresses specific needs of affected communities, ensuring inclusive recovery | Recovery Planning      | Post-Cyclone Recovery Framework that enhances future resilience against similar events. |
| <b>NAPA-I</b>                                                                 | Initial adaptation program prioritizing urgent adaptation actions in response to climate vulnerabilities identified through community engagement.                | Government of Tuvalu                | Government of Tuvalu, international support | Financial, Capacity Building | Gender considerations in project selection to ensure equitable benefits       | Program Implementation | Monitoring framework for assessing the implementation and impact of adaptation actions. |
| <b>NAPA-I+</b>                                                                | Updated adaptation priorities based on new assessments, community feedback, and emerging climate data, refining previous initiatives for improved effectiveness. | Government of Tuvalu                | International funding, GCF                  | Financial, Capacity Building | Inclusion of women's voices in planning to strengthen community resilience    | Program Update         | Evaluation of progress and impact to inform future adaptation planning.                 |



|                                                 |                                                                                                                                                                 |                         |                        |                                |                                                                                      |                        |                                                                                                      |
|-------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|------------------------|--------------------------------|--------------------------------------------------------------------------------------|------------------------|------------------------------------------------------------------------------------------------------|
| <b>NAPA-II</b>                                  | Second iteration of NAPA, focusing on comprehensive adaptation strategies, incorporating lessons learned and emerging best practices from previous initiatives. | Ministry of Environment | GCF, international aid | Financial, Technology Transfer | Ensures representation of marginalized groups in adaptation efforts                  | Program Implementation | Adaptive capacity assessment to gauge effectiveness and identify areas for improvement.              |
| <b>Ridge to Reef (R2R)</b>                      | An integrated approach to land and sea management, promoting biodiversity conservation and sustainable resource management for climate resilience.              | Ministry of Environment | GEF, local funding     | Financial, Capacity Building   | Promotes gender equity in project implementation and benefits                        | Program Implementation | Integrated management framework that aligns land and marine resource management practices.           |
| <b>Tuvalu Coastal Adaptation Project (TCAP)</b> | Enhances coastal resilience through restoration projects and infrastructure development, focusing on sustainable community-led initiatives.                     | Ministry of Environment | GEF, ADB               | Financial, Technology Transfer | Community-led initiatives focusing on vulnerable groups, ensuring inclusive benefits | Project Implementation | Coastal management strategies that integrate local knowledge and practices for effective adaptation. |

The following section outlines the progress made in various aspects, including the formulation of policies, implementation of specific adaptation actions, coordination of activities, and effectiveness of measures taken.

#### 4.16.1 Implementation of Actions Identified in National Frameworks

The implementation of adaptation actions in Tuvalu is guided by key national frameworks, including **Te Kete: Tuvalu National Strategy for Sustainable Development (2021-2030)** and **Te Vaka Fenua O Tuvalu: National Climate Change Policy (2020-2030)**. These frameworks aim to integrate climate resilience into the broader development agenda, ensuring that climate considerations are embedded in all aspects of governance and community planning.

**Te Kete** outlines specific actions for enhancing resilience across sectors, focusing on sustainable livelihoods, ecosystem protection, and disaster risk reduction. A notable achievement under this strategy has been the establishment of community-based adaptation programs that prioritize local knowledge and practices, enabling communities to tailor solutions to their specific vulnerabilities.

**Te Vaka Fenua O Tuvalu**, on the other hand, emphasizes the need for effective governance structures that facilitate collaboration between government, civil society, and the private sector. In recent years, Tuvalu has enhanced its participatory governance mechanisms, conducting local consultations to incorporate community inputs into adaptation planning. This approach has resulted in a more responsive and inclusive framework, allowing communities to actively engage in the implementation of climate initiatives.

The **National Adaptation Plan (NAP) Framework**, recently published, outlines priority actions, resources required, and stakeholders involved in achieving climate resilience. This framework was developed through extensive stakeholder engagement and reflects the latest climate data and community needs. Key areas of focus include water management, agriculture, coastal protection, and health, all critical for the livelihoods of Tuvalu's population.

#### 4.16.2 Formulation and Publication of Programmes and Strategies

Tuvalu has taken significant steps to formulate, implement, and publish various national and regional adaptation programs. The completion of the **National Adaptation Program of Action (NAPA)** has been pivotal in identifying priority adaptation needs. **NAPA-I** (2010-2016) was the first initiative funded through Tuvalu's NAPA, leading to projects focused on enhancing the resilience of coastal communities through improved infrastructure and sustainable resource management.

Building on the successes of NAPA-I, the **NAPA-II** (2011-2013) project expanded initiatives in agriculture, water, and coastal protection, funded by a combination of GEF LDCF and Australian Government contributions. Specific achievements included the implementation of rainwater harvesting systems, promotion of climate-resilient crop varieties, and the construction of community seawalls to protect against erosion.

**NAPA-II** (2013-2019) aimed to improve island-level governance and response capacities related to climate hazards. A key outcome was the establishment of local adaptation committees that empower communities to lead adaptation efforts and integrate climate resilience into local development plans.

The **Ridge to Reef (R2R) Project** (2015-2020) was launched to protect biodiversity and ecosystem functions, employing a holistic approach that links land and marine management. This initiative has resulted in enhanced management of marine protected areas, reforestation efforts, and community engagement in sustainable fishing practices. The project emphasized the importance of ecosystem health in supporting livelihoods and mitigating climate impacts.

The **Tuvalu Coastal Adaptation Project (TCAP)**, which began in 2017, represents a major commitment to enhancing coastal resilience. Funded by the Green Climate Fund (GCF), TCAP focuses on vulnerable islands such as Funafuti, Nanumea, and Nanumaga. Key interventions include the



construction of resilient infrastructure like seawalls, improved drainage systems, and restoration of coastal ecosystems. A significant achievement has been the completion of several coastal protection structures that have significantly reduced vulnerability to flooding and erosion.

### 4.16.3 Implementation of Current and Past Adaptation Actions

Tuvalu's adaptation actions have been actively implemented in alignment with both past and current adaptation communications. The **Tropical Cyclone Tino Recovery and Vulnerability Reduction Plan (2020)** is a prime example of integrating recovery efforts with climate resilience principles. This plan has facilitated coordinated responses to disasters, focusing on rebuilding infrastructure while incorporating adaptation strategies. Community engagement has been critical in identifying priority areas for recovery, ensuring that local needs and vulnerabilities are addressed.

Ongoing projects from previous NAPA initiatives have also yielded tangible results. For instance, investments in water management systems have improved access to safe drinking water, a critical adaptation action given Tuvalu's susceptibility to droughts. The successful introduction of drought-resistant crop varieties has also enhanced food security, demonstrating the effectiveness of adaptation measures.

### 4.16.4 Adaptation Actions Identified in NDCs

Tuvalu's adaptation actions are articulated in several key national documents, including the National Adaptation Programme of Action (NAPA), the National Climate Change Policy (2021-2030), and the National Strategic Action Plan for Climate Change and Disaster Risk Management (2012-2016). These frameworks outline the urgent adaptation needs of the country, focusing on sectors that are particularly vulnerable to climate change, such as coastal areas, agriculture, water resources, health, and fisheries.

The NAPA emphasizes the need to enhance coastal resilience through the construction and rehabilitation of sea walls, as well as the restoration of natural ecosystems. The ongoing Coastal Adaptation Project, funded by the Green Climate Fund (GCF) with a total allocation of USD 36 million (including USD 2.9 million in co-financing from the Government of Tuvalu), exemplifies these efforts. This project aims to improve existing infrastructure and catalyze additional adaptation finance for future initiatives.

In agriculture, Tuvalu is prioritizing the introduction of salt-tolerant pulaka species to increase productivity in response to changing climatic conditions. Water resource management initiatives focus on enhancing household water capacity and promoting conservation practices to address frequent water shortages. Health adaptation strategies include controlling vector-borne diseases and ensuring access to quality potable water, which are crucial for protecting community health.

Fisheries management is also a significant component of Tuvalu's adaptation strategy. The government is strengthening community-based conservation programs to enhance the resilience of near-shore marine ecosystems. Additionally, efforts to build disaster preparedness and response capabilities are critical for mitigating the impacts of climate-related disasters.

Tuvalu has made substantial progress in mobilizing funding for its adaptation initiatives, particularly through GCF support. The most recent grant of USD 7.5 million, disbursed in 2022, underlines the ongoing commitment to enhancing resilience. The development of a National Adaptation Plan (NAP) under the GCF Readiness program further supports medium and long-term adaptation planning, with implementation efforts currently underway.



Overall, Tuvalu's adaptation actions reflect a comprehensive and integrated approach to addressing climate change impacts, aligning immediate needs with long-term strategies to build a climate-resilient future for its communities.

#### 4.16.5 Coordination Activities and Regulatory Changes

Tuvalu has made significant progress in coordinating adaptation efforts across various sectors. The **National Disaster Management (Amendment) Act 2021** enhances the integration of disaster risk reduction and climate adaptation, facilitating better coordination between government agencies and local communities. This legal framework ensures that disaster preparedness and response plan incorporate climate resilience measures, enhancing overall community safety.

The establishment of the **Tuvalu Climate Change Resilience Fund** under the **Climate Change and Disaster Survival Fund Act 2015** has been a crucial development, providing a dedicated source of financing for adaptation initiatives. This fund has supported various community-driven projects, including the construction of climate-resilient infrastructure and the implementation of sustainable agricultural practices.

Furthermore, the **Climate Change Resilience Act 2019** mandates that all national and local development plans incorporate climate considerations, ensuring that adaptation actions are prioritized and systematically integrated into all facets of governance. This regulatory framework has facilitated a whole-of-government approach to adaptation, fostering collaboration between different sectors and levels of government.

#### 4.16.6 Effectiveness of Implemented Adaptation Measures

The effectiveness of implemented adaptation measures is being assessed through ongoing monitoring and evaluation mechanisms. Projects are designed with built-in feedback loops, allowing communities to share their experiences and challenges. For instance, community assessments of the TCAP have indicated high levels of satisfaction with the protective infrastructure developed, reflecting the project's success in meeting local needs.

Moreover, Tuvalu's participation in regional climate networks has facilitated knowledge exchange and capacity building, further enhancing the effectiveness of adaptation efforts. Collaborative initiatives with neighbouring Pacific Island nations have led to the sharing of best practices and resources, strengthening Tuvalu's adaptive capacity.

In summary, Tuvalu's progress in adaptation implementation is characterized by a comprehensive and integrated approach to addressing climate vulnerabilities. Through the establishment of robust policies, effective implementation of targeted adaptation projects, and ongoing community engagement, Tuvalu is actively building resilience against the impacts of climate change. Continued efforts to secure funding and expand adaptation measures will be essential for ensuring the long-term sustainability of these initiatives in the face of a changing climate.

### 4.17 Monitoring and Evaluation of Adaptation in Tuvalu

Tuvalu recognizes that effective monitoring and evaluation (M&E) are fundamental to the success of its adaptation actions and programs. These activities are essential for assessing the progress of adaptation measures, ensuring accountability, and promoting sustainable development in the face of climate change challenges. The monitoring and evaluation processes in Tuvalu are articulated in various national documents and frameworks, including the National Adaptation Programme of Action (NAPA), the National Climate Change Policy 2021-2030, and the National Adaptation Plan (NAP). This



comprehensive approach to M&E aligns with the international requirements, ensuring that Tuvalu's adaptation efforts are systematically tracked and evaluated.

#### 4.17.1 Approach to Monitoring and Evaluation

The **Guidance Note for Developing Monitoring and Evaluation (M&E) Frameworks in Tuvalu** provides a foundational document that outlines the role of M&E within the country's policy cycle. This guidance emphasizes the importance of M&E in supporting effective policy implementation and assessment, particularly in the context of climate adaptation.

To establish a robust M&E framework tailored to Tuvalu's unique context, the guidance recommends an **eight-step approach** which includes:

1. **Defining M&E Objectives:** Clearly identifying the goals and specific outcomes expected from adaptation actions is crucial for guiding M&E activities.
2. **Developing Indicators:** Establishing measurable indicators that align with the adaptation objectives allows for the quantification of progress and impacts. These indicators should encompass aspects such as resilience enhancement, vulnerability reduction, and adaptation effectiveness.
3. **Data Collection Methods:** Identifying appropriate and context-specific methods for data gathering ensures that relevant information is collected efficiently. This may include surveys, interviews, focus groups, and the utilization of existing data sources.
4. **Data Management:** Organizing and storing collected data systematically is essential for ease of access and analysis. A well-structured data management system supports ongoing monitoring efforts.
5. **Data Analysis and Interpretation:** Analyzing collected data to extract meaningful insights is critical for understanding the effectiveness of adaptation actions and identifying areas for improvement.
6. **Reporting:** Regularly communicating findings to stakeholders through clear and concise reports enhances transparency and accountability in the adaptation process.
7. **Learning and Adaptation:** Utilizing evaluation results to inform future adaptation actions fosters a culture of learning, allowing for the refinement of strategies based on empirical evidence.
8. **Stakeholder Engagement:** Actively involving communities and stakeholders in the M&E process enhances ownership and ensures that adaptation measures are relevant to local needs and contexts.

##### **Eight-step approach for preparing an M&E framework.**



**Source:** Pilot Program for Climate Resilience: Pacific Regional Track (PPCR-PR)

This structured approach is designed to provide comprehensive support for developing effective M&E frameworks that align with Tuvalu's climate adaptation goals.

#### 4.17.2 Monitoring, Evaluation, and Learning Framework

The concepts of **Monitoring, Evaluation, and Learning (MEL)** are integral to the implementation of the **National Adaptation Plan (NAP)**. The MEL approach encompasses several key elements:

- **Continuous Monitoring of Climate Change Impacts:** This involves tracking the effects of climate change on Tuvalu's environment, economy, and communities to inform adaptation strategies.
- **Tracking Financial Flows:** Monitoring the allocation and utilization of financial resources is crucial for ensuring that funds are directed toward effective adaptation initiatives and that financial support meets specific vulnerabilities.
- **Evaluating Adaptation Results:** Regular evaluations assess the outcomes and effectiveness of adaptation actions, providing insights into what works and what does not. This contributes to the overall goal of reducing climate vulnerability and strengthening community resilience.

By establishing robust MEL systems, Tuvalu aims to enhance its capacity to allocate resources effectively, ensure accountability, and promote continuous learning throughout the NAP process.

The **United Nations Development Programme (UNDP)** provides technical oversight for M&E of GEF-funded projects, ensuring that these initiatives adhere to strict evaluation standards. This includes conducting annual project reviews, mid-term evaluations, and terminal evaluations, all supported by allocated budgets for M&E activities. Similarly, the **Tuvalu Climate Adaptation Project (TCAP)**, funded by the Green Climate Fund (GCF), follows rigorous M&E protocols to enhance adaptation effectiveness and ensure comprehensive oversight of project outcomes.

#### 4.17.3 Governance Framework for Climate Change Policy

The **National Climate Change Policy 2021-2030** outlines a clear governance framework for the monitoring and review of climate adaptation efforts. The **Climate Change Department (CCD)** within Tuvalu's Ministry of Home Affairs, Climate Change and Environment (MHACCE) is responsible for overseeing the policy's implementation and ensuring alignment with national and international commitments. To facilitate this oversight, the CCD is tasked with developing a dedicated M&E framework that aligns with broader national strategies, such as:

- **Te Kete (National Strategy for Sustainable Development):** This strategy includes provisions for quarterly reporting, ensuring that adaptation efforts are regularly reviewed and adjusted as needed.
- **Annual Reports for the CCD:** The CCD produces annual reports that provide updates on the progress of policy implementation, outlining successes, challenges, and future directions.
- **National Advisory Council on Climate Change (NACCC):** This council meets monthly to discuss ongoing adaptation efforts, assess challenges, and coordinate responses to climate change impacts.

As part of the governance framework, the CCD plans to conduct a mid-term review at the end of 2024 to evaluate the initial implementation phase of the National Climate Change Policy. This review will assess progress toward achieving the policy's objectives and inform the development of a revised implementation plan for 2025–2030. A final review is scheduled for 2030, coinciding with broader global and national assessments of the SDGs and other related agreements.



#### 4.17.4 Sustainability of Adaptation Actions

Tuvalu's M&E efforts are leading to:

- **Increased Stakeholder Participation:** Engaging local communities and stakeholders in the M&E process fosters a sense of ownership over adaptation initiatives, ensuring that actions are tailored to local needs and circumstances.
- **Adaptive Learning:** Feedback obtained from M&E activities allows for the identification of successful practices and lessons learned, which are critical for refining future adaptation strategies. This continuous learning process is vital for adapting to the evolving challenges posed by climate change.
- **Alignment with Global Goals:** The integration of national and international frameworks facilitates the alignment of adaptation actions with global sustainability objectives, including the Sustainable Development Goals (SDGs) and the provisions of the Paris Agreement.
- **Resource Allocation and Effectiveness:** The rigorous tracking of financial flows and resource allocation has improved accountability and transparency, ensuring that funding is utilized effectively to address the most pressing vulnerabilities.

Tuvalu's approach to monitoring and evaluation of adaptation actions reflects a commitment to transparency, accountability, and continuous improvement. By establishing comprehensive M&E frameworks that incorporate stakeholder engagement and align with national and international strategies, Tuvalu aims to enhance its resilience to climate change. This commitment not only safeguards the well-being of its communities and ecosystems but also contributes to the global effort to combat climate change, ensuring a sustainable future for Tuvalu and its people.

### 4.18 Tuvalu's Vulnerability to Climate Change and Loss and Damage

Tuvalu, a small island nation in the Pacific Ocean, is increasingly recognized as one of the most vulnerable countries to the adverse effects of climate change. The nation's unique geographical characteristics, coupled with its socio-economic realities, make it particularly susceptible to various climate-related challenges. This comprehensive overview discusses the observed and potential climate change impacts in Tuvalu, actions taken to mitigate these impacts, and the institutional arrangements supporting these efforts, with a focus on enhancing understanding, action, and support for loss and damage associated with climate change.

#### 4.18.1 Observed and Potential Climate Change Impacts

Tuvalu is facing severe consequences from climate change, which can be classified into immediate, long-term, and potential future impacts.

##### 4.18.1.1 Coastal Erosion and Sea-Level Rise

- **Geographical Context:** Tuvalu consists of nine islands, predominantly coral atolls with an average elevation of just two meters above sea level. This geographic vulnerability places the islands at high risk from rising sea levels, which have been recorded globally due to melting polar ice and thermal expansion of seawater.
- **Current Coastal Erosion:** Extensive studies by the Tuvalu Meteorological Service and the national government have documented coastal erosion, which has accelerated in recent years. Coastal communities are witnessing significant land loss, with many structures and traditional lands becoming uninhabitable. This loss not only threatens housing but also impacts agricultural land and traditional fishing grounds, vital for food security.
- **Projected Sea-Level Changes:** Future projections indicate that if current trends continue, Tuvalu could see a rise in sea levels of up to several meters by the end of the century, leading

to increased flooding and more frequent inundation of low-lying areas, particularly in Funafuti, Tuvalu's capital.

#### 4.18.1.2 Saltwater Intrusion

- **Impact on Freshwater Supply:** Rising sea levels lead to saltwater intrusion, significantly affecting freshwater aquifers. Reports from the Tuvalu Water Authority indicate that the quality of groundwater is deteriorating, rendering traditional water sources brackish and unsuitable for consumption.
- **Agricultural Challenges:** Saltwater intrusion compromises agriculture, particularly subsistence crops such as pulaka (a traditional root crop) and coconuts, which are sensitive to salinity. The deterioration of these crops due to salinity stress threatens food security and the cultural practices of the Tuvaluan people.
- **Economic Consequences:** As local food production decreases, communities are increasingly reliant on imported goods, which are often more expensive and less nutritious. This reliance further strains household budgets and exacerbates the risk of food insecurity.

#### 4.18.1.3 Increased Frequency and Intensity of Extreme Weather Events

- **Cyclone Vulnerability:** Tuvalu has experienced an increase in the frequency and intensity of cyclones over recent decades, as evidenced by historical records and meteorological data. The devastation wrought by Cyclone Pam in 2015, which affected several islands and caused extensive damage to infrastructure and agriculture, exemplifies the dangers posed by extreme weather events.
- **Projected Future Risks:** Climate models predict that Tuvalu will face a growing risk of severe tropical storms, leading to heightened challenges for disaster preparedness and response. The anticipated increase in storm intensity and frequency will likely overwhelm existing infrastructure and strain emergency response capabilities.

#### 4.18.1.4 Droughts and Water Scarcity

- **Changes in Rainfall Patterns:** The region has seen alterations in rainfall patterns, with increasing variability and unpredictability. Periods of intense rainfall are followed by prolonged dry spells, leading to water scarcity during critical agricultural periods.
- **Community Impacts:** Water scarcity has profound implications for daily life, affecting drinking water availability and sanitation. The National Health Services of Tuvalu have reported increased health risks due to inadequate access to clean water and sanitation facilities during drought periods.
- **Adaptation Needs:** Community reliance on traditional rainwater harvesting systems is becoming less reliable, necessitating investment in alternative water supply systems and better resource management practices.

### 4.19 Activities Related to Averting, Minimizing, and Addressing Loss and Damage

To tackle the pressing issues of loss and damage associated with climate change, Tuvalu has implemented various strategies aimed at enhancing resilience and reducing vulnerability.

#### 4.19.1 Advocacy for Loss and Damage Financing

- **International Leadership:** Tuvalu has taken a proactive stance in international climate negotiations, advocating for a dedicated Loss and Damage Financing facility. This advocacy has been particularly pronounced at the Conference of the Parties (COP) meetings, where Tuvalu emphasizes the need for financial mechanisms to support vulnerable nations.



- **Need for Clear Frameworks:** The absence of universally accepted definitions of loss and damage complicates Tuvalu's advocacy efforts. Tuvalu stresses the necessity for clear, actionable frameworks that outline eligibility for loss and damage financing, ensuring that affected communities can access support effectively.

#### 4.19.2 Tuvalu Climate Adaptation Project (TCAP)

- **Comprehensive Adaptation Efforts:** The TCAP focuses on multifaceted strategies aimed at increasing climate resilience:
  - **Water Resource Management:** Initiatives include enhancing rainwater harvesting systems, constructing water storage facilities, and improving groundwater recharge methods to counteract saltwater intrusion and ensure a stable water supply.
  - **Coastal Defence Initiatives:** Projects involve the construction of seawalls and the restoration of mangrove forests, which provide natural barriers against erosion and flooding. The government collaborates with NGOs and international partners to implement these strategies effectively.
  - **Sustainable Agriculture:** Programs promote the use of climate-resilient crops and agricultural practices that improve soil health and reduce vulnerability to saltwater intrusion. Training workshops help farmers adopt sustainable practices, increasing their capacity to adapt to changing climatic conditions.

#### 4.19.3 Disaster Risk Reduction (DRR) Strategies

- **National Disaster Risk Management Framework:** Tuvalu has developed a comprehensive National Disaster Risk Management Plan, which integrates climate adaptation strategies into disaster preparedness efforts.
  - **Community Training Programs:** Local communities receive training on disaster preparedness and response, including simulations and drills that improve resilience and readiness for extreme weather events.
  - **Investment in Resilient Infrastructure:** Government efforts prioritize the construction and reinforcement of infrastructure such as schools, hospitals, and roads to withstand climate-related disasters.

#### 4.19.4 Community-Led Adaptation Initiatives

- **Empowerment of Local Communities:** Community engagement is central to Tuvalu's adaptation strategy. Local organizations are encouraged to develop and implement initiatives that reflect the unique cultural and environmental contexts of their areas.
  - **Promotion of Sustainable Practices:** Community gardens and cooperative farming initiatives foster local food production, reducing dependence on imports and enhancing food security.
  - **Ecosystem Restoration Projects:** Grassroots initiatives to restore coastal ecosystems, such as mangrove planting, not only protect shorelines but also enhance biodiversity and provide additional resources for local communities.

#### 4.19.5 Innovative Financial Instruments

- **Climate Risk Insurance Schemes:** Tuvalu is exploring innovative insurance mechanisms to provide rapid financial assistance after climate-related disasters. Such schemes can facilitate quicker recovery efforts and enhance overall resilience.
- **Establishment of a National Adaptation Fund:** The government aims to create a dedicated fund to support local adaptation projects, ensuring that communities have access to resources for implementing climate resilience initiatives.

## 4.20 Institutional Arrangements

Robust institutional frameworks are critical for effectively implementing strategies to address loss and damage associated with climate change.

### 4.20.1 National Climate Change Policy (2021-2030)

- **Strategic Vision:** The National Climate Change Policy outlines a strategic vision for Tuvalu's climate resilience efforts, establishing priorities for both adaptation and mitigation.
- **Goals and Objectives:** Key objectives include enhancing community resilience, protecting natural resources, and integrating climate considerations into all areas of national development planning.

### 4.20.2 Climate Change Department (CCD)

- **Central Coordinating Body:** Operating under the Ministry of Home Affairs, Climate Change and Environment (MHACCE), the CCD coordinates all climate initiatives, facilitating the flow of information and resources for effective implementation.
- **Data Management and Research:** The CCD collects climate data, monitors impacts, and assesses the effectiveness of adaptation measures, providing vital information for informed decision-making.

### 4.20.3 National Advisory Council on Climate Change (NACCC)

- **Multi-Stakeholder Engagement:** The NACCC brings together representatives from government agencies, civil society, and the private sector, fostering collaborative decision-making in climate action.
- **Oversight and Accountability:** The council monitors the implementation of climate policies, ensuring transparency and accountability in the management of resources allocated for climate adaptation and resilience.

### 4.20.4 Partnerships with Regional and International Organizations

- **Collaboration and Capacity Building:** Tuvalu collaborates with regional organizations, such as the Pacific Islands Forum, and international entities, including the United Nations Development Programme (UNDP), to enhance its capacity for climate resilience.
- **Technical Assistance and Resource Mobilization:** These partnerships facilitate access to technical expertise, best practices, and financial resources necessary for implementing adaptation initiatives.

### 4.20.5 Community-Based Adaptation Networks

- **Local Knowledge Sharing:** Grassroots organizations and community networks play a crucial role in facilitating knowledge sharing and capacity building, enabling communities to learn from successful adaptation initiatives.
- **Training and Empowerment:** Programs aimed at empowering local communities to implement effective adaptation strategies foster ownership and enhance resilience at the community level.

## 4.21 Conclusion

Tuvalu's efforts to avert, minimize, and address loss and damage associated with climate change are marked by a commitment to proactive advocacy, comprehensive national policies, community



engagement, and robust institutional frameworks. The combination of international advocacy for loss and damage financing, local adaptation initiatives, and effective governance structures positions Tuvalu as a model for climate resilience in the Pacific region. Continued prioritization of comprehensive, inclusive approaches is essential to safeguarding the future of Tuvalu's environment, economy, and communities in the face of existential threats posed by climate change. By enhancing understanding and action on loss and damage, Tuvalu aims to protect its cultural heritage, natural resources, and the well-being of its citizens while advocating for global recognition of the urgent need for loss and damage support.

## 4.22 Cooperation, Good Practices, Experience, and Lessons Learned

This section details Tuvalu's ongoing efforts to foster cooperation, share good practices, and leverage lessons learned in the context of climate adaptation. Given Tuvalu's unique challenges as a small island developing state facing the immediate impacts of climate change, its strategies provide valuable insights for global adaptation practices.

### 4.22.1 Science, Planning, and Policies Relevant to Adaptation

Tuvalu has established a robust framework for integrating scientific research into its climate adaptation policies. The **National Climate Change Policy (2021-2030)** not only articulates the country's vision for climate resilience but also sets forth specific goals that are informed by scientific data. This policy outlines strategies for enhancing adaptive capacity across sectors, including agriculture, fisheries, health, and infrastructure.

To facilitate evidence-based decision-making, Tuvalu collaborates with regional organizations such as the **Pacific Community (SPC)** and the **University of the South Pacific (USP)**. These partnerships enable access to cutting-edge climate research and technology, ensuring that Tuvaluan policies reflect the latest scientific understanding of climate risks and vulnerabilities. For example, collaborations with the **SPC's Geoscience Division** have enhanced the capacity for geospatial analysis, which is critical for assessing land use changes and sea-level rise impacts.

### 4.22.2 Policy Innovation and Pilot Projects

Tuvalu has initiated pilot projects designed to test innovative adaptation strategies. One notable initiative is the **Tuvalu Coastal Adaptation Project (TCAP)**, which aims to implement sustainable coastal management practices and infrastructure improvements. The project focuses on integrating traditional knowledge with modern engineering techniques to create resilient coastal defenses. For instance, the restoration of mangroves has been identified as a key nature-based solution that provides multiple benefits, including shoreline protection, biodiversity conservation, and carbon sequestration.

Additionally, Tuvalu's **Renewable Energy Policy** aims to enhance energy security and reduce greenhouse gas emissions. By investing in solar energy and exploring other renewable options, Tuvalu is setting an example for other Pacific Island nations. The installation of solar photovoltaic systems across government buildings and community facilities demonstrates a commitment to sustainable energy practices while also reducing vulnerability to energy supply disruptions.

### 4.22.3 Integration of Adaptation Actions into Planning

Tuvalu has made significant strides in embedding climate adaptation into its national and local development plans. The **National Strategy for Sustainable Development (2021-2030)** emphasizes the

importance of integrating climate resilience into all sectors. This approach ensures that adaptation strategies are not siloed but rather linked with economic development, health, and disaster risk reduction efforts.

Local governance structures play a crucial role in this integration. The Tuvalu Government empowers local councils to incorporate climate adaptation measures into their planning processes. Workshops and training sessions conducted by the government equip local leaders with the skills needed to assess climate vulnerabilities and devise context-specific solutions.

#### 4.22.4 Strengthening Cooperation and Knowledge Sharing

Tuvalu actively engages in regional and international cooperation to bolster its adaptation efforts. Partnerships with organizations such as **SPREP**, **UNDP**, and the **Green Climate Fund (GCF)** provide critical technical and financial support. Tuvalu's participation in regional climate forums allows for the exchange of knowledge and best practices with other Pacific Island nations facing similar challenges.

The government also utilizes platforms like the **Pacific Climate Change Portal** to disseminate information on climate impacts and adaptation strategies. This portal serves as a valuable resource for policymakers, researchers, and community leaders, facilitating access to relevant data, case studies, and adaptation tools.

#### 4.22.5 Area, Scale, and Types of Cooperation

Tuvalu's cooperative efforts extend to grassroots initiatives that empower local communities. The **Community-Based Adaptation** projects funded by international donors focus on enhancing community resilience through education, training, and the implementation of local adaptation measures. For example, CBA initiatives can support local farmers in adopting salt-tolerant crop varieties, ensuring food security in the face of salinization due to rising sea levels.

On a regional scale, Tuvalu participates in the **AOSIS**, advocating for the needs of small island states in international climate negotiations. This collaboration not only amplifies Tuvalu's voice but also facilitates the sharing of successful adaptation strategies among member states, reinforcing collective resilience efforts.

#### 4.22.6 Improving the Durability and Effectiveness of Adaptation Actions

To enhance the effectiveness of adaptation initiatives, Tuvalu has established a framework for monitoring and evaluation. This includes the development of key performance indicators (KPIs) that measure progress toward adaptation goals. For instance, climate change has been mainstreamed into all 12 strategic areas of the **TKIII**, as well as having its strategic area with strategies and key performance indicators (KPIs).

Regular assessments of these KPIs allow Tuvalu to identify successful strategies and areas needing improvement. The findings from these evaluations are used to inform future policy adjustments and project designs, ensuring a dynamic and responsive adaptation framework.



#### 4.22.7 Working with Other Developing Countries

Tuvalu fosters a mutual exchange of knowledge and best practices with other developing countries, enhancing regional resilience to climate change impacts. By participating in capacity-building initiatives and hosting training workshops, Tuvalu shares its experiences in vulnerability assessments and adaptation planning while also learning from the experiences of its peers. This collaborative approach emphasizes the integration of traditional knowledge with scientific methods, enabling all involved nations to develop more effective adaptation strategies.

Initiatives like the **Pacific Adaptation to Climate Change (PACC)** exemplify this commitment to regional solidarity, as Tuvalu and its neighboring Pacific Island nations work together to identify shared vulnerabilities, address challenges, and implement collective solutions. Through this mutual sharing and learning, Tuvalu not only strengthens its adaptation efforts but also contributes to a more resilient Pacific region overall.

### 4.23 Strengthening Scientific Research and Knowledge

#### 4.23.1 Climate Research and Systematic Observation

Tuvalu is dedicated to enhancing its climate research capabilities through partnerships with regional and global scientific institutions. The establishment of meteorological stations and tide gauges across the islands improves the systematic collection of climate data, which is essential for understanding local climate dynamics and informing adaptation strategies.

Research initiatives conducted in collaboration with international organizations focus on enhancing weather forecasting and early warning systems. These systems are crucial for preparing communities for extreme weather events, thereby minimizing potential damage and loss of life.

#### 4.23.2 Vulnerability and Adaptation Research

Tuvalu regularly conducts comprehensive vulnerability assessments to identify the most at-risk communities and sectors. These assessments involve participatory approaches that engage local communities in identifying their vulnerabilities and potential adaptation strategies. By incorporating local knowledge and perspectives, Tuvalu ensures that its adaptation measures are contextually relevant and culturally appropriate.

Moreover, Tuvalu has developed a **Vulnerability Assessment Framework** that guides the evaluation of socio-economic and environmental vulnerabilities. This framework serves as a basis for prioritizing adaptation actions and allocating resources effectively.

#### 4.23.3 Monitoring and Evaluation of Adaptation Efforts

Monitoring and evaluation (M&E) mechanisms are integral to Tuvalu's climate adaptation strategy. The government employs a participatory M&E process that involves stakeholders at all levels, ensuring transparency and accountability. Regular reporting on adaptation progress is conducted, allowing for real-time adjustments to strategies based on emerging challenges and successes.

Tuvalu also collaborates with regional partners to enhance M&E practices. This includes participation in regional workshops that focus on developing standardized indicators and methodologies for assessing climate adaptation efforts across the Pacific Islands.

#### 4.23.4 Summary

Tuvalu's proactive approach to cooperation, knowledge sharing, and the integration of scientific research into adaptation planning underscores its commitment to building resilience against climate change. By engaging local communities, collaborating with regional and international partners, and fostering innovation, Tuvalu not only enhances its adaptation efforts but also contributes to the global discourse on effective climate change responses. Through these comprehensive strategies, Tuvalu aims to pave the way for sustainable development and safeguard its future in the face of evolving climate challenges.



## 5 Chapter 5: Financial, Technological, and Capacity Support Needed and Received under Articles 9–11 of the Paris Agreement

### 5.1 National Circumstances, Institutional Arrangements, and Country-Driven Strategies

#### 5.1.1 National Circumstance and Vulnerabilities

Tuvalu, an island nation in the Pacific Ocean, classified as both a Least Developed Country (LDC) and a Small Island Developing State (SIDS), faces significant challenges due to climate change. With a total land area of just 26 square kilometres and a population of 10,645 during 2017 Census, Tuvalu is composed of nine small coral atolls, also possesses a vast Exclusive Economic Zone (EEZ). The average elevation of the land is only about two meters above sea level, making Tuvalu highly susceptible to rising sea levels, coastal erosion, and other climate-induced extreme weather events such as tropical cyclones, storm surges, and flooding.

Due to its low-lying geography, Tuvalu is also extremely vulnerable to saltwater intrusion, which threatens its freshwater resources and agriculture. Furthermore, the country's infrastructure, which includes homes, roads, schools, and hospitals, is at high risk from climate-related disasters, exacerbating the challenges faced by the nation.

Tuvalu's economy is heavily reliant on a few key sectors, including fisheries, agriculture, and remittances, leading to an increasing dependency on international aid and support from development partners. Climate finance in Tuvalu, crucial for addressing climate change vulnerabilities, is channelled mainly from external sources, predominantly bilateral and multilateral. However, much of this funding is delivered outside of government systems and is largely managed by development partners. Consistent with the trend in many Pacific SIDS, climate finance in Tuvalu is primarily delivered through short-term, project-based modalities, with grant financing as the dominant instrument. This reliance on external funding and project-based approaches presents both opportunities and challenges for long-term, sustainable adaptation planning and implementation.

#### 5.1.2 Key National Climate Change Documents:

- **Nationally Determined Contribution (NDC) (2022 Update):**
  - **Mitigation:** Tuvalu's updated NDC focuses on achieving net-zero emissions by 2050 and sets a target of reducing emissions by 2030 compared to the baseline year 2010. Tuvalu's mitigation actions primarily focus on energy transition through the increased use of renewable energy technologies such as solar power, wind energy, and energy storage solutions. The country is also investing in energy efficiency improvements and low-carbon transportation systems.
  - **Adaptation:** Tuvalu's updated NDC emphasizes the need to enhance resilience across various sectors, including coastal protection, water management, agriculture, fisheries, and public health. Priority adaptation actions include implementing measures to reduce the impact of sea-level rise, enhancing water security through desalination plants and rainwater harvesting, strengthening disaster preparedness and response, and improving the health sector's capacity to cope with climate change-related health risks.
- **Te Kete: Tuvalu National Strategy for Sustainable Development (2021–2030):**

- This strategy emphasizes the importance of integrating climate change adaptation and mitigation into national development plans. It provides a comprehensive approach to sustainable development, focusing on climate resilience, disaster risk management, and the transition to a green economy. Key areas of focus include improving resource management, developing low-carbon infrastructure, and enhancing community resilience to the impacts of climate change.
- **Te Vaka Fenua O Tuvalu: National Climate Change Policy (2020–2030):**
  - This policy outlines Tuvalu’s vision for addressing climate change and building resilience to its effects. The policy aims to reduce GHG emissions through the development of renewable energy and energy efficiency programs, while also prioritizing adaptation measures such as coastal protection, water management, disaster risk reduction, and the protection of livelihoods and biodiversity.
- **National Adaptation Program of Action (NAPA):**
  - NAPA outlines Tuvalu’s most urgent climate adaptation needs, with a focus on immediate priorities such as strengthening water security, improving coastal protection, enhancing infrastructure resilience, and safeguarding agricultural and fisheries sectors from climate impacts. The NAPA is a key document in shaping the country’s short-term adaptation response to the impacts of climate change.
- **National Adaptation Plan (NAP) Framework:**
  - Tuvalu’s NAP framework provides a long-term vision for climate adaptation, focusing on integrating climate change adaptation measures into national development planning and sectoral strategies. The NAP aims to address vulnerabilities in the most affected sectors, including water resources, health, agriculture, fisheries, and infrastructure, while ensuring sustainable development pathways for the future.
- **Climate Change Resilience Act (2019):**
  - This Act provides the legal framework for addressing climate change resilience and integrating climate change considerations into national policies, programs, and projects. It ensures that climate adaptation measures are embedded within the national development process and that resources are allocated to enhance resilience across the country.
- **Tuvalu Climate Change and Disaster Survival Fund Act (2015):**
  - The Tuvalu Climate Change and Disaster Survival Fund is designed to provide financial resources for implementing climate change adaptation measures and responding to climate-induced disasters. The fund supports the country’s national adaptation priorities, including coastal protection, disaster risk reduction, and water security.
- **National Disaster Management (Amendment) Act (2021):**
  - This amendment enhances the country’s disaster management system by incorporating climate change considerations into national disaster risk management plans. It also strengthens early warning systems, disaster preparedness, and response capabilities to protect communities from extreme climate events.
- **Health and Climate Change Country Profile (2019):**
  - This report highlights the health risks posed by climate change, including waterborne diseases, heat stress, and vector-borne diseases. It underscores the need for strengthening



the healthcare sector's resilience to climate impacts and integrating climate health adaptation into the broader climate change adaptation strategy.

- **Ridge to Reef (R2R) Program:**

- This integrated approach aims to protect Tuvalu's ecosystems by focusing on the sustainable management of water, land, and coastal resources. The R2R program seeks to reduce climate vulnerability and enhance resilience to climate change through sustainable resource management practices.

- **Tuvalu Coastal Adaptation Project (TCAP):**

- TCAP focuses on addressing coastal vulnerabilities due to rising sea levels, storm surges, and coastal erosion. It supports both soft and hard adaptation measures, such as mangrove restoration, seawalls, and beach nourishment, and also includes community relocation options in extreme cases of land loss.

### 5.1.3 Institutional Arrangements for Climate Action Support

Several institutions are key in coordinating and implementing Tuvalu's climate change strategy. These institutions facilitate the execution of Tuvalu's national climate commitments and ensure the alignment of climate actions with international frameworks, such as the Paris Agreement.

- **Ministry of Home Affairs, Climate Change and Environment (MHACCE):** MHACCE has oversight of the Department of Climate Change, which is responsible for implementing and coordinating Tuvalu's NDC goals.
- **Climate Change Department (CCD):** The CCD is situated under the MHACCE and controlled directly by the MHACCE. The CCD handles all climate change-related matters to project implementation under climate change. CCD is the national focal point for climate change and the Secretariat for the National Advisory Council on Climate Change (NACCC). CCD is responsible for implementing climate change adaptation and mitigation activities.
- **National Advisory Council on Climate Change (NACCC):** is a body set up by the Government of Tuvalu for any Climate Change-related matters and chaired by the Secretary to Government, with Heads of Department with relevant linkages to Climate Change. National Advisory Council on Climate Change (NACCC) was established to advise the Prime Minister's Office on implementing necessary activities to tackle the impacts of climate change. NACCC is also responsible for overseeing the implementation of the National Climate Change Policy.
- **Development Coordination Committee (DCC):** The Development Coordination Committee (DCC) is under the Ministry of Finance, where projects for donor funding are prioritized and submitted to the Cabinet for approval.
- **Tuvalu Electricity Corporation (TEC):** The Tuvalu Electricity Corporation (TEC) was established, incorporated, and constituted under the Electricity Act of 1991 and began operations in December 1991. It was previously known as the Tuvalu Electricity Authority. The TEC is governed by the requirements of the Public Enterprise Act 2009, and board members are appointed by the government. TEC is a state-owned enterprise and is the sole provider of electricity services in Tuvalu. TEC is working towards achieving the country's goal of using 100 percent renewable energy by 2030.
- **Ministry of Transport, Energy, Communication and Innovation (MTECI):** MTECI has a range of responsibilities, including: Overseeing the Tuvalu Electricity Corporation (TEC); Maintaining and expanding the electricity grid, and accommodating renewable energy; Managing maritime transport issues and fuel imports

- **Department of Energy (DOE):** DOE is responsible for the overall energy sector planning, as well as fuel imports and the import of appliances.
- **Island Councils (Kaupule):** Island Councils (Kaupule), in coordination with the Ministry of Local Government and Agriculture, manage the land transport infrastructure and other infrastructure of the outer islands. Kaupule are responsible for vehicle registrations outside of Funafuti, and conduct surveys of small boats and outboard motor use on the outer islands.
- **Ministry of Home Affairs, Climate Change and Environment:** MHA is responsible for waste levies and programmes in Tuvalu. The Department of Home Affairs is responsible for local government.

Tuvalu, as both a Small Island Developing State (SIDS) and a Least Developed Country (LDC), has a single, integrated institutional arrangement for all climate change-related activities. This includes climate change reporting, greenhouse gas (GHG) inventories, mitigation and adaptation initiatives. The institutional arrangements for climate change adaptation are therefore incorporated within this broader national structure, as described in Section 1.13 of Chapter 1.

#### 5.1.4 Climate Change Priorities:

The 2020-2030 Te Kete (NSSD) outlines the overall strategic outcomes on climate change for Tuvalu from 2021-2030. When it comes to climate change, the Te Kete aims to ensure that Tuvalu has the adaptive capacity for increased resilience which would be achieved through investments in five strategic actions. These investments are:

- Development of a long-term national adaptation strategy, including a staged land reclamation program, that takes into account a worst-case scenario of the sea level in Tuvalu rising by one meter by the year 2100;
- Secure increased funding from global climate finance facilities.
- Strengthened access to labor mobility schemes.
- Develop effective frameworks for disaster risk and resilience management.
- Implementing a land rehabilitation and reclamation framework that is resilient to sea level rise and climate change impacts.

Tuvalu has also developed the **Te Vaka Fenua o Tuvalu: National Climate Change Policy 2020-2030** to advance its national priorities as set out in the 2020-2030 Te Kete (NSSD). The Te Vaka Fenua sets out three priority policy outcomes which are:

- Strengthened access to climate finance and strategic partnerships;
- Reduced vulnerability to climate change impacts through enhanced resilience;
- Managed human mobility and protection of national sovereignty.

The Te Vaka Fenua lists 12 objectives and 40 priority actions. An Implementation plan (not costed) has also been developed to help the Tuvaluan Government implement these priorities.

Tuvalu has also developed a Priority Infrastructure Investment Plan (2020-2025) which articulates a costed project pipeline of priority infrastructure investments. This plan highlights 16 priority projects drawn from the Energy, Climate Change, Social, Telecommunications, Transport (Aviation, Land, and Maritime), and Waste Management Sectors. Four projects in the Climate Adaptation Infrastructure category were identified as High Priority for Tuvalu. These projects were:

- National Adaptation and Reclamation-Option Study
- Establishment of an International Runway
- National Climate Proofing Housing Project
- Tuvalu National Evacuation Centers and Sports Complex.

The total estimated cost of these priorities is AUD 153.6M (USD 110.3M).



Tuvalu is in the process of submitting its 3<sup>rd</sup> NDC to the UNFCCC. Tuvalu has also developed an NDC Implementation Roadmap and Investment Plan to accelerate the implementation of its NDC. The Tuvalu 2021 NDC Implementation Roadmap and Investment Plan outlines potential greenhouse gas (GHG) mitigation actions in the land transport, maritime transport, and energy sectors. Critically, it also provides costed project pipelines, totalling USD 26.5 million for fourteen (14) priority mitigation projects, for consideration by Tuvalu's funding partners. These projects represent Tuvalu's prioritized mitigation actions through 2030.

## 5.2 Financial, Technology Transfer, and Capacity-Building Support Needed and Received

Tuvalu is in critical need of financial support, technology transfer, and capacity-building assistance to achieve its climate change goals. These needs are categorized into specific areas that correspond to the country's climate action priorities.

### 5.2.1 Financial Support for Mitigation and Adaptation

#### 5.2.1.1 Climate Change - financial support received:

Climate finance in Tuvalu is channelled mainly from external sources predominantly bilateral sources, as well as multilateral sources. Most of these finances, however, are delivered outside of the government systems and are mostly managed by development partners outside of the country. Like most Pacific SIDS, climate finance in Tuvalu is delivered from short-term project-based modalities. Grant financing is the dominant instrument being used to deliver climate finance in Tuvalu.

In 2015, the Government of Tuvalu legally established the Tuvalu Climate Change and Disaster Survival Fund. The objective of the Fund is to, 1) provide immediate vital services to the people of Tuvalu in combating the devastating impact of climate change and natural disasters, and 2) allow the Government and the people of Tuvalu to respond to future climate change impacts and natural disasters in a coordinated, effective and timely manner. The Government made an initial contribution of AUD 5 million into the Fund and will consider future contributions in the future when necessary.

Tuvalu also has a well-established and endowed national trust fund known as the Tuvalu Trust Fund which was established in 1987. The Trust Fund was established to supplement the national budget, underpin economic development and help the nation achieve greater financial autonomy. Since 1990 the Tuvalu Trust Fund has contributed an estimated 15% of the annual government budget each year (~AUD 79 million).

In 1999, Tuvalu also established the Falekaupule Trust Fund (FTF), a development trust fund set up between the Government of Tuvalu and the Falekaupule or the island communities of Tuvalu. The FTF provided a new source of revenue for island development with a strong sense of ownership by communities themselves. Projects that are funded by the FTF are in three categories which are human capital development, physical capital development and maintenance of physical capital.

In 2019, the Adaptation Fund accredited the MoF as the National Implementing Entity (NIE) for Tuvalu under its streamlined accreditation process for a period of five years (expiring on 14 July 2024). The MoF is now entitled to submit project and program proposals to the Adaptation Fund for up to USD 2 million. Being accredited to the AF will allow the MoF to use the fast-track pathway towards obtaining GCF direct access.

The MoF is the National Designated Authority (NDA) and also the Readiness Delivery Partner for the GCF. Tuvalu has so far secured two (2) projects with GCF co-financing worth USD 45.5 million. Additionally, the GCF has also approved three (3) readiness funding for Tuvalu worth USD 3.9 million. Refer to the below Table for existing GCF-funded projects.

**Table 63: Active GCF Projects in Tuvalu**

| #  | Name of Project                                                                                             | Funding Type | GCF Funding Secured | Accredited Entity | Project Scope (Regional/National) | Time Frame  | Status                         |
|----|-------------------------------------------------------------------------------------------------------------|--------------|---------------------|-------------------|-----------------------------------|-------------|--------------------------------|
| 1. | National Adaptation Project                                                                                 | Readiness    | USD 3 Million       | SPREP             | National                          | 2022 - 2025 | Active                         |
| 2. | NDA Strengthening and Country Programming Support for Tuvalu                                                | Readiness    | USD 0.62 Million    | MoF               | National                          | 2020-2022   | Active                         |
| 3. | Climate Recovery and Resilient Project                                                                      | Readiness    | USD 0.3 Million     | MoF               | National                          | 2020-2023   | Active                         |
| 4. | Tuvalu Coastal Adaptation Project (TCAP)                                                                    | Project      | USD 36 Million      | UNDP              | National                          | 2018-2024   | Active                         |
| 5. | Enhancing Climate Information Knowledge Services for Resilient Islands in 5 Island Countries in the Pacific | Project      | USD 47.4 Million    | UNEP              | Regional                          | 2022-2027   | Active                         |
| 6. | Adapting Tuna-dependent Pacific Island Communities and Economies to Climate Change                          | Project      | USD 70.2 Million    | IUCN              | Regional                          | 2023-2029   | Concept Note Approved          |
| 7. | Locale Project                                                                                              | Project      | TBC                 | SPC               | Regional                          | 2023-TBC    | Concept Note Under development |

Tuvalu has also accessed climate finance from other sources including the GEF and other development partners.

**Table 64: Accessed climate finance from other sources in addition to GCF-funded projects**

| Project                                                                      | Implementing Entity                  | Value in USD (Secured) | Time Fram   |
|------------------------------------------------------------------------------|--------------------------------------|------------------------|-------------|
| Tuvalu Coastal Adaptation Project                                            | Asian Development Bank               | 36,010,000             | 2018-2024   |
| NDA strengthening and country programming support for Tuvalu through the MoF | Ministry of Finance                  | 618,534                | 2019        |
| Increasing Access to Renewable Energy in Tuvalu                              | Asian Development Bank               | 2,752,294              | -           |
| Development of Minamata Initial Assessment in Tuvalu                         | United Nations Environment Programme | 125,000                | 2020 - 2024 |



|                                                                                                                                                                          |                                      |           |                        |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------|-----------|------------------------|
| Integrated Agro-ecosystem Approach for Enhancing Livelihoods and Climate Resilience in Tuvalu                                                                            | Food and Agriculture Organization    | 2,365,753 | 2022 – 2026            |
| Climate Resilience in the Outer Islands of Tuvalu                                                                                                                        | Asian Development Bank               | 500,000   | 2016 - 2023            |
| Facilitation of the Achievement of Sustainable National Energy Targets of Tuvalu (FASNETT)                                                                               | United Nations Development Programme | 2,639,725 | 2017 - 2021            |
| R2R Implementing a Ridge-to-Reef Approach to Protect Biodiversity and Ecosystem Functions                                                                                | United Nations Development Programme | 3,762,844 | 2015 - 2021            |
| Support to Tuvalu for the Revision of the NBSAPs and Development of Fifth National Report to the Convention on Biological Diversity (CBD)                                | United Nations Environment Programme | 220,000   | 2014 - 2021            |
| Effective and Responsive Island-level Governance to Secure and Diversify Climate Resilient Marine-based Coastal Livelihoods and Enhance Climate Hazard Response Capacity | United Nations Development Programme | 4,200,000 | 2013 - 2021            |
| Increasing Resilience of Coastal Areas and Community Settlements to Climate Change                                                                                       | United Nations Development Programme | 3,300,000 | NAPA project profile 1 |
| National Biodiversity Strategy Action Plan, First and Third National Reports to the COP and CHM                                                                          | United Nations Development Programme | 232,000   | 2012-2016              |
| Enabling Activity for the Stockholm Convention on Persistent Organic Pollutants (POPs): National Implementation Plan for Tuvalu                                          | United Nations Environment Programme | 220,700   | 2005 - 2018            |
| National Adaptation Programme of Action (NAPA)                                                                                                                           | United Nations Development Programme | 200,000   | 2007                   |

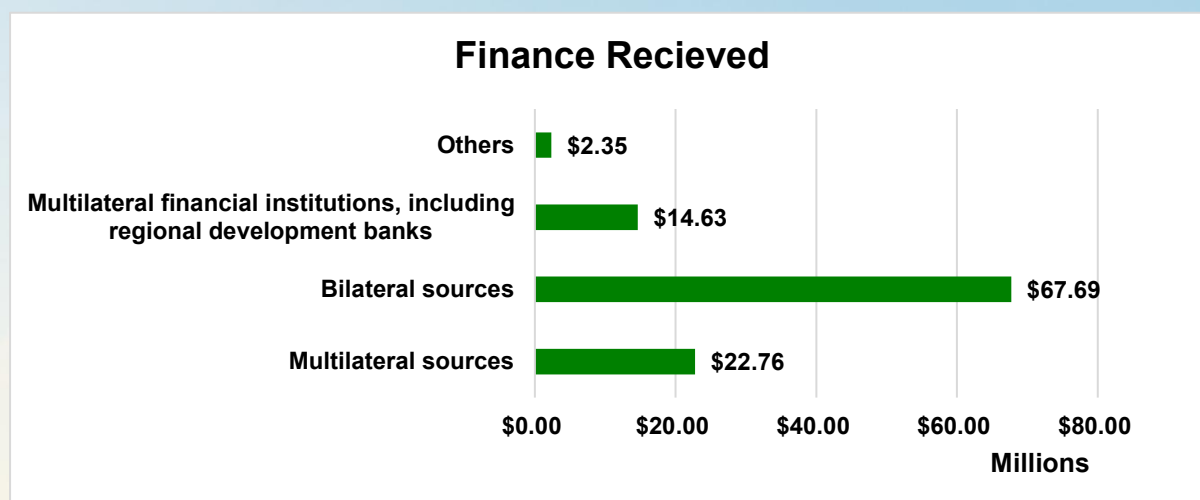
**Source:** Tuvalu Green Climate Fund Country Programme 2022-2026

Tuvalu requires substantial financial resources to implement both its mitigation and adaptation strategies. The below section covers the current status, need, constraints, and opportunities for Mitigation and Adaptation activities.

Other than GCF, GEF, and Annex II parties, bilateral and multilateral institutions have also financially supported climate change activities in Tuvalu. Tuvalu has received funding from a wide variety of international sources, including multilateral sources like GEF, GCF, UNDP, UNEP, LDCF, etc. Bilateral sources like the United States Agency for International Development (USAID), European Union (EU), Australia's Department of Foreign Affairs and Trade (DFAT), New Zealand Ministry of Foreign Affairs and Trade (MFAT), Government of the Republic of Korea, Japan, Finland, Italy, Germany Republic of China, etc. Tuvalu has also received funding from various multilateral financial institutions, including regional development banks and other regional organizations like the World Bank, Asian Development Bank (ADB), German Development Bank, SPREP, and SPC.

During 2014-2022, Tuvalu received approximately USD 107.4 million, of which approx. 21% was from multilateral sources, 63% from bilateral sources, 14% from Multilateral financial institutions, including regional development banks and the remaining 2% from other regional organizations.

**Figure 42: Finance received during 2014-2022**



*Source: Tuvalu's TNC*

This indicates that (at least in recent years) significant resources have been made available from international sources to support climate change efforts in Tuvalu.

A scarcity of technical skills and limited resources constrains Tuvalu's capacity to implement infrastructure projects. This shortage, encompassing areas like mechanics and electrical work, is particularly acute in the outer islands and likely rooted in the nation's small population, which inherently restricts the pool of skilled professionals. Compounding this issue are socio-economic factors and limited mobility, both within Tuvalu and internationally, which further hinder the development and availability of specialized expertise. Therefore, given these limitations, it is prudent that proper coordination for all stages of project implementation is meticulously planned and executed at the local level.

Accessing adequate and predictable climate finance is a major challenge for Tuvalu. Challenges that Pacific Island Countries (PICs) face when it comes to accessing climate finance are also experienced by Tuvalu. These challenges include:

- **Complex, messy, and fluid nature of the global climate finance architecture:** the complex nature of global climate finance architecture means that countries will require specialized technical capacity and resources to effectively engage. Small countries such as Tuvalu lack such capacity, and tend to miss out on funding opportunities;
- **Donor fragmentation:** such fragmentation is quite high in the Pacific region and can present significant challenges for Pacific SIDS to effectively plan, and implement their national priorities, systems, and capacities. Navigating also the demands of many different donors engaged in the region is complicated and requires significant dedicated human and institutional capacity.
- **Weak enabling environment- policy and institutions:** While many Pacific SIDS have committed to effectively mainstream climate change into their national plans and budget, for many this has been proven to be considerably complex in practice and requires ongoing national political support.
- **Limited private sector engagement:** Many PICs including Tuvalu have underdeveloped private sector due to their very small economic sizes.
- **Severe capacity constraints:** Capacity issues facing Pacific SIDS include internal capacity constraints, capacity constraints of the many bilateral donors and regional organizations engaged in the region as well as in the global funding architecture to accommodate better support for SIDS. Building and sustaining capacity can only be done with predictable resources and a good idea of the work that needs to be addressed. This requires a combination of predictable long-term and



flexible resources as well as clear understanding of the challenges ahead. These resources should also be responsive to Pacific SIDS' capacity constraints be they institutional, individual or systemic.

- **Maximizing mitigation and adaptation effort:** Mitigation efforts and resources offer clear co-benefits in key development areas such as reduced fossil fuel dependency. Capturing the co-benefits from climate change mitigation and adaptation for existing ODA, national, and community programs can present a low cost bonus. These can only be captured when a good knowledge of climate change is institutionalised across all the relevant sectors of government- something that is lacking in most PICs.

Figure below depicts the landscape of climate finance flows relevant to Tuvalu, illustrating potential funding sources for the nation's climate-related initiatives. Currently, Official Development Assistance (ODA) and bilateral funding constitute the primary financial support mechanisms for Tuvalu's adaptation and mitigation efforts. While the figure showcases a range of international climate finance mechanisms, accessing new avenues like the Green Climate Fund (GCF) and attracting private investment remains challenging due to Tuvalu's inherent vulnerabilities, limited institutional capacity, and perceived investment risks associated with small island developing states. This underscores the critical need for Tuvalu to strategically diversify its funding portfolio, strengthening its capacity to effectively navigate the complexities of international climate finance and secure the necessary resources to address its urgent climate change adaptation priorities.

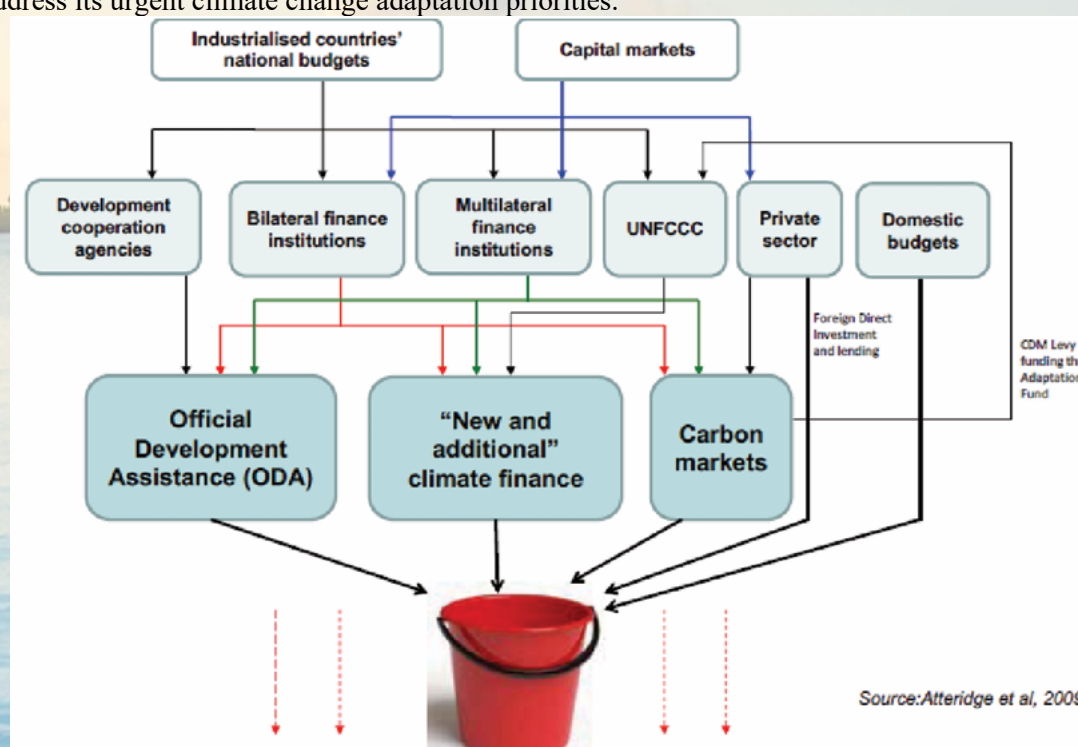


**Figure 43: Tuvalu's Climate Finance Landscape**

#### 5.2.1.2 Mitigation – Financial Support Received:

Financial resources and sound investments are needed to address climate change mitigation activities in Tuvalu. As discussed in the previous section and also presented in the table below, for realizing the NDC targets the mitigation measures identified will need funding of about US\$ 40.841 million.

Annexure 3 to the report presents the list of projects that received climate finance support from 2014-2021. In a nutshell, Tuvalu has received approximately USD 27 million<sup>20</sup> from both Bilateral (USD 11 million) and Multilateral financial institutions, including regional development banks (USD 16 million).

<sup>20</sup> Some of the funding secured are not in USD. Hence, they have been converted to USD equivalent using following conversion factors: 1 AUD= 0.68 USD, 1 NZD= 0.62 USD, 1 EUR= 1.06 USD

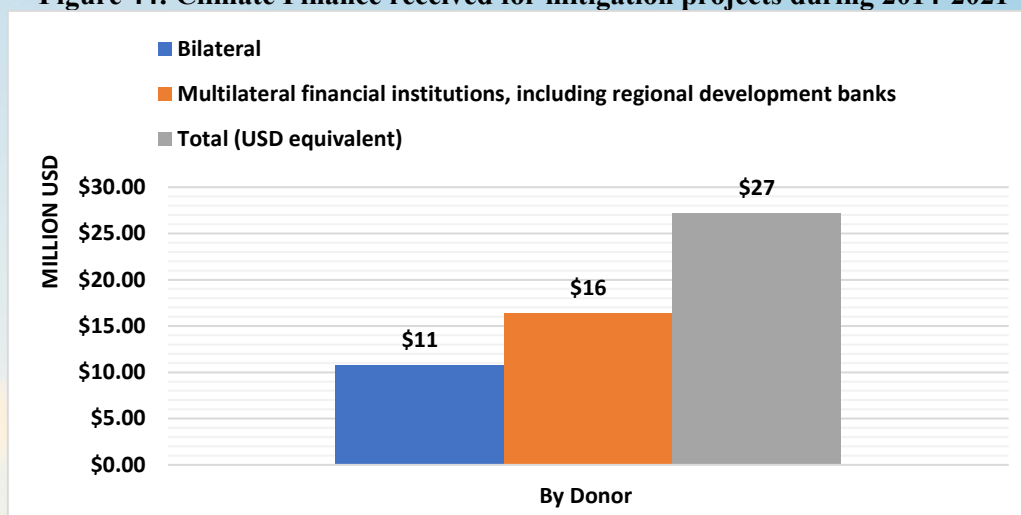
Bilateral funding sources include New- Zealand, the EU, UAE, Finland, and Italy. Whereas, Tuvalu has received funding from multilateral financial institutions like ADB, World Bank, regional organizations, and other sources like SIDS Dock and India UN Partnership Fund.

**Table 65: Climate Finance support received to Tuvalu for mitigation projects during 2014-2021**

| <b>By Donor</b>                                                                  |                          |                   |
|----------------------------------------------------------------------------------|--------------------------|-------------------|
| <b>Bilateral</b>                                                                 | <b>Amount</b>            | <b>Currency</b>   |
| New Zealand                                                                      | 6,533,000                | NZD               |
| EU                                                                               | 1,857,000                | EUR               |
| UAE                                                                              | 4,000,000                | USD               |
| Finland                                                                          | 18,000                   | USD               |
| Italy                                                                            | 727,000                  | USD               |
| <b><i>Sub-total (USD equivalent)</i></b>                                         | <b><i>10,763,880</i></b> | <b><i>USD</i></b> |
| <b>Multilateral financial institutions, including regional development banks</b> |                          |                   |
| World Bank                                                                       | 10,085,000               | USD               |
| ADB                                                                              | 6,000,000                | USD               |
| <b>Regional Organisation and Others</b>                                          |                          |                   |
| SIDS Dock                                                                        | 100,000                  | AUD               |
| India UN Partnership Fund                                                        | 213,151                  | USD               |
| <b><i>Sub-total (USD equivalent)</i></b>                                         | <b><i>16,366,151</i></b> | <b><i>USD</i></b> |
| <b>Total (USD equivalent)</b>                                                    | <b>27,130,031</b>        | <b>USD</b>        |



**Figure 44: Climate Finance received for mitigation projects during 2014-2021**



### 5.2.1.3 Adaptation – Financial Support Received:

During the 2000-2020 period, there have been over 76 nationally implemented projects in Tuvalu that focus on reducing climate change vulnerability and enhancing the adaptive capacity and resilience of communities and natural ecosystems. A vast majority of these projects are externally funded through bilateral and multilateral financing, the latter including the Global Environment Facility's (GEF) Least Developed Countries Fund (LDCF) and the GCF. The main adaptation initiatives to date in terms of scale and funding include:

- The NAPA-I: Increasing resilience of Coastal Areas and Community Settlements to Climate Change in Tuvalu (March 2010 – June 2016);
- The NAPA-I+: Follow-up full size project (July 2011 - December 2013);
- The NAPA-II: Effective and Responsive Island-level Governance to Secure and Diversify Climate Resilient Marine-based Coastal Livelihoods and Enhance Climate Hazard Response Capacity (August 2013 – June 2019);
- The Ridge to Reef (R2R) Project: Implementing a “Ridge to Reef” approach to protect biodiversity and ecosystem functions in Tuvalu (August 2015 – December 2020); and
- The Tuvalu Coastal Adaptation Project (TCAP) (August 2017 – September 2023).

The NAPA-I project was the very first project being funded and delivered in response to Tuvalu's submission of its NAPA to the UNFCCC Secretariat in 2007. NAPA-I+ was implemented to scale up adaptation initiatives piloted under NAPA-I in the areas of agriculture, water and coastal protection. NAPA II builds on the outcomes of NAPA-I and focuses on fisheries (adaptation and conservation) and disaster preparedness and response. The previous NAPA projects focused on six out of the seven short-term adaptation priorities identified in Tuvalu's NAPA. The last priority on climate change and health is addressed through a regional proposal to the GEF LDCF “Building Resilience of Health Systems in Pacific Island LDCs to Climate Change”, which will be implemented by the United Nations Development Programme (UNDP) and executed by the World Health Organization (WHO) in partnership with respective national health ministries. The GEF LDCF has approved the full- size project for US\$17m, of which US\$1.4m is allocated for activities in Tuvalu. The project is yet to commence.

In 2016, Tuvalu was one of the first nations in the Pacific to secure funding from the GCF for the implementation of TCAP. The coastal protection component of TCAP focuses on three islands (Funafuti, Nanumea and Nanumaga). The Government of Tuvalu has expressed its intention to

apply for subsequent funding from the GCF in the future to expand coastal protection measures to other outer islands. The table below provides a summary of the above adaptation initiatives.

**Table 66: Summary of adaptation initiatives to date: NAPA and TCAP**

| Project | Financing                         | Project Duration                   | Implementing Arrangements                                                           | Key Adaptation Priority Areas (PA) Addressed                                                                                                                                                                                                                                                                                | Project Location                                                                                                                                |
|---------|-----------------------------------|------------------------------------|-------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------|
| NAPA-I  | GEF LDCF<br>USD 3.3m              | Mar 2010 – Jun 2016<br>(Completed) | Implementing agency: UNDP<br>Implementing partner: GoT<br>Department of Environment | 1. Agriculture – pulaka pits and nurseries established<br>2. Water management – provision, repair and installation of water tanks and cisterns<br>3. Coastal protection – pilot of ecosystems-based coastal protection measures                                                                                             | Nanumaga (PA1&2), Niutao (PA1), Niulakita (PA1), Nanumea (PA2&3), Vaitupu (PA2), Nui (PA2), Nukulaelae (PA2), Nukufetau (PA1), Funafuti (PA1&3) |
| NAPA-I+ | Australian Government<br>AUD 1.1m | Jul 2011 - Dec 2013<br>(Completed) | Implementing agency: UNDP<br>Implementing partner: GoT<br>Department of Environment | 1. Agriculture – additional 12 pulaka, breadfruit and banana plantations in the outer islands<br>2. Water management – additional 400m <sup>3</sup> of fresh water supply in the outer islands<br>3. Coastal protection - expanded area of model demonstration projects on coastal protection measures in the outer islands | Nanumaga (PA1), Nanumea (PA1), Nui (PA1)                                                                                                        |



|                                                      |                                                           |                                             |                                                                                                             |                                                                                                                                                                                                                                                                                                         |                                                                                      |
|------------------------------------------------------|-----------------------------------------------------------|---------------------------------------------|-------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|
| NAPA-II                                              | GEF LDCF<br>USD 4.2m<br><br>GoT co-financing<br>USD 14.3m | Aug 2013 –<br>Jun 2019<br>(Completed)       | Implementing<br>partner: GoT<br>Department of<br>Environment                                                | 1. Fisheries –<br>community-based<br>conservation of<br>highly vulnerable<br>near-shore marine<br>ecosystems<br>2. Fisheries –<br>adaptation to<br>near-shore coastal<br>shellfish fisheries<br>resources and<br>coral reef<br>ecosystem<br>productivity<br>3. Disaster<br>preparedness and<br>response | All islands (PA1, 2<br>& 3)                                                          |
| Ridge to<br>Reef (R2R)                               | GEF USD<br>3.7m<br><br>GoT co-financing<br>USD 15.6m      | Aug 2015 –<br>December<br>2020<br>(Current) | Implementing<br>partner: Ministry<br>of Foreign<br>Affairs, Trade,<br>Tourism,<br>Environment and<br>Labour | 1. Conservation of<br>islands and<br>marine<br>biodiversity<br>2. Integrated<br>water resource<br>management<br>3. Governance<br>and institutional<br>capacity<br>4. Data and<br>information<br>management<br>systems for<br>natural resource<br>management                                             | All islands (PA1, 3<br>and 4) Funafuti,<br>Nanumea and<br>Nukufetau (PA2)            |
| Tuvalu<br>Coastal<br>Adaptation<br>Project<br>(TCAP) | GCF USD<br>36m<br>GoT co-financing<br>USD 2.9m            | Aug 2017 –<br>Sep 2023<br>(Current)         | Implementing<br>agency: UNDP<br>Implementing<br>partner: GoT<br>Climate Change<br>Department                | 1. Institutional<br>capacity, human<br>resources,<br>awareness and<br>knowledge<br>2. Coastal<br>protection to<br>protect critical<br>infrastructure<br>3. Financing<br>mechanism for<br>adaptation                                                                                                     | All islands (PA1 &<br>3) Funafuti<br>(reclamation),<br>Nanumea and<br>Nanumaga (PA2) |

In addition to the 76 projects enumerated for the 2000-2020 period, there are many other smaller-scale projects implemented outside of national government or public enterprise structures.

The Annexure 4 to the report presents the list of projects that received climate finance support from

2019-2024.

These include projects of varying purpose, size, budget, and duration, managed and implemented by the Island Kaupule, the University of the South Pacific (Funafuti campus), international non-governmental and philanthropic organisations, and civil society (i.e. Tuvalu Red Cross Society, Tuvalu Association of Non-Governmental Organisations, Ekalesia Kelisiano Tuvalu, Tuvalu Climate Action Network). Due to limitations associated with this desk review, it was not possible to compile an exhaustive list of adaptation initiatives undertaken at subnational levels. For the NAP process, it is important to consider local knowledge on past and current adaptation-related activities, and their lessons learned to identify and assess suitable adaptation strategies at the subnational scale.

#### 5.2.1.4 Mitigation – Financial Support Needed:

Financial resources and sound investments are needed to address climate change mitigation activities in Tuvalu. As discussed in the previous section and also presented in the table below, for the realization of the NDC targets the mitigation measures identified will need a funding of about US\$ 40.841 million.

**Table 67: Indicative investment need for climate change mitigation by 2030**

| Sector             | Indicative investment needs to 2030 (USD) |
|--------------------|-------------------------------------------|
| Renewable Energy   | 21,000,000                                |
| Land transport     | 16,914,000                                |
| Maritime transport | 2,671,000                                 |
| Energy efficiency  | 256,000                                   |
| <b>Total (USD)</b> | <b>40,841,000</b>                         |

GHG emissions will be further reduced from the other key sectors, agriculture, and waste, conditional upon necessary technology and finance.

There are three possible sources of funding for mitigation in Tuvalu. The costs of GHG mitigation projects need to be met in full of money from one or a combination of the following three possible sources:

- Grants from international donors
- Government funding (from the government's budgets—paid for by taxes or other government revenue sources)
- User fees from those who benefit from the projects.

In practice, many mitigation projects in Tuvalu will need to be funded using international grant funding. For NDC projects, finance is likely to come in one of two forms:

- Commercial finance from private lenders (this can sometimes be coupled with credit enhancements such as credit guarantees or risk-sharing facilities)
- Concessional finance from international donors (these would be in the form of sovereign lending).

Concessional finance includes blended finance. Public and private financial institutions are increasingly opting to blend investments they make on commercial terms with various types of concessional support. Concessional support includes advice, funding, or non-grant instruments such as debt financing, risk mitigation products, or equity investments with expectations of below-market returns. A potential challenge of financing NDC projects is that some may be too small to warrant engagement in the



complex procurement and approval systems that international financing institutions and concessional financing institutions have. Tuvalu should think about how individual projects could be aggregated with other projects across sectors. This will allow organizations to support a single, coherent program in Tuvalu or the Pacific more broadly. It will be easier for Tuvalu to get financing and concessional support for larger programs of activities covering multiple NDC projects.

The table in Annexure 1 identifies the likely funding sources for meeting the costs of each of the pipeline projects, states whether finance will be required and identifies the most appropriate type of finance. It also indicates the likelihood each project will attract private or donor funding and the capacity that would be required to implement each project.

#### **Identified mitigation actions with their financial needs:**

- **Renewable Energy Development:**
  - The country has set an ambitious target to transition to 100% renewable energy by 2030. Financial support is needed to deploy solar energy systems, wind turbines, and energy storage technologies.
  - **Estimated Financial Need:** USD 21.1 million to implement large-scale renewable energy projects.
- **Transportation- Road transport and Maritime transport:**
  - The Transport sector is identified as one of the key strategic areas for energy security, Electric Vehicle is the target technology identified for phasing out fossil fuel and minimizing emissions in the sector. Tuvalu's NDC Implementation Roadmap and Plan has identified two mitigation opportunities each in the land transport sector and maritime transport.
  - **Estimated Financial Need:** USD 19.6 million to implement these Land and Maritime transportation electrification initiatives.
- **Energy Efficiency:**
  - The Government of Tuvalu introduced the Energy Efficiency Act in 2016. The Act promotes energy efficiency and legislates control of the import, use, and sale of inefficient electrical appliances. As discussed earlier, the Government of Tuvalu (GoT) in its updated NDC has set a target to increase energy efficiency by 30% in Funafuti and later in the Outer Islands. Tuvalu's NDC Implementation Roadmap and Plan has identified two mitigation opportunities that focus on energy efficiency.
  - **Estimated Financial Need:** USD 265,000 to implement these two NDC's identified energy efficiency opportunities.
- **AFOLU:**
  - Tuvalu's mitigation efforts are primarily focused on the energy sector. The country has set ambitious targets for renewable energy adoption and has implemented initiatives like the installation of biogas digesters. However, there is significant potential for reducing greenhouse gas emissions in the agriculture, forestry, and land use (AFOLU) sector through practices like improved livestock management, sustainable agriculture, and afforestation. While these AFOLU initiatives are promising to reduce GHG emissions, their implementation depends on the availability of necessary technology and financial support.
  - **Estimated Financial Need:** To be assessed.
- **Waste:**
  - Tuvalu is implementing a comprehensive waste management strategy to reduce greenhouse gas emissions. This includes banning single-use plastics, improving waste collection, and promoting recycling. Additionally, the country is developing a robust waste management policy and action plan to further reduce waste generation and improve waste disposal practices. The successful implementation of these initiatives to reduce GHG emissions is



contingent upon receiving necessary technological and financial support from international partners.

- **Estimated Financial Need:** To be assessed.

### **Mitigation - constraints, gaps and needs:**

With the NDC in place, the NDC Implementation Roadmap and NDC Investment Plan (NDC Roadmap and Plan) provide guidelines for its implementation and achieve the target set out to meet the country's commitment for the land transport, maritime transport, and energy efficiency sectors. However, some constraints, gaps, and needs exist to implement GHG mitigation projects in Tuvalu and are highlighted hereunder.

- **Budget:** Institutions involved in NDC implementation do not have sufficient budgets to implement and manage new projects. It is estimated that a budget of USD 19.85 million is required for the implementation of the mitigation measures identified in the NDC Investment Roadmap and Implementation plan. Further, decarbonization of electricity generation and achieving 100% RE requires an additional budget of USD 21 million. Without having access to these funding requirements, it will not be possible to achieve the envisaged NDC target.
- **Private sector Involvement:** Negligible private sector involvement in mitigation projects. Private sector involvement in implementing GHG mitigation opportunities could help with budget constraints.
- **Institutional Capacity:** Institutions involved in NDC implementation do not have sufficient capacity (including personnel and staff time) to implement projects. Training is the key to this barrier. Training is also required in preparing tenders and securing suppliers and contractors to implement the projects.
- **Experience:** The staff members of institutions involved in the mitigation sectors lack the experience and technical skills required to implement, manage, and monitor NDC projects due to new technologies and regulatory and legislative changes that may need to be introduced. This hampers the smooth and timely execution of projects. However, the projects included in the pipeline have been designed to incorporate capacity-building programs and technical assistance activities when needed.
- **Technical expertise:** A training and capacity building program is required to assist with the development of the required physical maintenance, safety, and management to maintain the transformed power system including monitoring and physical testing of solar PV equipment, inverter testing and replacement, and battery system maintenance.
- **Lack of data:** Limited data is available on end usage of fuel, number of vehicles, number of vessels, their technology, and vintage. Without accurate data on demand and current usage, it is challenging to understand the impacts that infrastructure changes (such as improvements to the road network) or new vehicle options (such as EVs) would have on the GHG emissions in Tuvalu's land and maritime transport sector. There is very low capacity for tracking mitigation actions in the country which hinders the implementation of projects in various aspects. To this end there is a need for developing Database management system and Capacity building for CCD and relevant data providers (including private sectors) to collect and provide data related to project progress and implementation.
- **Data analysis:** There is a need of latest/advance data analysis tools and training to analyse data collected and carry out mitigation projections. This also includes training on types of data, sources of data, questionnaire design, research skills, data analysis, data entry, and basic statistics.
- **Coordination:** Activities in the sector are not well coordinated between ministries, agencies, development partners, financial entities, private businesses, and individuals. Having an overarching regulation, policy, or strategy that guides the land transport and maritime sector will help to overcome this barrier.



- **Public awareness:** Low awareness among Government ministries and the general population of the environmental benefits and co-benefits of transitioning to low-emissions technologies. Where relevant, awareness-raising programs have been included as a part of the design of the GHG mitigation project to demonstrate the capabilities of new technologies and encourage their uptake. Awareness-raising programs will be important to encourage behavioral changes.
- **Market structure:** Market structure constraints can limit the transition to low-emissions and EE technologies. There are also no incentives in the market, such as tax deductions and low-interest loans for low-emissions technologies. Although financial incentives have been introduced into the market to encourage the uptake of energy-efficient appliances and other energy-efficient projects, Tuvalu has experienced limited momentum.
- **Landscape and land acquisition:** Land space is limited and improving existing roads will be challenging. This constraint is particularly important for NDC projects in the land transport sector, which require Tuvalu's roads to be in good condition. Further, delays in the process of land acquisition affect the project timeline of various projects.
- **Review and revision of policy and plans related to mitigation:** National energy policy and RE master plan need to be reviewed and revised.
- Tuvalu could also leverage on following opportunities to overcome some of the constraints, gaps, and needs.

#### Opportunities:

- **International Carbon Markets:** Tuvalu could finance GHG emissions reduction projects by taking part in international carbon markets. Given the early stages of Article 6 negotiations, possible financing arrangements under Article 6 have not been included in the NDC Roadmap and Plan. However, this could be considered as a possible financing solution for Tuvalu in the future.
- **Access to multilateral funding:** Accessing climate finance under various multilateral funding mechanisms is a challenge, and frequently beyond the scope of Tuvalu's limited administrative resources and expertise. Multilateral funds for climate change investments and environmental protection are available under the Green Climate Fund (GCF), the Least Developed Country Fund (LDCF), the Special Climate Change Fund (SCCF), and the Global Environment Facility (GEF). Accreditation to these funds is critical to secure direct access. Established institutional arrangements under the Office of the Prime Minister (OPM), the Ministry of Foreign Affairs, Labour and Trade (MFALT) and Ministry of Home Affairs, Climate Change and Environment (MHACCE) can facilitate accessibility to these funds.
- **Blue carbon:** Tuvalu could initiate ocean-based carbon sequestration activities, especially for nearshore ecosystems such as blue carbon.
- **Energy Efficiency Strategy & Action Plan:** According to the United for Efficiency (U4E) Country Savings Assessment report, Tuvalu has the potential to reduce electricity use by over 1.1 GWh and reduce emissions by over 710 tCO<sub>2</sub>e by 2040. For the realization of this energy and GHG reduction potential, Tuvalu must explore options like revision of the Minimum Energy Performance Standards and its scope to improve product efficiency in a market, introducing the concept of energy conservation building codes (ECBC), and green building, Extended Producer Responsibility (EPR) as other important steps to reduce electricity consumption further. Developing a comprehensive Energy Efficiency Strategy & Action Plan is recommended.

#### 5.2.1.5 Adaptation – Financial Support Needed:

The next decade from 2020 to 2030 is a critical period for Tuvalu to plan for and implement adaptation strategies to increase its long-term resilience to the impacts of climate change. Adaptation planning is a matter of priority for the Government of Tuvalu, as articulated in its National Strategy for Sustainable Development, the Tuvalu Climate Change Resilience Act and key national policies.



## Identified Adaptation Actions with their financial needs:

- **Climate Proof Housing Project**
  - This project aims to construct climate-resilient housing infrastructure to protect vulnerable communities from the impacts of climate change, such as sea-level rise, storm surges, and extreme weather events. It will involve the design and construction of new housing units, retrofitting existing homes, and developing building codes and standards for future construction.
  - **Estimated Financial Need:** USD 50 million will be needed for this project involving constructing climate-resilient housing units, retrofitting existing homes, and developing building codes and standards. It will also include capacity building for local communities on climate-resilient housing practices.
- **Tuvalu Coastal Adaptation Project Phase II**
  - Phase II of this project will focus on implementing coastal protection measures to safeguard coastal communities and infrastructure. Key activities include the construction of seawalls, breakwaters, and beach nourishment, as well as ecosystem-based adaptation measures like mangrove restoration.
  - **Estimated Financial Need:** USD 70 million will be needed for this project will focus on implementing coastal protection measures, such as seawalls, breakwaters, and beach nourishment, as well as ecosystem-based adaptation measures like mangrove restoration.
- **Tuvalu Long-Term Adaptation Project - Business Plan**
  - This project aims to develop a comprehensive long-term adaptation strategy for Tuvalu, outlining strategies and investments needed to build resilience to climate change impacts. It will involve conducting vulnerability assessments, identifying adaptation options, and developing a detailed implementation plan.
  - **Estimated Financial Need:** USD 3 billion will be needed for this project will develop a comprehensive long-term adaptation strategy, including vulnerability assessments, identification of priority adaptation actions, and financial planning.
- **Adapting tuna-dependent PI communities and economies to climate change (Regional)**
  - This regional project aims to support Pacific Island countries dependent on tuna fisheries to adapt to climate change impacts on marine ecosystems and fisheries. Key activities include climate change impact assessments, development of adaptation strategies, capacity building for fisheries communities, and diversification of livelihoods.
  - **Estimated Financial Need:** USD 211.4 million will be needed for this regional project will support Pacific Island countries dependent on tuna fisheries by conducting climate change impact assessments, developing adaptation strategies, building capacity for fisheries communities, and diversifying livelihoods.
- **Supporting Resilient Island Communities in the Pacific (LOCAL) project (Regional)**
  - This regional project aims to enhance the resilience of Pacific Island communities to climate change impacts. Key activities include infrastructure development (e.g., seawalls, roads, water supply systems), community-based adaptation planning, disaster risk reduction, and early warning systems.
  - **Estimated Financial Need:** USD 45.96 million will be needed for this regional project aims to enhance the resilience of Pacific Island communities through infrastructure development, community-based adaptation planning, disaster risk reduction, and early warning systems.



- **Climate Smart Agriculture project**

- This project aims to promote climate-resilient agricultural practices, such as water-efficient irrigation, sustainable land management, and climate-smart crop varieties. Key activities include training and capacity building for farmers, development of irrigation systems, and promotion of agroforestry.
- **Estimated Financial Need:** USD 10 million will be needed for this project will promote climate-resilient agricultural practices, such as water-efficient irrigation, sustainable land management, and climate-smart crop varieties.

**Adaptation - constraints, gaps, and needs:**

Tuvalu faces various gaps and barriers that hinder its efforts to enhance climate resilience. Addressing these gaps and barriers is crucial to effectively manage climate change risks and ensure the long-term sustainability and well-being of Tuvalu's population. Below are some of the constraints, gaps, and needs identified for the implementation of adaptation measures within the country that need to be addressed.

**Lack of interest of stakeholders:** One of the significant challenges in implementing adaptation measures in Tuvalu is the lack of interest among various stakeholders.

**Lack of finance:** Due to their limited financial resources and dependence on external aid, it can be challenging for Tuvalu to allocate sufficient funds to implement large-scale adaptation measures. Additionally, accessing international climate finance mechanisms may be complex and time-consuming, further hindering the implementation of adaptation projects.

**Private sector involvement:** Private sector involvement in climate change adaptation can be valuable for providing financial resources to support the implementation of adaptation projects. However, in the case of Tuvalu, where the economy is small and the private sector is limited in size, getting significant private-sector participation remains a challenge.

**Limited access to outer Islands:** The geographical dispersion of the outer islands poses a challenge in accessing and providing essential services, including adaptation measures. The limited transportation and communication infrastructure between the main atoll and outer islands impedes the distribution of resources and hinders coordinated adaptation efforts.

**Land ownership:** Land ownership and tenure systems can also present challenges for implementing adaptation measures in Tuvalu. Traditional land ownership and the intricate social structure pose a challenge to establish new infrastructure or relocate communities to safer areas in response to climate change impacts.

**Lack of human capacity and retention of human capacity:** The scarcity of human resources and multiple responsibilities of the stakeholders present challenges in the recruitment, retention, and capacity building of technical officers across various sectors. This situation significantly hampers the progress of numerous projects, leading to delays. Stakeholders emphasize prioritizing and focusing on one project at a time to ensure effective management and carrying out assessments. Further, many educated and skilled individuals seek better opportunities abroad, often in more developed countries. This exodus of talent can exacerbate the shortage of human capacity in critical sectors, leaving the nation with a reduced pool of expertise to address adaptation needs.

**Staff retention and shifting priorities of employees:** Staff retention and shifting priorities of employees pose significant challenges to climate change adaptation efforts. Tuvalu's small population inherently limits the pool of available human resources. Skilled professionals, particularly those specialized in climate change adaptation, can be scarce. When new opportunities arise, employees may choose to pursue these opportunities within the country or abroad, leading to the loss of experienced and trained individuals from specific departments or projects. Past major projects on adaptation experienced significant delays in implementation due to difficulties in recruiting and retaining project



staff. Consequently, retaining and effectively utilizing the existing workforce becomes crucial to ensure continuity and success in adaptation initiatives.

**Low technical capacity in conducting sector-specific climate change and disaster risk analyses:**

Technical support and access to tools are required to conduct analyses like risk and vulnerability assessments, feasibility studies, environmental and social impact assessments, cost-benefit analyses, gender analyses, etc.

**Limited capacity to appraise adaptation options:** Tuvalu faces a lack of capacity to appraise adaptation options, hindering its ability to develop adaptation concept notes and proposals.

**Utilization of funds:** The utilization of funds is of utmost importance due to the country's limited financial resources and vulnerability to climate change impacts. However, some of the projects face challenges related to inefficient utilization of funds. Proper capacity building and accounting and reporting mechanisms will help to strategically prioritize the funds to address the most pressing climate change risks and vulnerabilities and provide stakeholders with clear information about how resources are being managed.

**Insufficient Climate Data:** Meteorological stations that are established in selected sites generate climate/weather data quite well however there are gaps in area coverage and data quality. Local experts largely depend on downscaled climate projections and scenario analysis to undertake risk and vulnerability assessments to simulate effective climate adaptation activities. Further, there is also a need to upgrade the existing equipment's and infrastructure in weather monitoring stations.

**Low adoption of climate-smart agriculture practices:** There are need for the provision of introducing technologies on climate-smart Agriculture (access to modern farming equipment) and policy that focuses on the preservation of traditional farming practices. Further, training of farmers on scaling up climate-smart agriculture, home gardening, and vertical gardening is needed, as improving the knowledge in management/care of climate-resistant varieties/genotypes and agro-technologies (various fields of agriculture). For livestock, there is limited availability of veterinary facilities, labs, and clinics. In the status quo, only one veterinary clinic in the country exists and is located on the main island. This causes challenges for the people living in outer islands to access them. Also, there is a need to improve knowledge of the breeding of domestic animals.

**Poor water resources management:** There is a requirement for providing access to tank cleaning equipment and repairing and maintenance of tanks and gutters. The water tanks installed under various initiatives and projects lack accessibility for cleaning due to design limitations. Further, there is a requirement for setting up Water testing laboratories and water standards. Capacity building and training are required for institutions carrying out water resource assessments e.g., groundwater resources, water catchments rehabilitation as well as staff for water testing enforcement.

**Integration of climate change issues into health and tourism sector plans, policies, and strategies:**

Need for raising awareness amongst the local people and private sector about climate change's impact on health and tourism and increasing public involvement in decision-making. Facilitate the assessment of health aspects of climate change vulnerability, health impacts, and adaptation, including the assessment of current and expected risks of climate change impacts on the health of the population.

**Improvement in current Institutional arrangements to support the NAP process:** Establishing and strengthening the linkage between national and subnational planning and decision-making processes is required to achieve vertical integration of adaptation priorities and actions. Further, enhancing the link between formal government institutions (i.e., national government and Island Kaupule) and civil society and faith-based organizations is also paramount to achieve both horizontal and vertical integration as the small size and population of Tuvalu mean that many of the non-governmental organizations are working in multiple sectors that are sensitive to climate change impacts. There is also a need to increase



dialogue and engagement with the private sector, including micro-, small- and medium-sized businesses that operate in Funafuti and the outer islands.

**Lack of scientific research:** There is a lack of Tuvalu-specific scientific research to inform adaptation planning and decision-making. In most cases, research is conducted as part of a larger regional program or project, with limited budgets and resources allocated for Tuvalu. This presents some challenges for Tuvalu, including difficulties in accessing research data, as the ownership of the data may be retained by an external organization and there is limited potential for the research to be replicated (or sustained as a longitudinal study).

**Information sharing:** The culture of information sharing between and within government and non-governmental organizations is gradually improving. The exchange of information and knowledge occurs through personal relationships and social interactions.

**Capturing traditional and cultural knowledge:** There is a gap in systematically documenting and capturing traditional and local knowledge of changes in climate and coping strategies used to adapt to the impacts of climate change. Further, the knowledge possessed by the elder generation on traditional practices of farming needs to be documented and passed on to the younger generation.

### **Climate Change - finance needs and gaps:**

As identified, for the realization of the NDC targets the mitigation measures will need funding of about US\$ 40.85 million by 2030. Of this estimated budget, approximately US\$ 19.85 million is required for the implementation of the mitigation measures identified in the NDC Investment Roadmap and Implementation plan. Further, for decarbonization of electricity generation and achieving 100% RE requires an additional budget of US\$ 21 million.

Further, the Tuvalu Coastal Adaptation Project (TCAP) was developed in response to the urgent national priority of building coastal resilience. TCAP aims to provide robust coastal protection infrastructure to the high-value vulnerable coastlines of Nanumaga, Nanumea and Funafuti. It also complements several earlier initiatives designed to assist in reducing the coastal vulnerability of the country. The project is funded by the Green Climate Fund grant of USD 36 million and co-financed by the Government of Tuvalu (USD 2.9 million), with the total cost representing 63.8 percent of 2022 GDP. The project is being executed by the United Nations Development Program in close collaboration with the Government of Tuvalu. Currently it is expected to be finalized by 2024.

The Tuvalu government and UNDP are developing the 'Te Lafiga o Tuvalu' (Tuvalu's Refuge) a Long-Term Adaptation Plan (L-TAP), that presents a new approach to adaptation and is designed to provide comprehensive national solutions to sea level rise beyond 2100.

The Government of Tuvalu is continuously taking proactive steps and has been successful in raising funds from international development partners for projects aimed at climate change mitigation and adaptation. However, continued international support is crucial to enable Tuvalu to implement further actions outlined in its policies and plans, including at sector level. Increased international assistance both technical and financial are required to continue building the resilience and improve vulnerability of people of Tuvalu, social protection activities for all, and expand investment in climate resilient infrastructure. Further, the goal to pursue a zero-carbon development pathway by 2050 is dependent on availability of finance and technology. Moreover, given the size of Tuvalu's population and its capacity (and particularly its public sector) providing a greater scale of funding may not be effective if it is not accompanied by technical support and capacity building and may lead to dependency.

The list of some projects proposed for finance support is shown in table below.

**Table 68: List of projects proposed for financing**

| List of projects proposed for financing                                                                                                | Category      |
|----------------------------------------------------------------------------------------------------------------------------------------|---------------|
| Tuvalu Long Term Adaptation Plan (L-TAP)                                                                                               | Adaptation    |
| Maritime Technology Cooperation Centre in the Pacific (MTCC)                                                                           | Mitigation    |
| Review of Energy Policy                                                                                                                | Mitigation    |
| Health and Climate Change                                                                                                              | Cross-cutting |
| Climate Change & Migration                                                                                                             | Cross-cutting |
| GCF Readiness Program                                                                                                                  | Adaptation    |
| Window Tinting                                                                                                                         | Cross-cutting |
| Tuvalu Renewable Energy Project                                                                                                        | Mitigation    |
| Tuvalu Energy Sector Development Project 2015 -2018                                                                                    | Mitigation    |
| Prepayment Meters                                                                                                                      | Mitigation    |
| Strengthening adaptation against climate variability through increasing clean water supply and sanitation at Motufoua Secondary School | Adaptation    |
| Climate Resilient Housing Project                                                                                                      | Adaptation    |

## 5.2.2 Technology transfer support needed and received

### 5.2.2.1 Mitigation – technology support

Tuvalu started its TNA process in 2023 as part of the TNA IV project, at which point it has started deciding its priority sectors and technologies for both mitigation and adaptation.

The project will support Tuvalu's national priorities, including those identified in the National Adaptation Plan of Action and the country's commitment to the relevant global environmental conventions. The country's goal to pursue a zero-carbon development pathway by 2050 (as part of Tuvalu's Intended Nationally Determined Contribution) needs technological innovations and depends on the availability of finance and technologies. The TNA project allows Tuvalu to identify priority technologies as well as what is required to deploy them.

Estimated funding to be received from GEF for TNA project is approximately USD 295,650.

The Tuvalu Technology Needs Assessment (TNA) project is implemented through the Tuvalu Third National Communications (TNC) which is funded under the Global Environment Facility (GEF) through the United Nations Environment Programme (UNEP). The TNA processes in Tuvalu are based around three main areas. These are:

- a) To identify and prioritise mitigation and adaptation technologies for selected sectors;
- b) To identify, analyse and address barriers hindering the arrangement and dissemination of the prioritised technologies, including the enabling framework for technologies;
- c) To produce a Technology Action Plan, which can be a medium or long-term plan for the implementation of identified technologies.



Enhancing technology transfer for the mitigation of greenhouse gas emissions (GHG) and adaptation to climate change through the TNA project is fundamental for Tuvalu's reaction to climate change. The TNA Project is based at the Climate Change Department (CCD) under the Ministry of Home Affairs, Climate Change and Environment (MHACCE). The Tuvalu TNA Project consists of the Project Coordinator who is housed in the Climate Change Department along with the Finikaso Consultants Firm who are responsible for the overall implementation of the TNA Project. The TNA team is the steering committee which includes the Adaptation local expert and the Mitigation local expert. The team works with the Technical Working Group in the selected areas. The TNA team consulted with relevant in-country stakeholders in the whole process of the project.

Technology transfer is a critical component of Tuvalu's climate strategy. The country requires access to cutting-edge technologies that can help it mitigate and adapt to climate change. Key technology transfer needs include:

The TNA-Mitigation project has assessed and selected key technologies across the energy and transport sectors for implementation in Tuvalu. These technological projects require technology transfer and development support from international partners to achieve the Nationally Determined Contributions (NDC) and overall mitigation targets. The following are the selected technologies for the energy and transport sectors identified by the TNA-Mitigation project:

**Table 69: Technologies to compliment implementation of energy and transport technologies in mitigation for climate change: Feasibility to use in Tuvalu**

| Technology                                     | Basic description                                                                                                                                                                                                                                                                                                                                                                                                                         | Feasible (Yes/No) |
|------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|
| Piggery/ Biogas/ Sludge for organic fertiliser | <ul style="list-style-type: none"> <li>Individual house systems or community</li> <li>Single large systems that house a large number of household pigs from the waste, with other additions, are used to generate biogas, the sludge of which is used as organic fertiliser.</li> </ul>                                                                                                                                                   | Yes               |
| Human waste (solids & wastewater) treatment;   | <ul style="list-style-type: none"> <li>Human waste is treated for use as organic fertiliser; avoids leaching into ground and contaminating groundwater and leaching into the sea and contamination of seawater.</li> <li>Wastewater treated for re-use in gardening.</li> <li>Stormwater water treated for re-use.</li> <li>Increase in water security as droughts occurrence and intensity increase as part of climate change</li> </ul> | Yes               |

|                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |     |
|--------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|
| Integration gardening and green development to increase vegetation | <ul style="list-style-type: none"> <li>Increased household gardening leads to increased consumption of locally organically fertilised food.</li> <li>Increase in physical activity of the populace leads to decrease in non-communicable diseases (NCDs);</li> <li>Increase in food security.</li> <li>Increase in vegetation leads to more carbon sinks.</li> <li>Increase in vegetation leads to better</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Yes |
| Demand for social services (demand for well-being)                 | <ul style="list-style-type: none"> <li>Demand-side mitigation and new ways of providing services can help avoid, shift, and improve final service demand.</li> <li>Socio-cultural and lifestyle changes can accelerate climate change mitigation; identified actions that could change individual consumption, individual mobility choices have the largest potential to reduce carbon footprints. Prioritising car-free mobility by walking and cycling and adoption of electric mobility could save 2 tCO<sub>2</sub>eq cap<sup>-1</sup> yr<sup>-1</sup> (globally);</li> <li>Demand side mitigations are achieved through changing Socio-cultural factors, Infrastructure use and Technology adoption by various social actors in urban and other settlements, food choice and waste management.</li> <li>Avoid-Shift-Improve options (ASI) framework.</li> <li>Requires government policies for behavioural change; digitalization, the</li> </ul> | Yes |



|                                 |                                                                                                                                                                                                                                                                                         |     |
|---------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|
|                                 | sharing economy, and the circular economy                                                                                                                                                                                                                                               |     |
| Urban forms, physical geography | <ul style="list-style-type: none"> <li>• Modify existing physical transportation infrastructure (roads) to allow for ease and safe use by pedestrians, non-motorized bikes &amp; electrical bikes (e-bikes);</li> <li>• Allow for drainage of human waste.</li> <li>• Zoning</li> </ul> | Yes |

**Table 70: Technology Prioritisation for the Energy Sector**

| Priority Ranking | Technology                                             | Relevance/Importance for Mitigation                             | Barriers                                                                                   |
|------------------|--------------------------------------------------------|-----------------------------------------------------------------|--------------------------------------------------------------------------------------------|
| 1                | Solar Home System (Solar PV + BESS + Rooftop)          | Solar system is highly available and robust.                    | High cost of installation for households                                                   |
| 2                | Solar PV (National grid electricity generation) + BESS | Not available                                                   | Maintenance issues.<br>Cost issues.<br>Limited access to information about the technology. |
| 3                | Biofuel                                                | Technology is viable and makes use of green waste and pig waste | Not sustainable on a large scale                                                           |

**Table 71: Technology Prioritisation for the Transport Sector**

| Priority Ranking | Technology                                         | Relevance/Importance for Mitigation | Barriers                                                                                                                                                                        |
|------------------|----------------------------------------------------|-------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1                | Shift to bikes, e bikes, & non-motorized transport | Reduction in GHG emissions          | Limited driving range and suitability for rainy weather conditions<br>Social perceptions and stigma associated with biking, such as being seen poor, unprofessional, or unsafe. |

|   |                                                        |                                                 |                                                                                                                                                                                                                                                                |
|---|--------------------------------------------------------|-------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 2 | Hydrogen powered shipping vessel                       | Reduction in GHG emissions and marine pollution | <p>High cost and complexity of hydrogen production, storage, and distribution.</p> <p>Lack of safety standards and regulations for hydrogen operators.</p> <p>Technical challenges and uncertainties regarding hydrogen fuel cells, engines, and tanks</p>     |
| 3 | Electric light-duty vehicle                            | Reduction in GHG emissions                      | <p>High cost of purchasing and maintaining electric vehicles.</p> <p>Limited driving range and suitability for different terrains and weather conditions.</p> <p>Lack of adequate charging infrastructure and availability of EV parts and repair stations</p> |
| 4 | Fuel-efficient heavy-duty vehicle                      | Reduction in GHG emissions                      | High cost and complexity of diesel engines which are the dominant technology for heavy duty vehicles                                                                                                                                                           |
| 5 | Fuel shift (including electricity) heavy-duty vehicles | Reduction in GHG emissions                      | Lack of adequate infrastructure for refuelling especially for long-distance freight transport                                                                                                                                                                  |
| 6 | Shore-side electricity supply for at-berth vessels     | Reduction in GHG emissions                      | <p>High capital and operations costs.</p> <p>Lack of harmonised standards and regulations</p>                                                                                                                                                                  |
| 7 | Fuel-efficient light-duty vehicles                     | Reduction in GHG emissions                      | High costs for fuel efficient light-duty vehicles.                                                                                                                                                                                                             |

#### 5.2.2.2 Adaptation – technology support

The TNA project aims to support Tuvalu in developing and prioritizing technologies for adapting to climate change, in line with its commitments under the United Nations Framework Convention on Climate Change (UNFCCC). Through stakeholder consultations involving government ministries, departments, and non-governmental organizations, the project identified key sectors—Coastal, Water, and Agriculture—as priority areas for adaptation. The technologies selected for each sector were prioritized using the Multi-Criteria Analysis (MCA) tool, with input from the Adaptation Working



Group (AWG) and the Climate Change Department (CCD). The final list includes the top three technologies for each sector, reflecting the urgent need for action in addressing climate change impacts such as droughts, tropical cyclones, coastal erosion, and agricultural degradation in Tuvalu. Overall, the three sectors and their top three respective technologies being identified consist of:

1. Coastal Sector.
  - Computer Monitoring Model/Tool to monitor coastal erosion and current strengths.
  - Land reclamation – seawalls and sandbags.
  - Wave Breaker (lagoon and ocean sides).
2. Water Sector.
  - Solar Reverse Osmosis System (mobile).
  - Water reticulation system (gravity process).
  - Groundwater solar extraction.
3. Agriculture Sector.
  - Composting for tolerant varieties.
  - Horticultural technology through Beddings (concrete, wooden, etc).
  - Cultivator & Irrigation.

**Table 72: Summary of technologies for the coastal sector.**

| Priority Ranking                   | Technology                                                                             | Relevance/Importance for Adaptation                                                                                                                                                                                                                                                                                       | Barriers                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|------------------------------------|----------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Coastal Sector Technologies</b> |                                                                                        |                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| 1                                  | <b>Computer Monitoring Model/ Tool</b> to monitor coastal erosion and waves strengths. | <ul style="list-style-type: none"> <li>• Technical data records availability for decision making.</li> <li>• Essentially provides available data to facilitate coastal development or technology to be adopted.</li> <li>• Coastal erosion in Tuvalu is alarmingly increased and so require proper monitoring.</li> </ul> | <ul style="list-style-type: none"> <li>• Low technical capacity:               <ul style="list-style-type: none"> <li>○ Unskilled/untrained staff.</li> <li>○ High staff turnover.</li> <li>○ Limited training programmes.</li> </ul> </li> <li>• High capital cost:               <ul style="list-style-type: none"> <li>○ Low or few local suppliers.</li> <li>○ Limited availability of local experts to operate, maintain and service the Computer models/tools. Technology has high commercial requirement.</li> </ul> </li> <li>• Coordination limitation:               <ul style="list-style-type: none"> <li>○ No designated unit computer modelling exists in country.</li> </ul> </li> </ul> |

|   |                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|---|----------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|   |                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | <ul style="list-style-type: none"> <li>○ Limited human resources.</li> </ul> <p>No particular regulatory framework to govern coastal issues.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| 2 | <b>Land reclamation</b> - seawalls, sandbags | <ul style="list-style-type: none"> <li>• The current reclaim land - the QEII Park has set a supporting scenario as the best option for coastal protection in Tuvalu.</li> <li>• Again, the existing reclamation under the TCAP project also strengthen significantly the relevance and value of the technology.</li> <li>• Constant and intense coastal erosion are obviously alarming, so land reclamation is highly recommended as a robust protection measure.</li> </ul> | <ul style="list-style-type: none"> <li>• Financial issues: <ul style="list-style-type: none"> <li>○ High capital cost.</li> <li>○ Inadequate financial status of the government.</li> </ul> </li> <li>• Low technical capacity: <ul style="list-style-type: none"> <li>○ Unskilled/untrained staff.</li> <li>○ High staff turnover.</li> </ul> </li> <li>• Coordination limitation:</li> <li>• No designated unit for land reclamation.</li> </ul>                                                                                                                                                       |
| 3 | <b>Wave Breakers</b> (lagoon and ocean)      | <ul style="list-style-type: none"> <li>• Proved to be most relevant in other countries, so can be applied in Tuvalu.</li> <li>• The application of wave breakers at the Tuvalu Deep Sea Wharf was confirmed extremely relevant and robust.</li> </ul>                                                                                                                                                                                                                        | <ul style="list-style-type: none"> <li>• Financial issue: <ul style="list-style-type: none"> <li>○ High capital cost.</li> <li>○ Inadequate financial cost at the national level.</li> <li>○ Require donor support.</li> </ul> </li> <li>• Low technical capacity: <ul style="list-style-type: none"> <li>○ Unskilled staff.</li> <li>○ Designing capacity is poor at the local level.</li> </ul> </li> <li>• Coordination limitation: <ul style="list-style-type: none"> <li>○ No designated institution to oversee the technology.</li> </ul> </li> <li>• No regulatory framework in place.</li> </ul> |



|   |                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|---|----------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 4 | Beach Groin                                  | <ul style="list-style-type: none"> <li>• This can be trialled in a more robust technique.</li> <li>• Traditional methods using tree trunks like coconut been practiced years back.</li> <li>• Proved to be most relevant in other countries, so can be applied in Tuvalu.</li> </ul>                                                                                                                                                                                         | <ul style="list-style-type: none"> <li>• Financial issues: <ul style="list-style-type: none"> <li>○ High capital cost when implementing permanent structure.</li> <li>○ Inadequate financial cost at national level.</li> <li>○ No financial saving.</li> <li>○ Durable methods designing and logistics are costly.</li> </ul> </li> <li>• Donor supports to be sought.</li> <li>• Less durable as easily taken away during hurricanes or cyclones.</li> <li>• No coordination mechanism in place as which institution to oversee the approach.</li> </ul> |
| 2 | <b>Land reclamation</b> - seawalls, sandbags | <ul style="list-style-type: none"> <li>• The current reclaim land - the QEII Park has set a supporting scenario as the best option for coastal protection in Tuvalu.</li> <li>• Again, the existing reclamation under the TCAP project also strengthen significantly the relevance and value of the technology.</li> <li>• Constant and intense coastal erosion are obviously alarming, so land reclamation is highly recommended as a robust protection measure.</li> </ul> | <ul style="list-style-type: none"> <li>• Financial issues: <ul style="list-style-type: none"> <li>○ High capital cost.</li> <li>○ Inadequate financial status of the government.</li> </ul> </li> <li>• Low technical capacity: <ul style="list-style-type: none"> <li>○ Unskilled/untrained staff.</li> <li>○ High staff turnover.</li> </ul> </li> <li>• Coordination limitation:</li> <li>• No designated unit for land reclamation.</li> </ul>                                                                                                         |

**Table 73: Summary of technologies for the water sector.**

| Priori<br>ty<br>Ranki<br>ng      | Technology                                        | Relevance/Importance<br>for Adaptation                                                                                                                                                                                                                                                                                                              | Barriers                                                                                                                                                                                                                 |
|----------------------------------|---------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Water Sector Technologies</b> |                                                   |                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                          |
| 1                                | Solar Reverse Osmosis System (Desalination Plant) | <ul style="list-style-type: none"> <li>• Water shortages during drought seasons is serious.</li> <li>• Solar system is highly available and robust.</li> </ul>                                                                                                                                                                                      | <ul style="list-style-type: none"> <li>• Hardware Issues.</li> <li>• Unavailability of parts.</li> <li>• Lack expertise in Tuvalu.</li> <li>• Cost can be a concern, however, donor funding always available.</li> </ul> |
| 2                                | Water reticulation system (gravity pressure)      | <ul style="list-style-type: none"> <li>• Technology is viable and highly practised at household levels.</li> <li>• Non-existence at the community level.</li> <li>• A windmill water pump was installed in 1981 at Nukufetau under the SPC funding assistance was confirmed to be very useful. The system is water gravity distribution.</li> </ul> | <ul style="list-style-type: none"> <li>• Unavailability of parts for servicing and maintenance</li> <li>• The cost can be a concern at the local level.</li> <li>• No institutional arrangement.</li> </ul>              |
| 3                                | Groundwater solar extraction                      | <ul style="list-style-type: none"> <li>• Underground water is available in outer islands.</li> <li>• Useful during drought periods.</li> </ul>                                                                                                                                                                                                      | <ul style="list-style-type: none"> <li>• Existence of groundwater aquifer/wells lack information.</li> <li>• Contaminatio n of groundwater.</li> </ul>                                                                   |
| 4                                | Plate type freshwater generator (solar powered)   | <ul style="list-style-type: none"> <li>• Not exist and so require trial.</li> </ul>                                                                                                                                                                                                                                                                 | <ul style="list-style-type: none"> <li>• Maintenance issues.</li> <li>• Cost issues.</li> <li>• Limited access of</li> </ul>                                                                                             |



|   |                  |                                                                                                                                                                                                                                                          |                                                                                                                                                                        |
|---|------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|   |                  |                                                                                                                                                                                                                                                          | information of the technology.                                                                                                                                         |
| 5 | UV Filter system | <ul style="list-style-type: none"> <li>Few households use the technology utilizing their own water reservoirs.</li> <li>Used as potable drinking water.</li> <li>Few households use it and sell the water at very low cost for drinking only.</li> </ul> | <ul style="list-style-type: none"> <li>Un-availability of parts.</li> <li>Expensive to low-income households.</li> <li>Capacity limitation for maintenance.</li> </ul> |
| 5 | Tree Planting    | <ul style="list-style-type: none"> <li>Already practiced in Tuvalu and looks to be an ongoing protection measure.</li> </ul>                                                                                                                             | <ul style="list-style-type: none"> <li>Cyclone intensity easily removed the trees.</li> <li>Climate proof plants are required.</li> </ul>                              |

**Table 74: Summary of technologies for the agriculture sector.**

| Prior<br>ity<br>Rank<br>ing          | Technology                                                        | Relevance/Importanc<br>e for<br>Adaptation                                                                                                                                                                | Barriers                                                                                                                                 |
|--------------------------------------|-------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Agriculture Sector Technology</b> |                                                                   |                                                                                                                                                                                                           |                                                                                                                                          |
| 1                                    | Composting with tolerant varieties                                | <ul style="list-style-type: none"> <li>Composting is common in Tuvalu.</li> <li>Climate change impact on plants and crops is high and ongoing.</li> <li>Tolerant varieties are most essential.</li> </ul> | <ul style="list-style-type: none"> <li>Technical expert requirement is essential.</li> <li>Procurement of tolerant varieties.</li> </ul> |
| 2                                    | Horticultural technology through Beddings (concrete, wooden, etc) | <ul style="list-style-type: none"> <li>Concrete based cultivation is now practice in Tuvalu (e.g.: swamp taro cultivation).</li> <li>Raising farming above the ground is very</li> </ul>                  | <ul style="list-style-type: none"> <li>Technical expert may be required on new technologies</li> </ul>                                   |

|   |                              |                                                                                                                                                                                                                                      |                                                                                                                                                             |
|---|------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|
|   |                              | essential for Tuvalu given its status to saltwater intrusion and heavy/frequent drought.                                                                                                                                             |                                                                                                                                                             |
| 3 | Cultivator with Irrigation   | <ul style="list-style-type: none"> <li>The status of poor soil quality in Tuvalu couple with in-favourable temperature with prolonged drought periods, it is a requirement to cultivate and irrigate the soil very often.</li> </ul> | <ul style="list-style-type: none"> <li>Technology is expensive and require technical expertise and equipment.</li> <li>Seeking donor assistance.</li> </ul> |
| 4 | Plow and Crop rotation       | <ul style="list-style-type: none"> <li>Similar to above technology (3). However, deeper soil cultivation will be more essential to overcome worst drought periods.</li> </ul>                                                        | <ul style="list-style-type: none"> <li>Also, the technology is expensive .</li> <li>Donor assistances are available.</li> </ul>                             |
| 5 | Livestock Farming technology | <ul style="list-style-type: none"> <li>Tuvaluans are very keen in livestock farming. So appropriate technologies are highly recommended.</li> </ul>                                                                                  | <ul style="list-style-type: none"> <li>Improve current status of farming with marketing capacity building.</li> </ul>                                       |

The selection and prioritization of mitigation and adaptation technologies for Tuvalu are based on the TNA assessment study of the Tuvalu project. These sector-specific technologies, identified as crucial for addressing climate change impacts, require technological support from international partners, alongside necessary financing and capacity building. This support is essential for Tuvalu to successfully implement these technologies and achieve its committed climate goals and targets.



### 5.2.3 Climate Change Mitigation and Adaptation - Capacity Building Support Received and Needed

Tuvalu, a small island developing state (SIDS), is acutely vulnerable to the impacts of climate change, particularly rising sea levels, extreme weather events, coastal erosion, saltwater intrusion, and coral bleaching. This vulnerability requires a multifaceted approach to build resilience through climate change mitigation and adaptation strategies. Given the national context, the Government of Tuvalu has sought capacity-building support from international, regional, and bilateral partners to strengthen its ability to respond to these challenges effectively.

This section provides a detailed account of the capacity-building support that Tuvalu has received in the areas of institutional strengthening, technical expertise development, community engagement, and climate finance, and highlights the remaining needs that must be addressed to further Tuvalu's resilience-building efforts.

#### 5.2.3.1 Capacity-building support received

Over the years, Tuvalu has received substantial support from various international organizations, bilateral donors, and regional institutions aimed at strengthening its institutional capacity, technical expertise, and climate resilience efforts. Below are the key areas in which Tuvalu has benefitted from capacity-building initiatives:

##### **1. Institutional and Governance Capacity Building:**

- **UNDP Support for National Adaptation Programme of Action (NAPA):**

- Tuvalu has received support from UNDP in the development of its National Adaptation Programme of Action (NAPA). These initiatives have enhanced Tuvalu's ability to integrate climate change adaptation into national development planning processes.
- The NAPA have identified priority projects such as coastal protection measures, water resource management, and disaster risk reduction, which are crucial for enhancing Tuvalu's climate resilience.

- **UNEP support for training and capacity during the Third National GHG Inventory:**

- As part of preparing Tuvalu's Third National GHG Inventory Report, a comprehensive capacity-building program, including training and stakeholder consultations, was conducted. The training, designed for the PIU/PMU team and key stakeholders, aimed to enhance expertise in developing the national GHG inventory, covering data collection, analysis, monitoring, reporting, and quality management within existing national statistical systems, incorporating lessons learned from previous NIRs and best practices. Training specifically addressed GHG estimation methods from the 2006 IPCC Guidelines (including 2019 enhancements and GPGs), their application to Tuvalu's national circumstances, and QA/QC and review processes. Stakeholder consultations, conducted in two phases, engaged government departments, public and private sectors, development partners, NGOs, and public groups. The first phase focused on project objectives, methodology, and data collection processes, while the second phase presented the draft inventory results (2015-2021), data, assumptions, and uncertainties, seeking stakeholder validation and input on data gaps and improvement plans to enhance the quality, completeness, and transparency of future inventories.

- **Green Climate Fund (GCF):**

- Tuvalu has benefited significantly from GCF's support in climate adaptation and capacity building, including the Tuvalu Coastal Adaptation Project (TCAP) and Tuvalu Readiness

program, aimed at protecting Tuvalu's coastal infrastructure and freshwater resources from sea-level rise and storm surges, and building capacity of the Climate Change Department and its relevant stakeholders an.

## **2. Technical Capacity Building:**

- **Asian Development Bank and World Bank:**

- ADB and WB have provided technical capacity support in renewable energy solutions, focusing on solar energy systems and battery storage. The agency has supported Tuvalu in transitioning to renewable energy and improving energy security through solar energy installations.
- Tuvalu now operates several solar-powered installations, including a pilot project on the island of Funafuti, which is powered entirely by solar energy, improving the resilience of energy supply.

- **World Bank Support for Climate-Resilient Infrastructure:**

- Through the World Bank's Tuvalu Resilient Infrastructure and Preparedness (TRIP) Project, Tuvalu has received support to improve coastal defences, construct sea walls, and develop flood protection measures, ensuring that critical infrastructure is climate resilient.

## **3. Climate Finance and Access to Funding:**

- **Global Environment Facility (GEF):**

- GEF has supported Tuvalu in accessing and managing climate finance for projects aimed at restoring mangroves and enhancing marine and coastal ecosystems, which play a critical role in mitigating the effects of sea-level rise.

- **GCF Readiness Program:**

- The GCF's Readiness Program has enhanced Tuvalu's ability to prepare robust climate adaptation proposals, including strengthening the institutional capacity to manage climate finance and ensure effective implementation of funded projects.

## **4. Public Awareness and Community Engagement:**

- **Climate Change Awareness Week 2024:**

- The Government of Tuvalu, with the support of UNFCCC, PIFS, and GCF, successfully organized the "Climate Change Awareness Week 2024" under the theme "Embracing Resilience, Our Climate, Our Future." This event aimed to increase public understanding of climate change impacts and resilience-building strategies.
- **Key Activities:** Workshops, youth programs, community outreach, disaster preparedness education, and coastal adaptation initiatives were held during the week, which saw active participation from local communities, government officials, and regional stakeholders.

### **5.2.3.2 Capacity-building support needed**

Despite the progress made, Tuvalu continues to face capacity-building challenges that need to be addressed to strengthen its long-term climate resilience. The country's capacity-building needs are outlined below:



## 1. Institutional Strengthening:

- **National Institutions:** Tuvalu needs support to further strengthen the capacity of key national institutions, including the Department of Environment, Department of Energy, the National Disaster Management Office (NDMO), and the Department of Climate Change (CCD). These institutions need enhanced training and support to effectively plan, implement, and monitor climate change policies and projects.
- **Local Governance and Stakeholders:** Strengthening the local government and community-level adaptation plans, including improving disaster risk management and climate change adaptation action at the island level, remains a priority. Institutional coordination must be improved across ministries, departments, and agencies involved in climate action.

## 2. Technical Expertise Development:

- **Renewable Energy:** As part of Tuvalu's transition to renewable energy, capacity-building support is needed to enhance technical expertise in solar and battery storage systems, bioenergy, and energy efficiency technologies. Professionals and technicians must be equipped with the latest knowledge in sustainable energy technologies to further expand Tuvalu's renewable energy infrastructure.
- **Water Resource Management:** Expertise in integrated water resource management is critical for addressing the growing challenges of freshwater availability due to climate-induced changes in rainfall patterns and saltwater intrusion.
- **Disaster Management and Resilience Engineering:** There is a significant need for advanced training in climate-resilient infrastructure design, coastal defences (including sea walls and beach nourishment), and disaster response strategies, especially for Tuvalu's remote outer islands.

## 3. Community Engagement and Awareness:

- **Raising Awareness:** Capacity building should focus on raising awareness about climate change, especially in remote and outer islands. There is a particular need to raise awareness among vulnerable groups, such as women, youth, and people with disabilities, about climate risks and adaptation measures.
- **Local Adaptation Actions:** Empowering local communities to design and implement locally appropriate climate adaptation strategies through participatory processes is essential. It is important to ensure that traditional knowledge is integrated with scientific knowledge to develop culturally appropriate solutions.

## 4. Climate Finance and Access to Funding:

- Tuvalu requires ongoing support to build its institutional capacity to access international climate finance, including by preparing high-quality funding proposals and managing climate finance effectively. There is a need to strengthen the technical capacity to prepare and submit proposals to major climate funds such as the Green Climate Fund (GCF) and the Global Environment Facility (GEF).

### 5.2.3.3 Challenges in training and capacity building

Despite the progress made, several challenges remain in the delivery and sustainability of capacity-building initiatives for climate change adaptation and mitigation:

**1. Lack of Continuity:** Many of the training and capacity-building efforts have been project-based or ad-hoc in nature, which can limit the retention and application of skills over time. There is a need for continuous training programs that provide long-term benefits.

**2. Limited Resources:** Tuvalu's small size and financial limitations pose constraints on the establishment of sustainable, large-scale capacity-building initiatives. Adequate funding must be secured to scale up training efforts and integrate them into national development plans.

**3. Access to Training Opportunities:** The isolation of Tuvalu's outer islands means that residents often lack access to capacity-building opportunities, particularly in remote areas. This can lead to unequal access to climate change education and training.

**4. Tailored Training Approach:** Many training programs have not been tailored to the specific needs of the outer islands or marginalized communities. A more localized approach, integrating traditional knowledge with modern techniques, is necessary to ensure effective capacity building.

**5. Integration of Local Knowledge:** Capacity-building efforts should better integrate indigenous knowledge and practices, which can enhance resilience strategies and adaptation measures that align with Tuvalu's cultural and environmental context.

#### 5.2.3.4 Future capacity-building needs and recommendations

Based on current gaps and challenges, Tuvalu's capacity-building needs can be further enhanced through the following strategic recommendations:

**1. Develop Continuity in Training Programs:** Establishing long-term, institutionalized training programs to ensure sustainability and deeper knowledge retention.

**2. Strengthen Community-Based Adaptation Efforts:** Focus on enhancing community-based climate adaptation strategies through participatory processes and tailored capacity-building activities, especially for marginalized groups.

**3. Enhance Climate Finance Access:** Continue to build Tuvalu's capacity to access and manage international climate finance to implement large-scale, transformative adaptation and mitigation projects.

**4. Integration of Traditional Knowledge in Climate Action:** Foster the integration of indigenous knowledge in climate resilience initiatives to enhance local-level adaptive capacity.

Tuvalu's ongoing collaboration with international donors, regional agencies, and technical experts is crucial in addressing these capacity-building needs and strengthening the country's resilience to the impacts of climate change.

## 5.3 Conclusion

Tuvalu is making significant strides in addressing climate change but requires continued and enhanced international support to effectively implement its mitigation and adaptation actions. Financial resources, technology transfer, and capacity-building support are essential to ensure that Tuvalu's climate objectives are met, with an emphasis on renewable energy, disaster resilience, and sustainable development. The country's progress in addressing its climate vulnerabilities depends on robust international cooperation and the mobilization of resources, particularly from climate finance mechanisms under the Paris Agreement.



## 5.4 Support Needed and Received for the Implementation of Article 13 of the Paris Agreement and Transparency-Related Activities

Tuvalu, as one of the most vulnerable Small Island Developing States (SIDS) and Least Developed Country (LDC), faces immense challenges in the implementation of climate change measures due to its limited resources and geographical constraints. The country's commitment to transparency in climate action under Article 13 of the Paris Agreement requires continuous international support for its climate-related activities, including financial, technical, and capacity-building support. This section outlines Tuvalu's needs and the support it has received, in alignment with the Transparency related activities and improvement of transparency systems.

### 5.4.1 Support Needed for Implementing Article 13 of the Paris Agreement

#### Support for preparing reports under Article 13

Tuvalu's ability to produce comprehensive and high-quality transparency reports as part of its obligations under Article 13 is contingent upon robust support in several key areas. The preparation of Tuvalu's Biennial Transparency Reports (BTRs) and other associated climate reports such as the National Inventory Reports (NIRs) requires both technical expertise and financial resources.

#### 1. Enhancement of Institutional Capacity and Data Collection Systems:

- **Tuvalu's Need:** Tuvalu faces significant data gaps in emissions inventory data across several key sectors, such as energy, waste, and land use, which are crucial for the preparation of the BTR and NIR. The country requires support to enhance its data collection systems, making them more efficient and consistent with international reporting standards under the Paris Agreement.
- **Specific Support Needed:**
  - Financial and technical support to establish comprehensive national greenhouse gas (GHG) inventory systems in line with the IPCC guidelines (2006 and 2019 refinements).
  - Integration of satellite-based data and remote sensing technologies to track land use and forestry emissions.
  - Support for developing sector-specific data collection tools, especially in the context of the energy and waste sectors, where data is currently scarce.

#### 2. Technical Expertise and Capacity Building:

- **Tuvalu's Need:** A skilled workforce is essential for the preparation and submission of accurate climate reports. Currently, Tuvalu requires further training for government staff and national experts in advanced climate data management, GHG inventory methods, and the application of transparency frameworks.
- **Specific Support Needed:**
  - Capacity-building programs for Tuvalu's national climate change team, including training on GHG inventory management, UNFCCC reporting requirements, and technical methodologies (e.g., IPCC 2006 guidelines, 2019 refinements).
  - Training workshops focused on the use of tools such as the UNFCCC's Transparency Reporting Platform (TRP), the MRV systems, and the Climate Action Transparency Platform (CAT) to report data on emissions and climate actions.

### 3. Financial Support for Report Preparation:

- **Tuvalu's Need:** Preparing the subsequent BTRs and NIRs incurs significant costs, particularly for data collection, analysis, and third-party verification. Tuvalu's national budget is insufficient to cover these costs, requiring support from international partners.
- **Specific Support Needed:**
  - Continued financial assistance for Tuvalu to cover the operational and administrative costs of preparing transparency reports, including hiring consultants and expert reviewers, conducting stakeholder consultations, and ensuring the accuracy of emissions data.
  - Funding for periodic workshops and training programs to engage local stakeholders, including civil society and private sector representatives, to better understand and contribute to the BTR preparation process.

### 4. Access to Digital Tools and Technologies:

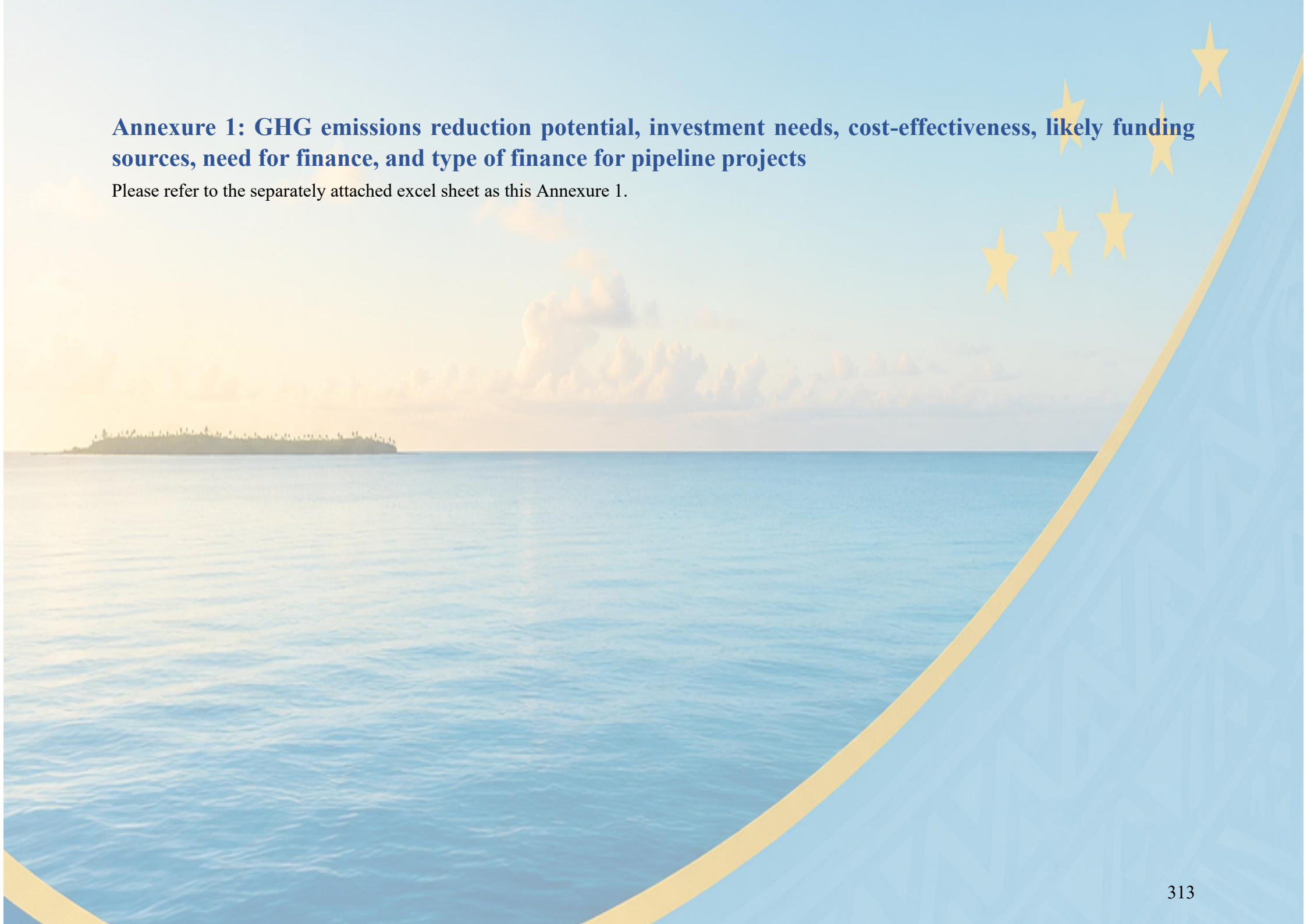
- **Tuvalu's Need:** The development and implementation of advanced digital tools for monitoring, reporting, and verification (MRV) are critical for improving the efficiency and accuracy of Tuvalu's transparency systems. The country lacks the necessary infrastructure and tools to fully integrate its climate data into international reporting systems.
- **Specific Support Needed:**
  - Provision of advanced climate data management software, including inventory management tools and emission calculators, that comply with the Paris Agreement's transparency standards.
  - Technical support for the strengthening integration of Tuvalu's climate data into digital platforms, which ensures the secure transfer of carbon credits and emissions data.

#### 5.4.2 Key challenges in transparency and reporting

Tuvalu faces several challenges in achieving full compliance with the transparency requirements of Article 13. These challenges include:

- **Limited Resources:** As a small island nation with limited financial and technical capacity, Tuvalu faces significant barriers to funding and maintaining the systems necessary for effective transparency.
- **Data Scarcity and Reliability:** Key gaps exist in data related to emissions and mitigation actions. For instance, the energy sector lacks detailed data on fuel consumption, renewable energy deployment, and emissions from electricity generation.
- **Technical Capacity Constraints:** Tuvalu has limited expertise in advanced reporting and tracking methodologies, which complicates the preparation of high-quality reports that meet international standards.





## **Annexure 1: GHG emissions reduction potential, investment needs, cost-effectiveness, likely funding sources, need for finance, and type of finance for pipeline projects**

Please refer to the separately attached excel sheet as this Annexure 1.

## Annexure 2: List of existing, recently completed and pipeline EE project

| Project                                                                                                                   | Project type<br>(infrastructure, equipment<br>upgrade, study, training,<br>public awareness,<br>incentive) | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Project completion<br>expectation                                                                                                                                                                                                                                                                                                                              | Organization responsible  |
|---------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|
| <b>Maritime transport sector</b>                                                                                          |                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                |                           |
| <b>Outer Island<br/>Maritime<br/>Infrastructure<br/>Project</b>                                                           | Infrastructure and training                                                                                | <p>This project involves:</p> <ul style="list-style-type: none"> <li>• Building and rehabilitating boat harbours on the island of Nukulaelae (original project), Niutao (first additional financing) and Nui (second additional financing)</li> <li>• Building better maritime facilities in the outer islands in order to expedite cargo handling and improve the safety and security of vessel and passenger traffic</li> <li>• Building capacity to maintain maritime infrastructure; and Developing a master plan for future harbour developments.</li> </ul> <p>This project is expected to cost US\$13.3 million. An ADB grant will fund \$11.3 million of the project, a Global Environment Facility grant will fund \$500,000 and the remaining \$1.5 million will be provided by the Government of Tuvalu.</p> | The construction of the boat harbour in Nukulaelae is 90 percent completed, and the civil works contract to construct the boat harbour in Niutao was awarded in November 2020. The contract award for the Nui project is scheduled for late 2022. This project is particularly important to accommodate for the government's procurement of the new LCT barge. | MTECI                     |
| <b>Energy efficiency sector</b>                                                                                           |                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                |                           |
| <b>The Facilitation of<br/>the Achievement of<br/>Sustainable<br/>National Energy<br/>Targets of Tuvalu<br/>(FASNETT)</b> | Infrastructure                                                                                             | FASNETT is funded by the Global Environment Facility (GEF) and seeks to facilitate the development and utilisation of feasible renewable energy resources and the application of energy efficiency technologies for achieving Tuvalu's 100 percent renewable energy targets.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Expected to be completed by July 2021. Updated completion date by the end of 2022 (including the Low Carbon Fund and Energy Efficiency Revolving Fund)                                                                                                                                                                                                         | MTECI (Energy Department) |



|                                                                                                                   |                                |                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                              |                           |
|-------------------------------------------------------------------------------------------------------------------|--------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|
| <b>Low Carbon Fund and Energy Efficiency Revolving Fund for energy-efficient appliances and housing retrofits</b> | Public awareness and Incentive | The Development Bank of Tuvalu started a subsidy scheme for energy-efficient appliances and housing retrofits in 2016. In November 2020, the bank was given financial assistance of US\$38,600 through the FASNETT programme to buffer the bank's existing energy efficiency program. <sup>148</sup> The programme will now be enhanced and implemented as part of the FASNETT project. | Expected to be completed by the end of 2020. Updated completion date by the end of 2022                                                                                                                                                                                                                                                      | DBT                       |
| <b>770 kW solar PV plant (with battery storage) on Funafuti</b>                                                   | Infrastructure                 | This US\$6.1 million MFAT funded project will include 770 kW of Solar PV and at least 1 MWh of battery storage. <sup>150</sup> The plant will help replace diesel on the island, where about 85 percent of electricity is currently generated from diesel.                                                                                                                              | The plant was expected to be completed by the end of 2020 but has been delayed due to COVID-19 travel restrictions. Construction is expected to begin as soon as the borders open                                                                                                                                                            | MTECI                     |
| <b>2 MW of solar PV, 2 MWh of battery storage, and a small wind turbine on Funafuti</b>                           | Infrastructure                 | Funded by the World Bank and the Asian Development Bank (ADB). This project involved implementing a 2 MW of solar PV, 2 MWh of battery storage, and a small wind turbine on Funafuti.                                                                                                                                                                                                   | Project delayed due to COVID-19 travel restrictions. Construction is expected to begin after October 2021 (once borders open) <ul style="list-style-type: none"> <li>• ADB is in the process of contract signing with the developer</li> <li>• Materials required for the project have been procured and some delivered to Tuvalu</li> </ul> | MTECI                     |
| <b>Radio education programme on household energy efficiency</b>                                                   | Public awareness               | The Department of Energy runs a quarterly education programme via the radio, on household energy efficiency.                                                                                                                                                                                                                                                                            | Project will be completed at the end of 2022.                                                                                                                                                                                                                                                                                                | MTECI (Energy Department) |

### **Annexure 3: List of Projects supported by Climate Finance from 2014 to 2021**

Please refer to the separately attached excel sheet as this Annexure 3.

### **Annexure 4: List of Projects supported by Climate Finance from 2019 to 2024**

Please refer to the separately attached excel sheet as this Annexure 4.

### **Annexure 5: Tuvalu's GHG Inventory Common Reporting Tables (CRTs) 2.83 from 2010 to 2023**

Provided in separate Excel files as per the latest CRT\_2.83 format of the UNFCCC's MPGs.

### **Annexure 6: Tuvalu's Common Tabular Format (CTF) for information related to the achievement of NDC**

Provided in separate Excel files as per the latest CTF format of the UNFCCC's MPGs.

### **Annexure 7: Tuvalu's Common Tabular Format (CTF) for information on financial, technology development and transfer and capacity-building support**

Provided in separate Excel files as per the latest CTF format of the UNFCCC's MPGs.



## 6 References

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