Government of Tuvalu

TECHNOLOGY ACTION PLAN
MITIGATION REPORT

TNA TECHNOLOGY NEEDS ASSESSMENT

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USP THE UNIVERSITY OF THE SOUTH PACIFIC

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Foreword

Climate change poses significant challenges to the small island nation of Tuvalu, particularly in the sectors of energy and transport. As we strive to adapt to these changes, it is crucial to identify and overcome the barriers that hinder our progress and to establish an enabling framework that supports the implementation of priority innovative technologies, and reduce damage to life, property, natural eco-systems and the Tuvalu economy.

This Technology Action Plan report focuses on two critical sectors:

1. **Energy**: Tuvalu is aiming to be 100% reliant on renewable energy by 2025. By prioritizing renewable energy technologies, Tuvalu is reducing its reliance on fossil fuels and focusing more on renewable energy technologies to meet its targets.
   Transport: Transport is a sector that has a high carbon footprint. Tuvalu is looking at technologies that not only reduce its carbon footprint, but also technologies that are more viable and sustainable for Tuvalu.

This report which was developed in partnership with the UNEP Copenhagen Climate Centre (UNEP CCC) and the University of the South Pacific (USP) aims to provide a comprehensive assessment of the barriers to technology adoption in these sectors and to propose actionable strategies to create an enabling environment for their implementation. By addressing these challenges, we can build a more resilient and sustainable future for Tuvalu.

As the Minister responsible for climate change concerns, it gives me great pleasure to present both adaptation and mitigation technologies outlined in report, to build greater resilience in Tuvalu and mitigate the impacts of Climate Change.

I would like to thank te TNA National team, UNEP CCC and USP for their invaluable contributions to preparing this report.

Hon. Dr. Maina Vakafua Talia
Minister for Home Affairs, Climate Change, and Environment.

Acknowledgement

The Climate Change Department through the TNA Project Coordinator, the Assistant Project Coordinator and the National TNA Consultant would like to acknowledge the contribution of all public and private stakeholders from different sectors who were involved in preparing and finalising this Technology Needs Assessment report for Tuvalu. The report was compiled by the National TNA Consultant under good guidance of the TNA Team and in particular the guideline instructions prepared by UNEP Copenhagen Climate Center and the University of the South Pacific (USP). It has been prepared for the Government of Tuvalu through the Climate Change Department coordination. Lastly, enormous gratitude to the Global Environment Facility (GEF) for providing financial support and the UNEP Copenhagen Climate Centre for their technical support and guidance.

List of Abbreviations

ADB:	Asian Development Bank
BAEF:	Barrier Analysis and Enabling Framework
BESS:	Battery Energy Storage System
CO2:	Carbon Dioxide
CSO:	Civil Society Organization
CTCN:	Climate Technology Centre and Network
DBT:	Development Bank of Tuvalu
DOE:	Department of Energy
ESIA:	Environment and Social Impact Assessment
EV:	Electric Vehicle
GEF:	Global Environment Facility
GCF:	Green Climate Fund
GHG:	Greenhouse Gas
GOT:	Government of Tuvalu
INDC:	Intended Nationally Determined Contribution
IRENA:	International Renewable Energy Agency
kWp:	Kilowatt peak
MCA:	Multi-Criteria Analysis
M&E:	Monitoring and Evaluation
MFALT:	Ministry of Foreign Affairs, Labour & Trade
MFAT NZ:	Ministry of Foreign Affairs and Trade, New Zealand
MOF:	Ministry of Finance
MTTECI:	Ministry of Transport, Tourism, Energy, Communication and Innovation
MW/MWh:	Megawatt/ Megawatt hour
NDC:	Nationally Determined Contributions
NGO:	Non-Governmental Organisation
NMT:	Non-Motorized Transport
PMU:	Project Management Unit
PPP:	Public-Private Partnership
PV:	Photovoltaic
RE:	Renewable Energy
SIDS:	Small Island Developing States
SPREP:	Secretariat of the Pacific Regional Environment Programme
TAP:	Technology Action Plan
TEC:	Tuvalu Electricity Corporation
TNA:	Technology Needs Assessment
TNEP:	Tuvalu National Energy Policy
UAE:	United Arab Emirates
UNDP:	United Nations Development Programme
UNEP:	United Nations Environment Programme
UNFCCC:	United Nations Framework Convention on Climate Change
USAID:	United States Agency for International Development
USD:	United States Dollar
USP:	University of the South Pacific

List of Tables

Table of Contents

Executive Summary

The Technology Needs Assessment (TNA) Report III on the Technology Action Plan (TAP) for Climate Change Mitigation Technologies builds upon the findings of previous reports, focusing on Energy and Transport as priority sectors for Tuvalu. The selected technologies for the Energy sector include Solar PV integrated with Battery Energy Storage Systems (BESS) and biogas, while Transport priorities involve Electric Light-Duty Vehicles (EVs), motorbikes, e-bikes, and Non-Motorized Transport (NMT). The TAP identifies essential actions and activities needed to implement these technologies and provides investment proposals aimed at attracting public, private, and international funding. These prioritized technologies hold the potential to scale into impactful projects and programs that can effectively reduce greenhouse gas (GHG) emissions, enhance climate resilience, and align with Tuvalu's Nationally Determined Contributions (NDCs).

Energy Sector: Biogas, Solar PV + BESS

In the Energy sector, biogas technology, which was initially ranked lower in priority, has recently gained focus due to advancements in the field. With targets set to reduce fossil fuel reliance by 40% in cooking and to integrate biogas for 15% of electricity generation by 2030, key actions for biogas include securing subsidies and international funding to reduce financial barriers, and training local technicians to address knowledge gaps. The TAP also outlines infrastructure development for biogas production and distribution, with support from key stakeholders, including the Department of Energy, Tuvalu Electricity Corporation (TEC), and local agricultural sectors, alongside financial and technical assistance from international donors like the Green Climate Fund (GCF) and USAID.

Solar PV + BESS is the top priority for Tuvalu's energy sector, with the potential to reduce dependency on imported diesel and to support the country's target of 100% renewable energy by 2025. The TAP proposes a phased deployment of Solar PV and BESS, starting with an initial installation funded by the Asian Development Bank (ADB) and the World Bank, and expanding in subsequent phases to achieve full renewable capacity. To overcome high costs and grid limitations, the TAP recommends subsidies, international financing, and institutional capacity building, with efforts to engage the public on the benefits of renewable energy.

Transport Sector: Electric Vehicles, Non-Motorized Transport (NMT)

In the Transport sector, Electric Vehicles (EVs) are essential for reducing Tuvalu's reliance on imported fossil fuels and improving energy security. The TAP addresses the high initial costs, limited charging infrastructure, and low public awareness of EVs through proposed financial incentives, subsidies, and renewable-powered charging infrastructure. Training and awareness campaigns will build local capacity and educate the public on the benefits of EVs. The TAP's goal is to have EVs make up 20% of light motor vehicles by 2030, contributing to emissions reduction, improved air quality, and job creation in green technology.

The shift to Non-Motorized Transport (NMT), including bicycles, e-bikes, and walking, is a key part of Tuvalu's sustainable transport strategy. The TAP aims to achieve a 50% shift to NMT for short-distance travel by 2030, reducing transport emissions by 30%. To achieve this, the plan emphasizes government subsidies, tax exemptions, and financial incentives, alongside developing safe cycling and walking paths and promoting public awareness of NMT's benefits.

Cross-Cutting Issues

To address cross-cutting issues affecting both sectors, the TAP recommends capacity building, public awareness, financing, and policy frameworks. Capacity building programs will train local technicians, operators, and policymakers, supported by the establishment of Centre of Excellence for technology and sustainability. Public engagement campaigns are critical for fostering trust and understanding in renewable technologies, especially for biogas and NMT. Additionally, leveraging international financing mechanisms and public-private partnerships (PPPs) will help alleviate the high costs of renewable energy projects. The TAP also emphasizes the need for a robust policy framework with clear standards and streamlined approval processes to support sustainable development and investment.

Next Steps

To implement the TAP, each technology has specific next steps, including securing funding, stakeholder engagement, capacity building, and establishing Project Management Units (PMUs) for coordination. For NMT, the immediate focus is on securing international funding, conducting feasibility studies, and establishing a PMU within the Ministry of Transport, Tourism, Energy, Communications, and Innovation (MTTECI). For EVs, the emphasis is on engaging stakeholders, implementing pilot projects, and building EV infrastructure. The Solar PV + BESS initiative requires funding for expansion, grid upgrades, and ongoing stakeholder engagement, while biogas will focus on feasibility studies, securing funding, and developing a regulatory framework to support long-term sustainability.

By addressing these next steps, Tuvalu can advance toward its climate goals, promoting sustainable, low-carbon development across its energy and transport sectors. Each technology's success will contribute to Tuvalu's transition to renewable energy and sustainable transport, aligning with global climate goals and creating a cleaner, more resilient future.

Chapter 1 Background and Introduction

1.1. Introduction

The Technology Needs Assessment (TNA) project assists developing countries in identifying their priority technologies for mitigating greenhouse gas (GHG) emissions, removing barriers to the diffusion and dissemination of these technologies, and developing portfolios of prioritised projects that align with their national mitigation strategies. The TNA process helps guide countries in advancing their climate action goals through the adoption and deployment of environmentally sound technologies.

In Tuvalu, the TNA project commenced in March 2022, led by the Climate Change Department under the Ministry of Home Affairs, Climate Change and Environment of the Government of Tuvalu, in collaboration with the UNEP Copenhagen Climate Centre, the University of the South Pacific (USP), United Nations Environment Program, and the Global Environment Facility (GEF). This partnership has been instrumental in analysing Tuvalu's technology needs and developing projects that facilitate the transfer of relevant technologies.

The purpose of the project is to analyse Tuvalu's priority technology needs and facilitate the development of projects to support the transfer and adoption of environmentally sound technologies, in line with Article 4.5 of the UNFCCC. The primary objectives of the Technology Action Plan (TAP) are to:

1. Identify and prioritise technologies through country-driven participatory processes that can contribute to mitigation and adaptation goals, while supporting Tuvalu's national sustainable development objectives.

2. Identify barriers hindering the acquisition, deployment, and diffusion of prioritised technologies.

3. Develop a Technology Action Plan (TAP) that outlines specific activities and enabling frameworks to overcome these barriers, facilitating the transfer, adoption, and diffusion of selected technologies in key priority areas relevant to Tuvalu's national context.

The project, upon its implementation, will build the capacity of the Government of Tuvalu to effectively meet its obligations under the UNFCCC for mitigating GHG emissions. This initiative aims to reduce the vulnerability of key sectors and safeguard the livelihoods of communities exposed to the adverse impacts of climate change.

The Technology Needs Assessment (TNA) Report I on Mitigation presented an evaluation of prioritized sectors and technologies. Two key sectors—Energy and Transport—were identified, along with 11 potential technologies for consideration. These sectors were prioritized based on their feasibility in Tuvalu and alignment with national frameworks, such as Tuvalu's Energy Policy, National Climate Change Policy, and National Strategy for Sustainable Development (Te Kete). These frameworks ensured that the selected technologies supported the country's climate goals and contributed to sustainable development.

In Step 1: TNA Identification and Prioritization Process, the technologies initially identified under Energy included: (i) Solar PV (National Grid) + BESS, (ii) Home System Solar PV + BESS, (iii) Biofuel, and (iv) Small-Scale Wind Energy. For Transport, the initial technologies were: (i) Shift to bikes, e-bikes, and non-motorized transport, (ii) Electric light-duty vehicles, (iii) Shift to fuel-efficient (including electric) heavy-duty vehicles, (iv) Shore-side electric supply for at-berth vessels, (v) Hydrogen-powered shipping vessels, and (vi) Fuel-efficient light-duty

vehicles. Following a prioritization process using Multi-Criteria Analysis (MCA), the top three ranking technologies were shortlisted for each sector. For Energy, these were: (1) Home System Solar PV + BESS, (2) Solar PV (National Grid) + BESS, and (3) Small-Scale Wind Turbine. For Transport, the top three were: (1) Shift to bikes, e-bikes, and non-motorized transport, (2) Hydrogen-powered shipping vessels, and (3) Electric light-duty vehicles.

In Step 2: Barrier Analysis and Enabling Framework (BAEF), further consultations were conducted with stakeholders. For Energy, stakeholders recommended specifying Biogas under Biofuel, influenced by the success of the SPC-USAID-funded project that demonstrated an efficient and effective biogas system. They also proposed removing Home System Solar PV + BESS to prioritize technologies for the national grid and ensure a diverse energy mix, including Small-Scale Wind Turbine. For Transport, stakeholders emphasized the feasibility and maturity of technologies, leading to the prioritization of: (i) Electric light-duty vehicles, (ii) Shore-side electricity for at-berth vessels, and (iii) Shift to bikes, e-bikes, and non-motorized transport.

The assessment identified common barriers faced across the prioritized technologies, reflecting challenges typical of many developing nations. These included high capital costs, limited incentives within government policy, a shortage of trained and certified technicians, and low levels of knowledge and awareness. To address these obstacles, the enabling framework highlighted the need for policy revisions, the promotion of technology diffusion through donor support, and targeted training programs to strengthen local capacity. Additionally, adjustments to regulatory and policy frameworks were deemed essential to ensure alignment with Tuvalu's renewable energy and climate targets.

In Step 3: Technology Action Plan (TAP), stakeholders further refined the list of technologies, selecting two technologies from each sector for detailed planning and implementation. For Energy, the final technologies were: (i) Solar PV (National Grid) + BESS and (ii) Biogas. For Transport, the focus narrowed to: (i) Shift to bikes, e-bikes, and non-motorized transport and (ii) Electric light-duty vehicles.

This structured, step-by-step process ensured a practical and targeted approach to identifying and prioritizing technologies. The final selection reflects Tuvalu's environmental conditions, practical needs, and strategic goals, laying the foundation for detailed action planning in the TAP.

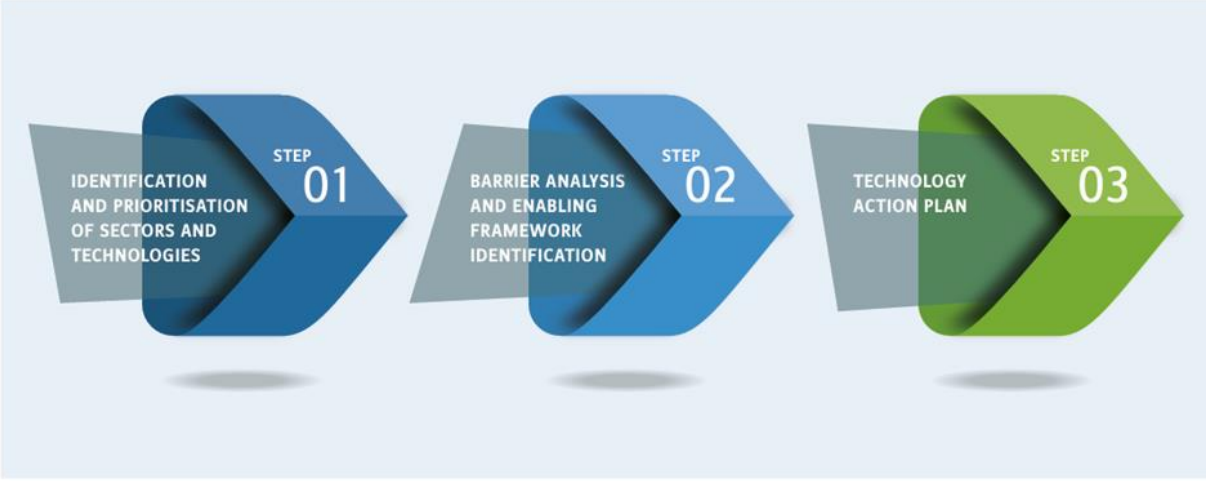

Figure 1: Steps in the TNA Process: from priorities to action

1.2 Methodology

The methodology adopted for designing the Technology Action Plan (TAP) and Project Idea Notes in Tuvalu includes the following steps:

1. Review of TNA Reports: A comprehensive review of the two previous reports was conducted—Report I on the Identification and Prioritization of Technologies for Mitigation, and Report II on the Barrier Analysis and Enabling Framework (BAEF) for Climate Change Mitigation. These reports provided the foundation for further analysis and project development.

2. Consultations and Group Meetings: The process involved two group meetings with members of the Tuvalu Mitigation Stakeholders (Annex I), as well as several one-on-one consultations. Follow-up discussions and clarifications were done via email to ensure thorough feedback was collected.

3. Alignment with National Priorities: Feedback from the stakeholders was aligned with Tuvalu's current priorities, as captured in key national policies, including the National Climate Change Policy, Tuvalu Energy Policy, and National Strategy for Sustainable Development (Te Kete). This ensured the TAP remained relevant to Tuvalu's broader development goals.

4. Formulation of the TAP: The formulation of the Technology Action Plan involved setting clear ambitions for the diffusion and adoption of the selected technologies in Tuvalu's context. This included identifying specific measures to address the identified technology barriers, determining the necessary actions and activities for successful implementation, and outlining timelines, key stakeholders, capacity-building requirements, and estimated costs. Additionally, the TAP considers management strategies and develops Project Idea Notes to facilitate the mobilisation of resources for the effective deployment and dissemination of these technologies.

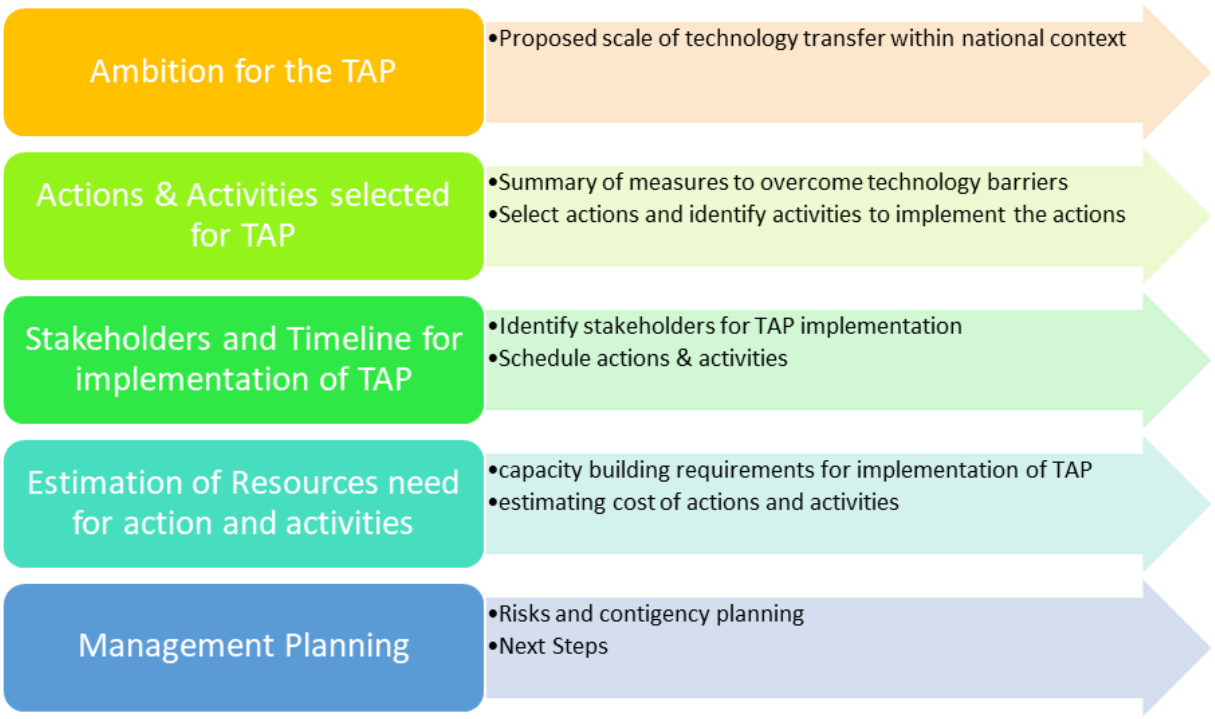

Figure 2: Overview of TAP formulation process for each technology

Chapter 2: Technology Action Plan for Sector A: Energy

2.1 TAP for the Energy Sector

2.1.1 Sector overview

The energy sector in Tuvalu plays a crucial role in the country's development but remains heavily reliant on imported fossil fuels, primarily for electricity generation and transportation. This dependency not only poses economic risks due to the high cost of imports but also environmental risks, as it contributes significantly to Tuvalu's greenhouse gas (GHG) emissions. The country's energy mix currently relies almost entirely on diesel-powered electricity generation, making it vulnerable to fluctuations in global oil prices and external supply shocks.

Biogas, along with solar and wind energy, is increasingly being recognized as an essential component in Tuvalu's strategy to transition towards renewable energy sources. This transition is not only critical for reducing GHG emissions but also for improving the country's energy security, reducing the environmental impacts of fossil fuel use, and enhancing the resilience of the energy sector.

Role of the Energy Sector

The energy sector supports vital infrastructure and services in Tuvalu, powering industries, healthcare, education, and transportation. Electricity generation and transportation are the largest consumers of fossil fuels, and the cost of fuel imports places a heavy financial burden on the country's economy. The sector's role is fundamental, but its reliance on imported diesel fuel creates a dependency that exposes the country to risks, particularly due to volatile global oil prices.

Transitioning to renewable energy, including biogas derived from organic waste, is therefore a key national priority. Biogas presents an opportunity for Tuvalu to reduce its dependence on imported fuels, enhance energy security, and lower GHG emissions, all while contributing to the sustainable development goals and commitments under the Paris Agreement.

GHG Emissions Level and Trends

The energy sector is Tuvalu's largest source of GHG emissions, contributing to the bulk of the nation's emissions. Key emission sources include diesel-powered electricity generation and the use of fossil fuels in the transport sector. Over the past decade, emissions have trended upwards due to increased energy demand driven by population growth and continued reliance on diesel generators.

- Electricity Generation: Almost all of Tuvalu's electricity generation is diesel-powered, accounting for approximately 80% of the country's energy-related GHG emissions. This dependency significantly contributes to Tuvalu's growing GHG emissions footprint, as noted in Tuvalu's Second National Communication (2015) to the UNFCCC, which underscores diesel-generated electricity as the primary source of CO2 emissions in the energy sector. This reliance on imported fossil fuels not only drives emissions but also exposes the country to fuel price volatility.

  The findings from the National Communication align with Tuvalu's climate targets and policies, as outlined in the National Energy Policy and Intended Nationally Determined

Contributions (INDCs), which target a 100% transition to renewable energy by 2025. This shift would reduce emissions and enhance energy security by minimising diesel dependence.

- Transportation: The transport sector, particularly sea transport critical for inter-island connectivity, also heavily relies on fossil fuels, contributing to the remaining share of energy-related emissions. Unless mitigated, these trends are expected to continue increasing as demand grows.

The introduction of biogas technology provides an opportunity to reduce emissions by converting organic waste into a sustainable energy source. Integrating biogas in both electricity generation and potentially as fuel for small-scale transportation could play a vital role in reversing the upward trajectory of emissions.

Vulnerability of the Energy Sector

Tuvalu, as a Small Island Developing State (SIDS), is particularly vulnerable to external shocks, such as global fuel price fluctuations and supply chain disruptions. These shocks can have a direct impact on the energy supply, creating uncertainty and increased costs. Additionally, Tuvalu is highly exposed to climate change risks, such as sea-level rise and extreme weather events, which threaten critical infrastructure, including energy infrastructure.

The country's reliance on fossil fuels exacerbates these vulnerabilities, making the current energy system both unsustainable and precarious. Moving toward renewable energy sources, including biogas, is crucial for enhancing the resilience of the energy sector. By converting organic waste and agricultural residues into biogas, Tuvalu can develop a localised energy source that improves energy independence, mitigates environmental impacts, and supports the country's long-term sustainability goals.

Existing Policies and Measures Related to Energy Sector Development

To address these challenges, the government of Tuvalu has implemented several policies aimed at reducing its dependence on fossil fuels, lowering GHG emissions, and increasing the uptake of renewable energy technologies. These policies are aligned with international commitments under the Paris Agreement and focus on the deployment of Biogas, solar energy, and wind power to meet national energy needs sustainably.

Below is a table outlining the key policies and regulations governing the energy sector in Tuvalu, along with their main contents and current technology profiles. Action Plan for Biogas

Table 1 - Outline of key policies & regulations governing the Energy sector in Tuvalu

Policy/Law	Year Enacted/Revised	Main Contents	Current Technology Profile
Tuvalu National Energy Policy (TNEP)	2009 (Revised 2017)	Sets the goal of achieving 100% renewable energy in	Dominated by diesel generators; biogas, solar, and wind in pilot stages.

		electricity generation by 2025, including biogas.	
Nationally Determined Contributions (NDCs)	2016 (Revised 2020)	Commits to GHG reductions through renewable energy deployment, focusing on solar, wind, and biogas.	Minor uptake of solar PV systems; no large-scale biogas production yet.
Renewable Energy Subsidy Program	2021	Provides financial incentives for renewable energy projects, primarily targeting private sector initiatives in biogas and solar energy	Initial private sector interest, with incentives in place to encourage further investment in biogas and solar energy; full-scale deployment is still developing.
Tuvalu Climate Change and Disaster Risk Reduction Policy	2012	Focuses on mitigation and adaptation strategies, with energy sector reform as a key component.	Supports the transition to renewable energy sources across all sectors.

Selected Technologies from the TNA Report

The Technology Needs Assessment (TNA) for Tuvalu identified key renewable energy technologies critical for reducing GHG emissions and enhancing energy security. These technologies focus on diversifying the country's energy mix away from imported fossil fuels and utilising locally available renewable resources, such as solar energy and agricultural waste for biogas.

Biogas Production and Integration:

- Current Level of Uptake: Biogas production is in its early stages, with small-scale projects in the pilot phase. The potential to expand biogas facilities using organic waste from agriculture, households, and municipal sources is significant.
- Future Targets: Tuvalu aims to expand the integration of biogas into its renewable energy portfolio as part of its broader goal of achieving 100% renewable energy by 2025. This includes exploring biogas applications in electricity generation as well as in cooking and heating to reduce household reliance on fossil fuels. These efforts align with Tuvalu's commitment to sustainable energy solutions that leverage local resources.

Solar Photovoltaic (PV) + BESS (National Grid) Systems:

- Current Level of Uptake: Solar PV installations are present in limited capacity, mainly on government buildings and some residential areas. According to the International

Renewable Energy Agency, solar currently contributes to approximately 10% of electricity generation.

- Future Targets: The goal is to increase solar PV's contribution to 50% of Tuvalu's energy mix by 2025, contributing to the broader objective of 100% renewable energy in electricity generation. The remaining energy needs are anticipated to be met through other renewable sources, such as wind energy and biogas, based on guidance from national policy documents and stakeholder consultations (Ministry of Foreign Affairs and Trade [MFAT], New Zealand, 2022).

Wind Energy:

- Current Level of Uptake: Wind energy remains largely untapped in Tuvalu, with no large-scale projects currently operational.
- Future Targets: The government plans to explore the feasibility of wind energy projects to complement biogas and solar PV, with intentions to integrate wind power into the energy mix by 2030. This aligns with the strategies outlined in Tuvalu's Enetise Tutumau 2012-2020: Master Plan for Renewable Electricity and Energy Efficiency in Tuvalu, which emphasises the diversification of renewable sources to achieve 100% renewable electricity generation (Pacific Centre for Renewable Energy and Energy Efficiency, PCREEE, 2010; Asia Pacific Energy Policy, 2012).

Tuvalu's energy sector is in a critical transition phase as the country seeks to reduce its reliance on imported fossil fuels and enhance its energy security through the adoption of renewable energy technologies. The integration of biogas, solar PV, and wind energy is central to achieving Tuvalu's ambitious targets under the Nationally Determined Contributions (NDCs) and other climate commitments. The government has implemented several policies to support this transition, but significant challenges remain, particularly in scaling up renewable energy technologies and ensuring adequate financing for biogas and solar infrastructure. Nevertheless, with continued support from international partners and the private sector, Tuvalu is well-positioned to meet its renewable energy goals and contribute to global climate mitigation efforts.

2.1 Action Plan for Technology A1 - Biogas

2.1.1 Introduction

Tuvalu, like many Small Island Developing States (SIDS), faces critical energy security challenges due to its dependency on imported fossil fuels. This dependency not only makes the country vulnerable to price fluctuations but also contributes significantly to greenhouse gas (GHG) emissions. To address these challenges and align with its commitments to climate change mitigation under the Paris Agreement, particularly through its Nationally Determined Contributions (NDC) and Tuvalu National Energy Policy (TNEP), Tuvalu is seeking to transition toward renewable energy sources. One of the most promising technologies in this regard is biogas, which presents an opportunity to use organic waste for clean energy production.

Biogas technology has the potential to provide a reliable, sustainable energy source for Tuvalu, addressing both waste management and energy security. Through anaerobic digestion of organic materials such as agricultural residues, food waste, and animal manure, biogas can be produced and used for cooking, heating, and electricity generation. This chapter outlines a comprehensive Technology Action Plan (TAP) for the deployment of biogas technology in Tuvalu's energy and waste management sectors. The TAP focuses on fostering biogas adoption through a structured, actionable framework that addresses existing barriers, identifies key actions, and provides a roadmap for implementation. The TAP is designed to be

practical and measurable, ensuring that the proposed interventions are aligned with international best practices and tailored to Tuvalu's specific context.

2.1.2 Ambition for the TAP

The overarching ambition of the Technology Action Plan (TAP) is to reduce Tuvalu's reliance on imported fossil fuels by expanding the use of biogas. Currently, around 48% of Tuvalu's population relies on traditional biomass or fossil fuels for cooking, with 52% having access to clean cooking technologies (IRENA, 2021). In electricity generation, biogas integration remains minimal, and the sector is primarily dependent on diesel generators. The TAP specifically aims to reduce fossil fuel use for cooking by 40% and to integrate biogas into 15% of electricity generation systems by 2030. These targets align with Tuvalu's broader goal of achieving 100% renewable energy by 2025, as outlined in the Tuvalu National Energy Policy (TNEP) and Tuvalu's Nationally Determined Contribution (NDC) under the Paris Agreement. Achieving these goals is essential for reducing greenhouse gas emissions, enhancing energy security, and improving waste management (SPREP, Tuvalu Renewable Energy Study).

To achieve these goals, the TAP outlines a series of strategic interventions aimed at overcoming the technical, economic, social, and regulatory barriers that have hindered the adoption of biogas technology in Tuvalu thus far. The TAP will focus on establishing small-scale biogas production facilities using organic waste, developing the infrastructure for biogas storage and distribution, building local capacity through training programs, and strengthening the policy framework to support biogas integration.

2.1.3 Actions and Activities selected for inclusion in the TAP

The adoption of biogas technology in Tuvalu faces several barriers—economic, technical, social, and regulatory—that must be systematically addressed to ensure the successful implementation of the TAP.

Economic Barriers

One of the significant economic barriers is the high capital cost of establishing biogas production facilities and associated infrastructure. Limited access to financing in Tuvalu further exacerbates this issue, as the small domestic market size makes achieving economies of scale challenging. While initiatives like the Fiji Development Bank's Sustainable Energy Financing Facility (SEFF) previously provided low-interest loans to support renewable energy projects, similar financing options are currently lacking in Tuvalu.

To address these barriers, the TAP proposes a suite of financial support mechanisms, including government subsidies, low-interest loans, and tax exemptions for biogas investors. Additionally, international funding sources, such as the Global Environment Facility (GEF) and the Green Climate Fund (GCF), will be explored to cover the high upfront costs associated with biogas projects. Establishing these funding mechanisms is essential to reduce the financial burden and make biogas development more viable within Tuvalu's energy sector.

Technical Barriers

A lack of local expertise in biogas production and management, coupled with inadequate infrastructure for processing, storage, and distribution and its digesters, presents technical challenges for the widespread adoption of biogas in Tuvalu. Establishing effective systems for biogas production, including digesters, and ensuring reliable storage and distribution networks are essential steps for successful integration. The TAP will address these issues by implementing capacity-building programs to train local engineers and technicians in the

operation, maintenance, and optimization of biogas systems and digesters. Additionally, international partnerships with organizations experienced in biogas technologies will be pursued to facilitate knowledge transfer. To support biogas adoption, the TAP emphasizes the construction of necessary infrastructure, including biogas production facilities, digesters, and storage systems revised section provides clarity on the infrastructure components related to biogas technology, specifically including digesters as part of the processing system. This addition ensures alignment with the comment and offers a more complete view of the technical needs for biogas in Tuvalu.

Social and Cultural Barriers

Public awareness of the benefits of biogas for cooking specifically remains low in Tuvalu, and there may be resistance to adopting new cooking technologies. To address this, the TAP will implement public awareness campaigns focused on educating households about the environmental, economic, and health benefits of biogas as a cooking fuel. These campaigns will emphasize how biogas can reduce dependence on imported fossil fuels, offer cost savings, and provide a cleaner, safer alternative for daily cooking. By clearly demonstrating these advantages, the TAP aims to encourage acceptance and adoption of biogas technology within Tuvaluan households.

Regulatory Barriers

Currently, Tuvalu lacks a clear regulatory framework that promotes the development and use of biogas. The TAP will work to establish comprehensive national policies that incentivize biogas production and use. These policies will include standards for biogas quality, safety regulations, and incentives for private investment in biogas infrastructure. The introduction of biogas mandates for specific sectors, such as cooking and electricity generation, will ensure consistent demand for biogas, promoting its integration into the country's energy mix.

Strategic Actions and Activities for Biogas Integration in Tuvalu's Energy Sector

The TAP outlines several strategic actions and activities aimed at reducing fossil fuel use and increasing biogas integration in Tuvalu's energy mix. These actions are designed to address the barriers identified above and create an enabling environment for biogas adoption.

1. Establishing Small-Scale Biogas Production Facilities

One of the key actions in the TAP is the establishment of small-scale biogas production facilities that use locally available organic waste, such as agricultural residues and food waste. These facilities will provide a sustainable, low-cost alternative to fossil fuels. The initial phase of this action will involve conducting feasibility studies to identify suitable locations and feedstocks for biogas production. Based on these studies, pilot projects will be implemented to test biogas production on a small scale. Successful pilot projects will then inform the scaling up of biogas production facilities across the country.

2. Developing Biogas Infrastructure

The TAP emphasizes the need to develop infrastructure for biogas storage and distribution. This includes the construction of biogas storage tanks, digesters, and distribution networks at key locations. The infrastructure development will be phased, with an initial focus on areas with high potential for biogas production, such as agricultural and urban centres. The

establishment of reliable biogas infrastructure will ensure the consistent and safe supply of biogas to households and businesses.

3. Capacity Building and Public Awareness Programs

Capacity building is essential to ensure that local engineers, technicians, and operators have the necessary skills to manage biogas technologies. The TAP will implement training programs, facilitated by international organisations such as UNEP and GCF, to build the technical capacity of local stakeholders. Simultaneously, public awareness campaigns will be launched to educate citizens about the benefits of biogas, particularly its role in reducing GHG emissions and improving waste management. These campaigns will target schools, community groups, and local businesses to encourage widespread participation in biogas projects.

4. Policy and Institutional Strengthening

The TAP will support the development of a national Biogas Policy that provides a clear regulatory framework for the production and use of biogas. This policy will establish biogas quality standards and mandates for biogas use in sectors such as cooking and electricity generation. Additionally, the policy will include financial incentives, such as tax breaks and subsidies, to encourage private investment in biogas infrastructure.

Actions to be Implemented as Project Ideas

To achieve the goals of the TAP, several key actions and activities have been identified. These actions focus on establishing the necessary infrastructure, building technical capacity, engaging the public, and creating supportive policies.

1. Establishing Small-Scale Biogas Production Facilities: The TAP proposes the establishment of small-scale Biogas production facilities that will use locally available organic waste and agricultural residues. These facilities will provide a sustainable alternative to fossil fuels and will be scaled based on the results of initial pilot projects.
2. Developing Biogas Infrastructure: To ensure the successful integration of Biogas into the energy and transport sectors, the TAP includes plans for developing the necessary infrastructure, including biogas storage, blending facilities, and distribution networks. This infrastructure will enable the consistent supply and use of biogas throughout the country.
3. Capacity Building and Public Awareness Programs: Capacity building is essential to ensure that local engineers and technicians have the skills needed to manage biogas technologies. The TAP will also implement public awareness campaigns to educate the public about the benefits of biogass and their role in reducing GHG emissions.

To achieve the TAP's goals, several key actions and activities have been identified, including:

1. Establishing Small-Scale Biogas Production Facilities

- These facilities will use organic waste and agricultural residues to produce biogas. Initial pilot projects will inform the scaling up of biogas production across the country.

2. Developing Biogas Infrastructure

- Building biogas storage tanks, digesters, and distribution networks will ensure the reliable supply of biogas throughout Tuvalu, particularly in areas with high organic waste production.

3. Capacity Building and Public Awareness Programs

- Training programs for local engineers and technicians will be established, while public awareness campaigns will engage communities in biogas projects and highlight the benefits of renewable energy.

4. Policy and Regulatory Support

- A national Biogas Policy will be developed to create a conducive environment for biogas production, ensuring regulatory support and financial incentives for biogas projects.

2.1.4 Stakeholders and Timeline for implementation of TAP

The successful implementation of the Technology Action Plan (TAP) for biogas in Tuvalu will require the active participation of a wide range of stakeholders. Each stakeholder will play a vital role in the development, execution, and scaling of biogas projects to ensure the TAP's objectives are met. Below is an outline of the key stakeholders, along with their respective roles in the biogas implementation process.

1.Government of Tuvalu

- The Government of Tuvalu will take on the central role in driving the policy development, regulatory enforcement, and overall coordination of the biogas initiatives. The government's primary responsibilities include:
- Policy Development and Regulation: Developing a comprehensive Biogas Policy that includes incentives for biogas production, use, and integration in sectors like cooking and electricity generation. The government will also be responsible for setting up safety and quality standards for biogas technologies.
- Coordination and Oversight: Leading inter-ministerial efforts to ensure the integration of biogas into national energy plans and climate goals, particularly under the Tuvalu National Energy Policy (TNEP) and the Nationally Determined Contributions (NDC).
- Financial Support: Providing subsidies, tax breaks, and financial incentives to encourage private sector investment in biogas infrastructure and technologies.

Key government bodies involved:

- Department of Climate Change and Disaster: Leading overall coordination of climate-related projects.
- Department of Public Works and the Department of Energy: Overseeing the integration of biogas into the national energy grid.
- Ministry of Finance: Managing subsidies, financial incentives, and liaising with international donors to mobilise funds for biogas projects.

2. Private Sector

Private sector entities will play a crucial role in investing in the necessary infrastructure for biogas production and distribution. Their primary roles include:

- Investment in Biogas Infrastructure: Establishing biogas production facilities, such as small-scale digesters, as well as storage and distribution systems. These investments will help ensure the scalability and sustainability of biogas projects.
- Partnerships with Local Communities: Collaborating with local farmers and communities to secure feedstock such as agricultural residues, food waste, and organic material for biogas production.

- Innovation and Efficiency: Leading research and development initiatives to improve the efficiency of biogas technologies and make them more cost-effective for local use.

Private sector participants may include:

- Renewable energy companies: Focused on biogas production and distribution.
- Agricultural businesses: Providing organic waste for use as feedstock in biogas production.

3. Local Communities and Civil Society Organizations

The involvement of local communities is essential for the successful deployment and long-term sustainability of biogas projects. Communities and civil society organisations (CSOs) will contribute to:

- Feedstock Collection and Management: Local communities will supply organic waste such as food scraps, animal manure, and agricultural residues for biogas production, fostering a circular economy at the grassroots level.
- Public Awareness and Engagement: Local leaders, CSOs, and schools will help educate the public on the benefits of biogas technology, especially its role in reducing reliance on imported fossil fuels and enhancing waste management.
- Community-Led Biogas Projects: Community-based organisations will be instrumental in leading small-scale biogas pilot projects, creating a sense of ownership and fostering local capacity to manage these systems.

Key roles for civil society:

- NGOs: Supporting community engagement and public awareness campaigns.
- Educational institutions: Integrating biogas technology education into school curriculums and local workshops.

4. International Partners and Donors

International donors and partners will provide the financial and technical assistance necessary for the successful implementation of the TAP. Their roles include:

- Funding and Financial Support: Organisations such as the Green Climate Fund (GCF), Global Environment Facility (GEF), and United Nations Environment Programme (UNEP) will offer grants, loans, and other financial mechanisms to support the capital-intensive aspects of biogas production, such as the construction of digesters and storage facilities.
- Technical Expertise and Capacity Building: International partners will facilitate the transfer of technical know-how, providing training programs for local engineers, technicians, and policymakers. This includes capacity-building initiatives to ensure long-term sustainability and local management of biogas systems.
- Monitoring and Evaluation: Supporting the establishment of monitoring and evaluation systems to track progress and ensure the effective implementation of biogas projects over time.

Key international stakeholders:

- GCF, GEF: Providing financial assistance and resources for large-scale biogas infrastructure.
- UNEP CCC, UNDP: Facilitating technical support and capacity building.

5. Research and Academic Institutions

Academic institutions and research bodies will contribute to the technical advancement and localization of biogas technology in Tuvalu. Their roles include:

- Research and Development (R&D): Conducting studies on feedstock availability, biogas production potential, and new technologies that can improve biogas efficiency and reduce costs.
- Capacity Building: Working closely with the government and private sector to develop training programs aimed at building local expertise in biogas technology and operations.
- Monitoring and Evaluation: Academic institutions will assist in designing methodologies for assessing the environmental and economic impacts of biogas projects.

Institutions involved:

- University of the South Pacific (USP): Providing technical support and research related to biogas development in Pacific Island contexts.

The timeline for the implementation of the TAP is outlined below:

Table 2: Implementation of the TAP - Biogas

Action	Short-term (1-2 years)	Medium-term (3-5 years)	Long-term (6-10 years)
Feasibility Study	Conduct feasibility study for biogas production for household cooking applications.	-	-
Pilot Biogas Facilities	Establish small-scale pilot projects	Evaluate and scale up successful pilots	Full-scale biogas production

Infrastructure Development	Begin initial infrastructure development	Expand infrastructure across additional sites	Maintain and optimise infrastructure
Capacity Building	Launch training programs for local technicians	Continue training and knowledge transfer	Ensure sustainability through capacity-building programs
Public Awareness Campaigns	Launch initial awareness campaigns	Ongoing public engagement	Maintain public support through targeted campaigns
Policy Development	Draft and implement the Biogas Policy which includes establishing a financing facility to support the biogas projects.	Monitor compliance, evaluate the impact of the financing facility, and adjust policies as needed to ensure effective financial support for biogas adoption.	Review and update policies and financing mechanisms to maintain long-term support for biogas infrastructure and technology improvements.

This phased approach ensures that the TAP remains flexible and adaptive, allowing for adjustments based on the results of pilot projects and evolving conditions in Tuvalu's energy sector. Continuous engagement with stakeholders across all levels will be key to ensuring that the biogas initiatives are scaled effectively and sustainably.

2.1.5 Estimation of Resources Needed for Action and Activities

The successful implementation of the Technology Action Plan (TAP) for biogas will require substantial financial investments from both domestic and international sources. The estimated cost of implementing the TAP is approximately $2.85 million, covering feasibility studies, infrastructure development, capacity building, and public awareness campaigns.

The financial sustainability of the TAP is critical to its success. Below is a breakdown of the estimated costs associated with key actions in the plan, along with potential funding sources. These estimates encompass infrastructure development, capacity building, and policy implementation.

Table 3: Estimation of resources Needed for Action and Activities

Action	Estimated Cost (USD) - Cookin	Estimated Cost (USD) Electrici	Funding Source(s)	Description

	g Digesters	ty Generation		
Feasibility Study	$60,000	$60,000	GEF, Bilateral Aid	Conduct feasibility study to identify potential sites and feedstocks for biogas production, with assessments for both household cooking and electricity generation.
Pilot Biogas Facilities	$300,000	$250,000	GCF, Private Sector, Bilateral Partners	Develop and set up small-scale pilot biogas plants to test the feasibility of using local organic waste as feedstock, focusing on separate setups for cooking and electricity applications.
Infrastructure Development	$1,200,000	$1,000,000	GCF, GEF, Government of Tuvalu	Build biogas production, storage, and distribution systems, with infrastructure tailored for both household cooking digesters and electricity generation requirements.
Capacity Building & Training	$150,000	$125,000	UNEP, GEF	Implement training programs for local engineers, technicians, and plant operators to manage and maintain biogas systems for both cooking and electricity generation.
Public Awareness Campaigns	$100,000	$65,000	International NGOs, GEF	Launch public awareness and educational campaigns to promote adoption of biogas technology for both household cooking and electricity generation.
Policy Development and Implementation	$100,000	$100,000	Government of Tuvalu	Develop and implement national biogas policies, regulatory frameworks, and quality standards to support integration for both cooking and electricity generation applications.

Estimation of Capacity Building Needs

Capacity building is essential for the successful implementation and long-term sustainability of biogas technology in Tuvalu. The TAP will focus on building local expertise through training programs for engineers, technicians, and plant operators to ensure they have the skills to

manage and maintain biogas facilities. These training programs will be supported by international partners like the United Nations Environment Programme (UNEP) and will include both technical skills for plant operations and knowledge of biogas technology for policy development.

The following capacity-building activities are planned:

- Technical Training for Engineers and Technicians: Training on how to design, build, operate, and maintain biogas plants.
- Public Sector Capacity Building: Strengthening government officials' understanding of biogas policies, regulatory frameworks, and project management.
- Community Engagement Programs: Educating local communities on how to collect organic waste for biogas production and encouraging participation in feedstock management.

Estimations of Costs for Actions and Activities

The estimated cost for implementing the TAP for biogas in Tuvalu, based on the activities outlined above, is approximately $2.85 million. This estimation builds on the economic assessments conducted in the Barrier Analysis and Enabling Framework (BAEF) report, which identified the measures required for overcoming barriers to biogas adoption.

The costs cover:

- Infrastructure Development: Including biogas production facilities and storage units.
- Capacity Building: Training programs and community engagement initiatives.
- Policy and Regulatory Framework: Development and implementation of a biogas policy that includes mandates, quality standards, and financial incentives.

2.1.6 Management Planning

The Management Planning section of the Biogas Technology Action Plan (TAP) focuses on ensuring that the implementation process is well-structured, risks are properly managed, and critical steps are taken to achieve the objectives. As a small island nation, Tuvalu faces unique challenges, including limited financial resources, technical capacity, and vulnerability to external factors such as global market fluctuations. This section evaluates whether the proposed plans are realistic and provides a strategic roadmap to mitigate risks and ensure the success of biogas integration.

Risks and Contingency Planning

Given the economic, technical, and social conditions in Tuvalu, it is essential to identify key risks that could hinder the success of the TAP and develop contingency measures to address them. This approach ensures that the TAP is adaptable, flexible, and capable of responding to internal and external challenges.

1. Economic Risks:

- Identified Risk: Tuvalu's dependence on international funding and market fluctuations poses an economic risk. A drop-in fuel prices, for example, could reduce the financial incentive for biogas, making fossil fuels more attractive.
- Contingency Plan: Tuvalu will establish a financial buffer through international funding mechanisms such as concessional loans and grants from the Global Environment Facility (GEF) and the Green Climate Fund (GCF). This buffer will help stabilise biogas projects during periods of market uncertainty. Additionally, government subsidies and tax incentives will be maintained to ensure biogas remains competitive.

2. Technical Risks:

- Identified Risk: Limited local technical expertise in biogas technology and plant operation could result in poor performance or facility failures. Additionally, the availability of consistent feedstock, necessary for biogas production, may be limited due to the small scale of local agriculture and livestock operations.
- Contingency Plan: On-the-job training programs will be implemented, supported by international partners like UNEP, to build local capacity. These programs will focus on operating and maintaining biogas plants, as well as managing feedstock requirements effectively. To address potential feedstock shortages, the TAP will explore partnerships with local agricultural sectors and consider establishing commercial piggery operations as dedicated sources of organic waste. Regular technical assessments will also be conducted to ensure biogas facilities are performing optimally and that feedstock supply is adequate to maintain consistent production.

3. Social Risks:

- Identified Risk: Public acceptance of biogas technology may be low if the population does not fully understand its benefits, which could result in resistance to biogas projects.
- Contingency Plan: Public awareness campaigns will educate the population about the environmental and economic benefits of biogas, such as reduced greenhouse gas emissions and improved waste management. Community participation in biogas projects, such as feedstock collection, will also be encouraged to foster ownership and local support.

4. Regulatory Risks:

- Identified Risk: Delays in developing and implementing biogas-supportive policies and regulations could slow adoption.
- Contingency Plan: Early engagement with policymakers and regulatory bodies is critical. A dedicated policy advocacy team within the Project Management Unit (PMU) will work closely with the government to expedite the development of biogas policies, including blending mandates and quality standards. Temporary regulatory measures, such as tax breaks, may also be introduced to accelerate biogas adoption.

2.1.7 Next Steps

The next steps for the Biogas TAP are focused on addressing immediate requirements and ensuring that critical actions are taken to set the project on the right path. By identifying these steps, the government and stakeholders can effectively commit resources to ensure success.

1. Immediate Requirements to Proceed

a. Securing Funding:

- Critical Action: The immediate priority is to secure funding from international donors and climate financing mechanisms, such as GEF, GCF, and bilateral partners. The Ministry of Energy will lead funding negotiations and ensure sufficient capital for feasibility studies, infrastructure development, and capacity building.

b. Conducting a Feasibility Study:

- Critical Action: A feasibility study is essential to assess the technical, financial, and environmental aspects of biogas production. This study will identify suitable locations for biogas plants, assess feedstock availability, and evaluate potential environmental impacts.

c. Establishing the Project Management Unit (PMU):

- Critical Action: The PMU must be established within the Ministry of Energy to coordinate all TAP activities, monitor progress, and ensure effective use of funds. The PMU will work closely with key stakeholders and the Project Steering Committee to align biogas projects with national goals.

d. Stakeholder Engagement and Public-Private Partnerships (PPPs):

- Critical Action: Immediate engagement with the private sector is required to attract investment in biogas infrastructure. Public-private partnerships (PPPs) will help share the financial burden, and community engagement will be critical to ensure local participation and buy-in.

2. Critical Steps to Succeed

a. Policy and Regulatory Framework Development:

- Critical Action: Developing a biogas policy that includes blending mandates, tax incentives, and quality standards is essential for ensuring the long-term success of the TAP. The Ministry of Energy will work with the Ministry of Environment to draft and implement the necessary regulatory framework.

b. Capacity Building and Technical Training:

- Critical Action: Capacity building is key to ensuring the long-term sustainability of biogas projects. Training programs will be implemented in collaboration with international experts to train local technicians, plant operators, and government officials.

c. Infrastructure Development:

- Critical Action: Developing the infrastructure for biogas storage and distribution is critical to integrating biogas into Tuvalu's energy grid. Partnerships with private investors and international donors will be key to financing and constructing this infrastructure.

d. Public Awareness and Community Engagement:

- Critical Action: A strong public awareness campaign is needed to educate the population on the benefits of biogas. Engaging local communities in feedstock sourcing and biogas plant operations will be essential for ensuring public support.

e. Continuous Monitoring and Evaluation (M&E):

- Critical Action: A robust Monitoring and Evaluation (M&E) framework will be established to track the progress of the TAP. The PMU will be responsible for data collection, reporting, and conducting evaluations to ensure that goals are being met and adjustments are made as needed.

2.1.8 TAP overview table (Biogas)

Table 4 - TAP Overview Table for Biogas

TAP overview table								
Sector	Energy							
Sub-sector	Transport and Energy							
Technology	Biogas							
Ambition	30% fossil fuel replacement in Energy by 2030							
Benefits	Reduce GHG emission, enhanced energy security, reduced reliance on imported fossil fuels							
Action	**Activities to be implemented**	**Sources of funding**	**Responsible body and focal point**	**Time frame**	**Risks**	**Success criteria**	**Indicators for Monitoring of implementation**	**Budget per activity**
1. Feasibility Study for Biogas Production	**Activity 1.1:** Conduct feasibility study to identify potential sites and feedstocks for biogas production	GEF, Bilateral Aid	Government of Tuvalu, GCF	Short term	Lack of data or technical capacity	Completion of feasibility study, identification of viable sites	Feasibility study report, list of viable sites	**USD 100,000**
	Activity 1.2: Technical assessment and impact analysis for potential feedstock sources and site locations							
	Activity 1.3: Environmental and social impact							

	assessment (ESIA) for identified sites							
2. Establish Small-scale Biogas Production	**Activity 2.1** Develop biogas plants across Tuvalu using agricultural and organic waste	National Budget, GCF, GEF	Ministry of Energy	Medium Term	Lack of funding	Number of plants established	Number of subsidies disbursed subsidy allocation rate	**USD 450,000**
	Activity 2.2: Secure land and feedstock for biogas production				Land ownership or availability issues	Securing land and feedstock arrangements	Signed agreements for land and feedstock	
	Activity 2.3: Set up pilot biogas production facilities				Potential delays in setting up pilot project	Establishment of functional pilot facilities	Number of pilot projects established	USD 250,000
3. Investment in Biogas Infrastructure	**Activity 3.1:** Build biogas storage and distribution systems for grid and transport sector	International Partnership	Department of Energy, Academia, NGOs	Short term	Lack of skilled personnel	Successful development of biogas infrastructure	Number of biogas storage tanks and distribution channels built	**USD 1,800,000**

	Activity 3.2: Construction of biogas storage tanks							
	Activity 3.3: Develop biogas distribution channels							
4. Capacity Building and Training Programs	**Activity 4.1:** Establish technical training for biogas plant operations	International Partnerships	Department of Energy, Academia, NGOs	Short-term	Lack of skilled personnel	Training programs developed and conducted	Number of certified technicians, training completion rate	**USD 250,000**
	Activity 4.2: Train engineers and technicians on biogas operations							
	Activity 4.3: Establish technical certification programs for biogas specialists							
5. Public Awareness and Policy Advocacy	**Activity 5.1** Awareness campaigns and policy advocacy for biogas	Government	Ministry of Environment	Medium-term	Regulatory hurdles, public opposition	Adoption of supportive policies, widespread public engagement	Policy implementation rate, public survey results	**USD 150,000**

	Activity 5.2: Engage communities to promote biogas							
	Activity 5.3: Advocate for biogas-supportive regulatory frameworks							
6. Scale-up Biogas Production	**Activity 6.1:** Expand biogas production facilities based on pilot success	GCF, Private Sector, Bilateral Partners	Ministry of Energy	Long-term	Production scalability challenges	Large-scale biogas production	Number of biogas plants in operation, capacity output	**USD 2,500,000**
	Activity 6.2: Develop additional biogas plants							
7. Monitoring and Evaluation of Biogas Integration	**Activity 7.1:** Establish robust M&E systems to track progress and ensure targets are met	GEF, Government	Government of Tuvalu, International Partners	Ongoing	Inadequate data collection	Periodic reporting and adjustments	Timely reports and feedback, emission reduction tracking	**USD 100,000**

	Activity 7.2: Regular data collection and impact analysis							
	Activity 7.3: Annual reporting and project reviews							

2.2 Action Plan for Technology A2 - Solar Photovoltaic (PV) and BESS

2.2.1 Introduction

Solar Photovoltaic (PV) technology, integrated with Battery Energy Storage Systems (BESS), has emerged as the most feasible and cost-effective renewable energy solution for Tuvalu. Given the nation's dependence on imported fossil fuels and the volatility of international energy markets, this technology offers a critical pathway to achieving energy security and sustainability. Solar PV + BESS has already been trialled and tested extensively in Tuvalu, demonstrating its effectiveness in reducing greenhouse gas emissions, stabilising energy supply, and ensuring consistent access to clean electricity.

In Step 1 of the Technology Needs Assessment (TNA) process, Solar PV + BESS was prioritised as the top renewable energy solution, with household-scale systems ranked 1st and national grid-scale systems ranked 2nd. This prioritisation reflects the technology's proven capacity to meet both residential and national energy needs. The combination of solar PV and energy storage ensures that excess solar energy generated during the day can be stored and used at night or during cloudy periods, reducing the reliance on diesel generators.

The selection of Solar PV + BESS for further analysis is driven by its potential to significantly lower energy costs, provide environmental benefits, and enhance Tuvalu's resilience to climate change. This technology not only mitigates the impacts of fossil fuel dependency but also aligns with the country's long-term goals for sustainable development.

2.2.2 Ambition for the TAP

The overarching ambition of the Technology Action Plan (TAP) for Solar PV with Battery Energy Storage Systems (BESS) is to align with the staged deployment outlined in the Tuvalu Energy Assessment and contribute significantly toward Tuvalu's goal of achieving 100% renewable energy (RE) by 2025. Specifically, the TAP aims to integrate Solar PV + BESS systems into the national grid to reduce the country's dependence on imported fossil fuels, enhance energy security, and lower greenhouse gas emissions, in line with the Tuvalu National Energy Policy (TNEP) and Tuvalu's Nationally Determined Contribution (NDC) under the Paris Agreement.

The TAP will support the phased implementation outlined in the Tuvalu Energy Assessment, which includes:

- **Stage 1**: Installation of 1250 kWp Solar PV and 2000 kW/3000 kWh BESS, funded by the Asian Development Bank (ADB) and the World Bank.
- **Stage 2:** Expansion to 2400 kWp Solar PV and 2000 kW/3000 kWh BESS, for which no confirmed funding is available but remains critical to achieving energy independence.
- **Stage 3**: Full deployment of 3300 kWp Solar PV and 1000 kW/11,000 kWh BESS, a final step towards meeting Tuvalu's 100% RE target.

The TAP aims to align with these stages by providing a strategic framework that addresses the technical, financial, regulatory, and capacity-building challenges associated with large-scale Solar PV + BESS implementation. This includes attracting additional funding for Stages 2 and 3, developing the necessary technical and institutional capacity to maintain and manage these systems, and fostering public-private partnerships to ensure the long-term sustainability of renewable energy projects.

By aligning the TAP with the Tuvalu Energy Assessment, the country aims to not only meet its ambitious renewable energy targets but also deliver socio-economic and environmental

benefits such as improved energy reliability, reduced air pollution, and increased resilience to climate change.

2.2.3 Actions and Activities selected for inclusion in the TAP.

a) Summary of barriers and measures to overcome barriers

The adoption of Solar PV + Battery Energy Storage Systems (BESS) in Tuvalu faces several economic, financial, and non-financial barriers, which must be addressed to achieve the country's 100% renewable energy (RE) target.

Economically, the high initial investment and maintenance costs present significant obstacles. Due to Tuvalu's remote location, the cost of importing Solar PV and BESS components is elevated, compounded by the expenses related to system maintenance and battery replacement. Access to financing is another critical challenge, as Tuvalu heavily relies on international financial aid. Local financing options are limited, and private sector investment in the energy sector remains low. The high-risk perception of renewable energy projects further hampers efforts to secure loans and investment. To overcome these barriers, measures such as reducing import tariffs and taxes on renewable energy equipment, subsidising Solar PV + BESS projects through government and donor support, and fostering public-private partnerships (PPPs) are essential.

Non-financial barriers also hinder the large-scale deployment of Solar PV + BESS in Tuvalu. The Department of Energy, which oversees renewable energy initiatives, is understaffed and lacks the capacity to manage complex projects, delaying decision-making and project implementation. Additionally, unclear roles and responsibilities among supporting institutions result in coordination challenges. Furthermore, Tuvalu faces a shortage of skilled professionals who can install and maintain these systems, leading to increased reliance on foreign consultants and higher project costs. The grid infrastructure itself is not fully equipped to handle fluctuations in energy supply and demand, limiting the integration of renewable energy sources.

Moreover, environmental factors such as Tuvalu's vulnerability to climate change, including sea-level rise and extreme weather, pose significant risks to infrastructure resilience. On the social side, public awareness of the benefits of renewable energy remains low, limiting public support for Solar PV + BESS adoption.

To address these non-financial challenges, measures such as strengthening institutional capacity within the Department of Energy, developing a comprehensive renewable energy policy, enhancing local technical expertise through training programs, and upgrading the national grid to accommodate renewable energy integration are vital. Public awareness campaigns and climate-proofing infrastructure are also essential to ensure the long-term sustainability of renewable energy projects in Tuvalu.

Table 5: Overview of Solar PV Barriers and Measures to overcome these

Categories	Identified Barriers	Measures to overcome barriers

Economic	High investment cost and maintenance cost	Reduce import tariffs and taxes on solar PV + BESS Components Subsidise Solar PV + BESS projects through government and donor support. Encourage public-private-partnerships
	Limited access to financing	Develop credit lines and green financing mechanisms. Attract international donor support
Non-Economic	Limited capacity of the Department of Energy.	Strengthen institutional capacity through training programs.
	Unclear roles and responsibilities among institutions	Develop a comprehensive renewable energy policy.
	Limited technical expertise for installation and maintenance	Enhance local technical expertise through training programs.
	Grid limitation and energy demand fluctuations	Upgrade grid infrastructure.
	Vulnerability to climate impacts	Climate-proof infrastructure.
	Low public awareness of renewable energy benefits.	Conduct community awareness campaigns. Link renewable energy to climate change educational programs.

By addressing these barriers through targeted interventions, Tuvalu can create the necessary conditions for the successful adoption of Solar PV + BESS, ensuring energy security, reducing reliance on fossil fuels, and contributing to climate change mitigation efforts.

b) Framework for ranking measures for inclusion as Actions selected for the TAP.

c) Actions selected for inclusion as Actions selected for the TAP.

See Annex II for the framework for ranking measures and ration for the selection of Actions for the TAP.

The selection of Actions was done in close consultation with TNA Mitigation Stakeholders. Six measures have been taken as actions for developing TAP for Solar PV (National Grid) + BESS as summarised in the Table below.

Table 6: Measures selected as Actions for inclusion in TAP.

Categories	Identified measures to overcome barriers	Measures selected as actions for inclusion in TAP
Economic	Reduce import tariffs and taxes on solar PV + BESS Components (8) [1]Subsidise Solar PV + BESS projects through government and donor support (2) Encourage public-private-partnerships (12)	Subsidise Solar PV + BESS projects through government and donor support. Attract international donor support.
	Develop credit lines and green financing mechanisms (7) Attract international donor support (1)	
Non-Economic	Strengthen institutional capacity through training programs. (5)	Strengthen institutional capacity through training programs.
	Develop a comprehensive renewable energy policy. (3)	Develop a comprehensive renewable energy policy.
	Enhance local technical expertise through training programs. (6)	Enhance local technical expertise through training programs.
	Upgrade grid infrastructure. (4)	
	Climate-proof infrastructure. (9)	Upgrade grid infrastructure.

[1] (Numbers) denotes ranking of identified measures.

	Conduct community awareness campaigns. (10) Link renewable energy to climate change educational programs. (11)	

d) Activities identified for implementation of selected Actions.

Action 1: Attract international donor support.
Tuvalu seeks to enhance its renewable energy infrastructure by attracting international donor support for Solar PV + BESS systems and other sustainable energy initiatives. Given the country's reliance on donor funding for large-scale infrastructure, the Government of Tuvalu, in collaboration with key stakeholders, will focus on engaging development partners and international financial institutions to secure funding for renewable energy projects. The action will involve identifying key donors, preparing detailed proposals, and establishing mechanisms to manage and monitor donor-supported projects efficiently.

Table 7: Specific Activities to support Action 1

Specific activities to support the Action
Activity 1.1: Identify potential international donors/ DFIs
Activity 1.2: Prepare concept notes and project proposals.
Activity 1.3: Strengthen donor coordination mechanisms.
Activity 1.4: Conduct donor outreach and partnerships.
Activity 1.5: Establish a project management and reporting framework.
Activity 1.6: Provide periodic updates and reporting.
Activity 1.7: Develop post-donor support sustainability plans.

This set of activities aims to systematically attract and secure international donor support for Tuvalu's renewable energy transition, ensuring that Solar PV + BESS projects are well-funded and effectively managed to achieve the country's ambitious 100% renewable energy goals.

Action 2: Subsidise Solar PV + BESS projects through government and donor support.

Subsidizing Solar PV + Battery Energy Storage System (BESS) projects are a key initiative to promote renewable energy adoption in Tuvalu by reducing the financial burden on households, businesses, and public institutions. The Government of Tuvalu, with support from

international donors, aims to develop a structured subsidy program that lowers upfront costs and incentivizes the transition to clean energy. This action will involve designing the subsidy framework, securing donor funding, and implementing efficient disbursement and monitoring mechanisms. Additionally, the program seeks to attract new investors, foster public-private partnerships, and encourage the participation of independent power producers, thereby enhancing the sustainability and scalability of renewable energy initiatives in Tuvalu.

Table 8: Specific Activities to support Action 2

Specific activities to support the Action
Activity 2.1: Design subsidy framework and eligibility criteria
Activity 2.2: Secure donor funding and government budget allocation
Activity 2.3: Develop application and disbursement process
Activity 2.4: Collaborate with local financial institutions
Activity 2.5: Public awareness and outreach campaigns
Activity 2.6: Monitor and evaluate subsidy impact
Activity 2.7: Adjust subsidy levels based on market trends and project success

These activities are designed to create a robust and accessible subsidy program that encourages broad adoption of Solar PV + BESS in Tuvalu. By working with both the government and international donors, the country can ensure that renewable energy solutions are affordable and widely implemented across all sectors.

Action 3: Develop a comprehensive renewable energy policy.

The development of a comprehensive Renewable Energy Policy in addition to the TNEP, which is critical to providing a clear regulatory framework, setting ambitious but achievable goals, and coordinating efforts to transition Tuvalu to 100% renewable energy by 2025. This action will involve stakeholder consultations, drafting policy documents, and establishing mechanisms for policy implementation, monitoring, and evaluation.

Table 9: Specific Activities to support Action 3

Specific activities to support the Action
Activity 3.1: Conduct stakeholder consultations
Activity 3.2: Review existing legislation and international best practices

Activity 3.3: Draft the comprehensive renewable energy policy
Activity 3.4: Define institutional roles and responsibilities
Activity 3.5: Establish legal and regulatory frameworks
Activity 3.6: Secure government approval and legislative backing
Activity 3.7: Implement public awareness and capacity-building programs
Activity 3.8: Develop an implementation plan
Activity 3.9: Monitor and evaluate policy implementation

These activities ensure that the comprehensive renewable energy policy will be inclusive, well-researched, and strategically implemented. A clear policy framework will guide Tuvalu's transition to renewable energy, attract investment, and provide legal certainty for all stakeholders involved.

Action 4: Upgrade grid infrastructure.

Upgrading Tuvalu's grid infrastructure is essential to support the integration of renewable energy sources, such as Solar PV + BESS, and to ensure the reliability, stability, and efficiency of electricity supply. This action will involve technical assessments, planning, funding, and the implementation of necessary grid upgrades to handle fluctuations in supply and demand, as well as future increases in renewable energy generation capacity.

Table 10: Specific Activities to support Action 4

Specific activities to support the Action
Activity 4.1: Conduct technical assessments of existing grid infrastructure
Activity 4.2: Develop a grid upgrade plan
Activity 4.3: Secure funding for grid upgrades
Activity 4.4: Upgrade transmission and distribution lines
Activity 4.5: Integrate smart grid technologies
Activity 4.6: Increase grid storage capacity

Activity 4.7: Train local technicians and engineers for grid maintenance
Activity 4.8: Establish grid resilience measures
Activity 4.9: Monitor and evaluate grid performance
Activity 4.10: Explore regional grid connectivity

These activities are designed to ensure that Tuvalu's grid infrastructure is robust enough to handle the increased penetration of renewable energy, support future growth in demand, and withstand the impacts of climate change. By upgrading the grid, Tuvalu will be better positioned to achieve its goal of 100% renewable energy while maintaining a stable and reliable electricity supply.

Action 5: Strengthen institutional capacity through training programs.

Strengthening institutional capacity through targeted training programs is essential to support the effective planning, implementation, and maintenance of renewable energy projects like Solar PV + BESS in Tuvalu. This action will focus on enhancing the knowledge, skills, and technical expertise of government agencies, local technicians, engineers, and project managers to ensure the successful deployment and long-term sustainability of renewable energy infrastructure.

Table 11: Specific Activities to support Action 5

Specific activities to support the Action
Activity 5.1: Conduct a skills gap assessment
Activity 5.2: Develop a comprehensive training curriculum
Activity 5.3: Establish partnerships with international organisations for training
Activity 5.4: Implement technical training programs for local engineers and technicians
Activity 5.5: Provide policy and regulatory training for government officials
Activity 5.6: Build project management and M&E capacity
Activity 5.7: Establish a knowledge-sharing platform
Activity 5.8: Develop certification programs for renewable energy technicians

Activity 5.9: Implement refresher training and continuous learning programs
Activity 5.10: Monitor and evaluate the effectiveness of training programs

These activities aim to build a strong foundation of local expertise, ensuring that Tuvalu's institutions and workforce are capable of managing the country's transition to renewable energy. By investing in institutional capacity, the government will be better positioned to oversee the implementation of Solar PV + BESS projects and ensure long-term sustainability.

Action 6: Enhance local technical expertise through training programs.

Enhancing local technical expertise is vital for ensuring the successful installation, operation, and maintenance of Solar PV + BESS systems in Tuvalu. This action will focus on building the technical capacity of local engineers, technicians, and energy professionals through specialised training programs, ensuring that Tuvalu can manage and sustain its renewable energy infrastructure independently, without relying heavily on foreign expertise.

Table 12: Specific Activities to support Action 6

Specific activities to support the Action
Activity 6.1: Conduct a technical skills gap analysis
Activity 6.2: Develop specialised training modules for renewable energy
Activity 6.3: Partner with international agencies for technical training
Activity 6.4: Organise hands-on technical training for installation and maintenance, including financing options and scholarship opportunities.
Activity 6.5: Train local trainers for sustainable capacity building (train-the-trainers)
Activity 6.6: Certify local technicians and engineers
Activity 6.7: Develop an apprenticeship program
Activity 6.8: Provide refresher training and upskilling opportunities
Activity 6.9: Create a local knowledge-sharing platform
Activity 6.10: Monitor and evaluate the impact of technical training

By implementing these activities, Tuvalu will build a strong foundation of local technical expertise capable of managing Solar PV + BESS projects, reducing reliance on external consultants, and ensuring the long-term sustainability of renewable energy systems in the country.

2.2.4 Stakeholders and Timeline for implementation of TAP

a) Overview of Stakeholders for the Implementation of the TAP
b) Scheduling and sequencing of specific activities

Table 13: Stakeholders for Each Action and Activity + Scheduling and Sequencing

Identifying Stakeholders for Each Action and Activity | Scheduling and Sequencing							
Action	Activities	Responsibility		Planning		Implementation	
		WHO?		WHEN?			
		Primary & Focal Point	Secondary	Start Date	End Date	Start Date	End Date
1: Attract international donor support	Activity 1.1: Identify potential international donors/ DFIs	Department of Energy	Tuvalu Electricity Corporation (TEC) Climate Change Department Ministry of Finance Ministry of Foreign Affairs	Feb-25	Mar-25	Apr-25	May-25
	Activity 1.2: Prepare concept notes and project proposals.	Department of Energy	TEC Climate Change Department	Apr-25	Jun-25	Jul-25	Sep-25
	Activity 1.3: Strengthen donor coordination mechanisms.	Department of Energy	TEC Climate Change Department Ministry of Finance Ministry of Foreign Affairs	Aug-26	Mar-26	Apr-26	Sep-26

	Activity 1.4: Conduct donor outreach and partnerships.	Department of Energy	Climate Change Department Ministry of Finance Ministry of Foreign Affairs	Jan-26	Mar-26	Apr-26	Sep-26
	Activity 1.5: Establish a project management and reporting framework.	Department of Energy	TEC	Sep-26	Dec-26	Jan-27	Mar-27
	Activity 1.6: Provide periodic updates and reporting.	Department of Energy	TEC	Ongoing	Ongoing	Jan-27	Ongoing
	Activity 1.7: Develop post-donor support sustainability plans.	Department of Energy	TEC Climate Change Department	Mar-27	Apr-27	May-27	Jul-27
2: Subsidise Solar PV + BESS projects through government and donor support	Activity 2.1: Design subsidy framework and eligibility criteria	Department of Energy	TEC Ministry of Finance	Feb-25	Mar-25	Apr-25	May-25
	Activity 2.2: Secure donor funding and government budget allocation	Department of Energy	Climate Change Department Ministry of Finance Ministry of Foreign Affairs	Apr-25	May-25	Jun-25	Jul-25
	Activity 2.3: Develop application and disbursement process	Department of Energy	TEC Ministry of Finance	May-25	Jun-25	Jul-25	Aug-25

	Activity 2.4: Collaborate with local financial institutions	Department of Energy	Development Bank of Tuvalu (DBT) Ministry of Finance	Jun-25	Jul-25	Aug-25	Sep-25
	Activity 2.5: Public awareness and outreach campaigns	Department of Energy	Development Bank of Tuvalu (DBT) Tuvalu Media Services/ Tuvalu Government Communications Team	Aug-25	Sep-25	Oct-25	Dec-25
	Activity 2.6: Monitor and evaluate subsidy impact	Department of Energy	TEC	Ongoing	Ongoing	Jan-26	Ongoing
	Activity 2.7: Adjust subsidy levels based on market trends and project success	Department of Energy	DBT Ministry of Finance	Ongoing	Ongoing	Feb-26	Ongoing
3: Develop a comprehensive renewable energy policy.	Activity 3.1: Conduct stakeholder consultations	Department of Energy	Climate Change Department Attorney General's Office Consultant (supported by donor funding)	Feb-25	Mar-25	Apr-25	May-25
	Activity 3.2: Review existing legislation and international best practices	Department of Energy	Climate Change Department Attorney General's Office Consultant (support by donor	Mar-25	Apr-25	May-25	Jun-25

			funding)				
	Activity 3.3: Draft the comprehensive renewable energy policy	Department of Energy	Climate Change Department Attorney General's Office Consultant (support by donor funding)	May-25	Jul-25	Aug-25	Sep-25
	Activity 3.4: Define institutional roles and responsibilities	Department of Energy	Climate Change Department Attorney General's Office Consultant (support by donor funding)	Jul-25	Aug-25	Sep-25	Oct-25
	Activity 3.5: Establish legal and regulatory frameworks	Department of Energy	Climate Change Department Attorney General's Office Consultant (support by donor funding)	Sep-25	Oct-25	Nov-25	Dec-25

	Activity 3.6: Secure government approval and legislative backing	Department of Energy	Climate Change Department Attorney General's Office Consultant (support by donor funding)	Dec-25	Jan-26	Feb-26	Mar-26
	Activity 3.7: Implement public awareness and capacity-building programs	Department of Energy	Climate Change Department Attorney General's Office Tuvalu Media Services/	Feb-26	Mar-26	Apr-26	Jun-26
	Activity 3.8: Develop an implementation plan	Department of Energy	Climate Change Department Attorney General's Office	Apr-26	May-26	Apr-26	Jun-26
	Activity 3.9: Monitor and evaluate policy implementation	Department of Energy	Climate Change Department	Ongoing	Ongoing	Aug-26	Jul-26
4: Upgrade grid infrastructure	Activity 4.1: Conduct technical assessments of existing grid infrastructure	TEC	Department of Energy Climate Change Dept.	Feb-25	Mar-25	Apr-25	May-25
	Activity 4.2: Develop a grid upgrade plan	TEC	Department of Energy Climate Change Dept.	Apr-25	May-25	Jun-25	Jul-25
	Activity 4.3: Secure funding for	Department of Energy	TEC Ministry of Finance	Jun-25	Jan-26	Feb-26	Sep-26

	grid upgrades						
	Activity 4.4: Upgrade transmission and distribution lines	TEC	Foreign company (funded by donor)	Sep-26	Oct-26	Nov-26	May-27
	Activity 4.5: Integrate smart grid technologies	TEC	Foreign company (funded by donor)	Jan-27	Feb-27	Mar-27	Jul-27
	Activity 4.6: Increase grid storage capacity	TEC	Foreign company (funded by donor)	Apr-27	May-27	Jun-27	Dec-27
	Activity 4.7: Train local technicians and engineers for grid maintenance	Solar Energy Engineers (funded by donor)	TEC Department of Energy Private Sector	Jun-27	Jul-27	Aug-27	Sep-27
	Activity 4.8: Establish grid resilience measures	Solar Energy Engineers (funded by donor)	TEC	Aug-27	Sep-27	Oct-27	Dec-27
	Activity 4.9: Monitor and evaluate grid performance	Solar Energy Engineers (funded by donor)	TEC	Ongoing	Ongoing	Jan-28	Ongoing
	Activity 4.10: Explore regional grid connectivity	Solar Energy Engineers (funded by donor)	TEC	Jul-27	Aug-27	Sep-27	Dec-27
5: Strengthen institutional capacity through training programs.	Activity 5.1: Conduct a skills gap assessment	Department of Energy	All RE stakeholders	Feb-25	Mar-25	Apr-25	Mar-25
	Activity 5.2: Develop a comprehensive training curriculum	Department of Energy	International Consultant (donor funded)	Mar-25	Apr-25	May-25	Jun-25

	Activity 5.3: Establish partnerships with international organisations for training	Department of Energy	International Consultant (donor funded)	Apr-25	May-25	Jun-25	Jul-25
	Activity 5.4: Implement technical training programs for local engineers and technicians	Department of Energy	International Consultant (donor funded)	Jun-25	Jul-25	Aug-25	Oct-25
	Activity 5.5: Provide policy and regulatory training for government officials	Department of Energy	International Consultant (donor funded)	Aug-25	Sep-25	Oct-25	Nov-25
	Activity 5.6: Build project management and M&E capacity	Department of Energy	International Consultant (donor funded)	Oct-25	Nov-25	Dec-25	Jan-26
	Activity 5.7: Establish a knowledge-sharing platform	Department of Energy	International Consultant (donor funded) Other R.E. stakeholders	Jan-26	Feb-26	Mar-26	May-26
	Activity 5.8: Develop certification programs for renewable energy technicians	Department of Energy	International Consultant (donor funded)	May-26	Jun-26	Jul-26	Sep-26
	Activity 5.9: Implement refresher training and continuous learning programs	Department of Energy	International Consultant (donor funded)	Jul-26	Aug-26	Sep-26	Ongoing

	Activity 5.10: Monitor and evaluate the effectiveness of training programs	Department of Energy	International Consultant (donor funded)	Ongoing	Ongoing	Aug-26	Ongoing
6: Enhance local technical expertise through training programs.	Activity 6.1: Conduct a technical skills gap analysis	Department of Energy	International Consultant (donor funded)	Feb-25	Mar-25	Apr-25	May-25
	Activity 6.2: Develop specialised training modules for renewable energy	Department of Energy	International Consultant (donor funded)	Mar-25	Apr-25	May-25	Jun-25
	Activity 6.3: Partner with international agencies for technical training	Department of Energy	International Consultant (donor funded)	May-25	Jun-25	Jul-25	Sep-25
	Activity 6.4: Organise hands-on technical training for installation and maintenance	Department of Energy	International Consultant (donor funded)	Jul-25	Aug-25	Sep-25	Dec-25
	Activity 6.5: Train local trainers for sustainable capacity building (train-the-trainers)	Department of Energy	International Consultant (donor funded) TEC	Sep-25	Oct-25	Nov-25	Dec-25
	Activity 6.6: Certify local technicians and engineers	Department of Energy	International Consultant (donor funded) TEC Private Sector	Dec-25	Jan-26	Feb-26	Apr-26

	Activity 6.7: Develop an apprenticeship program	Department of Energy	International Consultant (donor funded) TEC	Jan-26	Feb-26	Jun-26	
	Activity 6.8: Provide refresher training and upskilling opportunities	Department of Energy	International Consultant (donor funded) TEC Private Sector	Jun-26	Jul-26	Aug-26	Ongoing
	Activity 6.9: Create a local knowledge-sharing platform	Department of Energy	International Consultant (donor funded) TEC	Aug-26	Sep-26	Oct-26	Dec-26
	Activity 6.10: Monitor and evaluate the impact of technical training	Department of Energy	International Consultant (donor funded) TEC	Ongoing	Ongoing	Jan-27	Ongoing

2.2.5 Estimation of Resources Needed for Action and Activities

a) Estimation of capacity building needs

To successfully implement the actions outlined for Solar PV + BESS deployment and broader renewable energy initiatives in Tuvalu, it is essential to build the capacity of all stakeholders involved. This will ensure efficient project execution, effective policy development, financial sustainability, and long-term project oversight. Capacity building will focus on technical, financial, legal, and institutional areas critical for the successful implementation of renewable energy infrastructure in Tuvalu.

Key Capacity Building Areas:

1. Technical Training and Knowledge Transfer

Local technicians and engineers, particularly those in the Tuvalu Electricity Corporation (TEC), require hands-on training in the installation, maintenance, and operation of Solar PV + BESS systems. International technical experts and technology suppliers will play a key role in

knowledge transfer. Training programs must also cover areas such as smart grid integration and climate-proofing infrastructure to ensure the long-term sustainability of the systems.

2. Financial and Subsidy Management
Financial institutions, such as the Development Bank of Tuvalu (DBT), will play a critical role in managing subsidies provided by the Government or donor support. Capacity building will focus on the efficient disbursement of subsidies. Institutions will need to be trained in tracking the impact of subsidies on renewable energy adoption. The Ministry of Finance will coordinate aid and ensure that donor contributions are aligned with Tuvalu's financial strategies.

3. Policy and Regulatory Framework Development
The Department of Energy and the Attorney General's Office will require extensive training in policy formulation and the amendment of legal and regulatory frameworks to support renewable energy adoption. This will include developing the necessary legal structures to govern Solar PV + BESS systems, creating incentives for renewable energy investment, and aligning Tuvalu's laws with any policy changes. Strengthening the capacity of the Attorney General's Office will be crucial to ensuring that all legal frameworks are updated in a timely manner to support the renewable energy transition.

4. Project Management and Monitoring
The Department of Energy and TEC staff need comprehensive training in project management and monitoring and evaluation (M&E). This will enable them to provide effective oversight of renewable energy projects, ensuring that timelines, budgets, and performance targets are met. Staff will also be trained to track project progress, report on key milestones, and ensure compliance with donor requirements. Project management tools and techniques will be introduced to facilitate efficient project execution and tracking.

5. Institutional Strengthening and Knowledge Sharing
All stakeholders, including the Department of Energy, TEC, Ministry of Finance, Ministry of Foreign Affairs, the private sector and the Attorney General's Office, will require capacity building to ensure that their roles are clearly defined and that each entity contributes to the overall success of renewable energy projects. For example:

- The Department of Energy will provide overall oversight and direction.
- TEC will be responsible for technical support, installation, and maintenance.
- The Ministry of Finance will manage financial resources, aid coordination, and budgeting.
- The Ministry of Foreign Affairs will communicate Tuvalu's energy needs to international development partners and potential donors.
- The private sector will complement services provided by Government/ TEC.
- The Attorney General's Office will ensure that Tuvalu's legal frameworks align with the renewable energy policies and any necessary amendments to laws.

6. Public Awareness and Outreach
Building the capacity of communication teams in the Department of Energy and TEC will be critical for raising public awareness of renewable energy initiatives. Public awareness campaigns will be designed to inform the general public, businesses, and government agencies about the benefits of Solar PV + BESS and the available financial incentives, including subsidies and credit lines.

Coordination and Partnerships
Development partners such as the Asian Development Bank (ADB), the World Bank, Ministry of Foreign Affairs & Trade of the Government of New Zealand (MFAT), the UAE, and technical

consultants will play a crucial role in providing expertise and training resources. Local educational institutions and technical institutes such as TASTII, with support from international agencies, will facilitate ongoing training and certification programs for renewable energy professionals.

b) Estimations of costs of actions and activities

Estimations of costs of actions and activities are detailed in Table 15 (Overview of TAP for Solar PV and BESS) below.

2.2.6 Management Planning

a) Risks and Contingency Planning

Table 14: Risks and Contingency Planning

Risks	Description	Contingency Action
Socio-economic instability	Economic shocks, e.g., fluctuating fuel prices, import costs, or changes in exchange rates could raise project costs.	Strengthen partnerships with international donors, seek concessional financing, and diversify funding sources to mitigate economic fluctuations.
Change in government policies	A change in government or leadership may shift national priorities, potentially delaying or altering renewable energy goals.	Develop cross-party consensus on renewable energy policy and institutionalise policies through legislative backing to ensure continuity.
Vulnerability to climate change	Tuvalu is highly vulnerable to climate change impacts like sea-level rise, extreme weather events, and coastal erosion, which could damage Solar PV + BESS infrastructure.	Design and climate-proof Solar PV + BESS infrastructure, incorporating resilience measures to withstand extreme climate conditions.
Technical capacity limitations	Limited local expertise in Solar PV + BESS technology could lead to delays in installation, maintenance, and management.	Implement ongoing technical training programs and partner with international experts to build local capacity in renewable energy management.
Funding shortages	Delays in securing sufficient funding for large-scale Solar PV + BESS projects, especially for Stages 2 and 3.	Develop robust project proposals, strengthen donor outreach, and establish partnerships with international financial institutions for sustained funding.
Grid infrastructure limitations	Tuvalu's existing grid infrastructure may be insufficient to support the integration of large-scale Solar PV + BESS.	Upgrade grid infrastructure alongside Solar PV + BESS projects, including investments in grid storage, smart grid technologies, and resilience measures.
Public awareness and engagement	Low public awareness of the benefits of Solar PV + BESS could lead to insufficient local support for the project.	Launch public awareness campaigns and engage communities early in the project development process to build support and ensure community involvement.

2.2.7 Next Steps

Immediate Requirements to Proceed:

1. Secure Initial Funding for Key Projects: Immediate action is required to secure funding for ongoing and planned Solar PV + BESS projects, particularly for Stages 2 and 3. Reaching out to international donors (such as ADB, World Bank, Italy, Japan, and other bilateral donors) and preparing comprehensive funding proposals will be critical. This includes both concessional financing and grants to mitigate financial risks.

2. Establish Cross-Sectoral Working Group: Form a task force that includes representatives from the Department of Energy, Tuvalu Electricity Corporation (TEC), Climate Change Department, Ministry of Finance, and Ministry of Foreign Affairs. This group will coordinate the activities across all relevant institutions and donors, ensuring consistent communication and avoiding delays in project implementation.

3. Develop Comprehensive Grid Upgrade Plan: Immediate technical assessments need to be carried out to determine the gaps in Tuvalu's grid infrastructure. A plan must be drawn to ensure that Solar PV + BESS integration is aligned with grid improvement and resilience measures. This plan will be essential for securing funding and moving forward with infrastructure investments.

4. Stakeholder Engagement and Community Awareness: Immediate outreach efforts should be focused on community engagement and raising public awareness about the benefits of renewable energy technologies, particularly Solar PV + BESS. Public support is key for long-term success, and early engagement will create a foundation for future buy-in.

5. Capacity Building for Key Personnel: Begin technical training and certification programs for engineers, technicians, and government personnel involved in renewable energy projects. This will build local expertise and reduce reliance on foreign consultants, ensuring that installation, operation, and maintenance can be handled locally.

Critical Steps to Succeed:

1. Finalise and Institutionalize Renewable Energy Policy: Developing and securing government approval for a comprehensive renewable energy policy is crucial for creating a stable policy environment. This policy must include clear institutional roles, grid integration strategies, and incentives for private and international investments. Ensuring legislative backing will provide policy continuity, even amid political changes.

2. Secure Full Funding for Stages 2 and 3 of Solar PV + BESS: The success of the Solar PV + BESS project hinges on securing the remaining USD21.1 million for Stages 2 and 3. Robust donor engagement and project proposal development are essential to ensure that funding gaps do not delay the project's implementation. A clear project management framework and reporting system must also be established to satisfy donor requirements.

3. Develop a Grid Resilience and Modernization Strategy: Upgrading the existing grid is critical for the successful integration of large-scale Solar PV + BESS systems. This strategy should focus on increasing grid storage, introducing smart grid technologies, and enhancing resilience against climate change impacts. Coordinating grid upgrades with renewable energy deployment will ensure system stability and long-term sustainability.

4. Continuous Monitoring and Evaluation (M&E): Establish a comprehensive M&E system that regularly tracks the progress of Solar PV + BESS projects, grid upgrades, and capacity-building

efforts. This will ensure that any emerging issues are promptly addressed, and lessons learned can be applied in real-time. Regular reporting to donors and stakeholders will help maintain confidence and accountability throughout the project lifecycle.

5. Foster Regional and International Partnerships: To overcome Tuvalu's technical and financial limitations, it is essential to foster partnerships with regional organisations, international donors, and technical experts. These partnerships will support knowledge-sharing, capacity building, and funding efforts. In particular, exploring regional grid connectivity opportunities can provide Tuvalu with a more robust and reliable energy network.

By focusing on these immediate and critical steps, Tuvalu will be better positioned to achieve its renewable energy goals, specifically the successful deployment of Solar PV + BESS, and transition towards a sustainable, low-carbon energy future.

2.2.8 TAP Overview Table: Solar PV (National Grid) + BESS

Table 15: TAP Overview Table for Solar PV (National Grid) and BESS

Sector	**Energy**
Sub-Sector	Renewable Energy Generation
Technology	Solar PV (National-Grid) + BESS
Ambition	100% Renewable by 2030
Benefits	(1) Energy security & reliability (2) Reduction in GHG Emission (3) Cost Saving (4) Environmental sustainability

Summary of Actions, Activities, Implementation Schedule, Responsible Parties, Potential Sources of Funding, Risks, Indicators and Budget for Solar PV + BESS

Action	**Activities**	**Responsibility**		**Planning**		**Implementation**		**Potential Sources of funding**	**Risks**	**Success Criteria**	**Indicators for Monitoring and implementation of Solar PV**	**Budget for Activity (USD)**
		WHO?		**WHEN?**								
		Primary & Focal Point	**Secondary**	**Start Date**	**End Date**	**Start Date**	**End Date**					

1: Attract international donor support	Activity 1.1: Identify potential international donors/ DFIs	Department of Energy	Tuvalu Electricity Corporation (TEC) Climate Change Department Ministry of Finance Ministry of Foreign Affairs	Feb-25	Mar-25	Apr-25	May-25	ADB, World Bank, Italy, Japan, MFAT (NZ) UAE	Limited interest from donors due to competing global priorities	Identification of at least 5 potential donors	List of identified donors	$5,000
	Activity 1.2: Prepare concept notes and project proposals.	Department of Energy	TEC Climate Change Department	Apr-25	Jun-25	Jul-25	Sep-25	ADB, Green Climate Fund (GCF), Global Environment Facility (GEF), Italy, Japan	Lack of sufficient information to create compelling proposals	Submission of at least 3 complete project proposals to donors	Number of concept notes and proposals submitted	$15,000

	Activity 1.3: Strengthen donor coordination mechanisms.	Department of Energy	TEC Climate Change Department Ministry of Finance Ministry of Foreign Affairs	Aug-26	Mar-26	Apr-26	Sep-26	ADB, GEF, World Bank, Italy, Japan	Inconsistent communication and coordination among stakeholders.	Regular coordination meetings held with all relevant donors	Number of coordination meetings and engagements	10,000
	Activity 1.4: Conduct donor outreach and partnerships.	Department of Energy	Climate Change Department Ministry of Finance Ministry of Foreign Affairs	Jan-26	Mar-26	Apr-26	Sep-26	ADB, MFAT (NZ), USAID, Italy, Japan	Lack of donor engagement or slow responses.	Securing at least two donor commitments for Solar PV projects	Signed MOUs or funding agreements	$21,100,000
	Activity 1.5: Establish a project management and	Department of Energy	TEC	Sep-26	Dec-26	Jan-27	Mar-27	World Bank, GCF, ADB	Poor management of reporting	An established reporting framework that meets	Project reporting compliance with donor	15,000

	reporting framework.								requirements	donor standards	requirements	
	Activity 1.6: Provide periodic updates and reporting.	Department of Energy	TEC	Ongoing	Ongoing	Jan-27	Ongoing	All secured donors	Delays in reporting or missing deadlines	Timely submission of project reports to donors	Number of reports submitted on time	5000 (annually)
	Activity 1.7: Develop post-donor support sustainability plans.	Department of Energy	TEC Climate Change Department	Mar-27	Apr-27	May-27	Jul-27	ADB, GCF, Italy, Japan	Lack of clear plans for sustainability after donor support ends	Comprehensive sustainability plan developed and approved.	Documented sustainability plan.	10,000
2: Subsidise Solar PV + BESS projects through government and donor support	Activity 2.1: Design subsidy framework and eligibility criteria	Department of Energy	TEC Ministry of Finance	Feb-25	Mar-25	Apr-25	May-25	GCF, Government of Tuvalu (GOT), ADB, World Bank, Italy, Japan	Ineffective framework design leading to low participation	Clear, accessible subsidy framework developed	Clear, accessible subsidy framework	20,000

	Activity 2.2: Secure donor funding and government budget allocation	Department of Energy	Climate Change Department Ministry of Finance Ministry of Foreign Affairs	Apr-25	May-25	Jun-25	Jul-25	ADB, GCF, World Bank, Italy, Japan, GOT	Delays in securing funds	Sufficient funding secured for subsidy programs	Signed funding agreements	50,000
	Activity 2.3: Develop application and disbursement process	Department of Energy	TEC Ministry of Finance	May-25	Jun-25	Jul-25	Aug-25	GOT, Development Bank of Tuvalu (DBT)	Inefficient disbursement processes causing delays.	Fast and transparent disbursement process implemented.	Number of disbursements made processing time	15,000
	Activity 2.4: Collaborate with local financial institutions	Department of Energy	Development Bank of Tuvalu (DBT) Ministry of Finance	Jun-25	Jul-25	Aug-25	Sep-25	DBT, GOT, ADB	Lack of interest or capacity from local financial institutions	Formalised partnerships with at least 2 financial institutions	Number of partnerships formalised	10,000

	Activity 2.5: Public awareness and outreach campaigns	Department of Energy	Development Bank of Tuvalu (DBT) Tuvalu Media Services/ Tuvalu Government Communications Team	Aug-25	Sep-25	Oct-25	Dec-25	GOT, Donor Agencies	Low awareness or uptake of subsidies	Increase in applications for subsidies	Number of applicants, awareness campaign reach	30,000
	Activity 2.6: Monitor and evaluate subsidy impact	Department of Energy	TEC	Ongoing	Ongoing	Jan-26	Ongoing	GCF, ADB, Donors	Lack of monitoring mechanisms	Regular evaluation of the subsidy program's impact	Number of evaluations conducted, Positive impact assessments	10,000 (annually)
	Activity 2.7: Adjust subsidy levels based on market trends and project success	Department of Energy	DBT Ministry of Finance	Ongoing	Ongoing	Feb-26	Ongoing	GOT, GCF	Market fluctuations that increase costs unexpectedly	Dynamic adjustment of subsidies to reflect market conditions	Frequency and effectiveness of subsidy adjustments	7,000 (annually)

3: Develop a comprehensive renewable energy policy.	Activity 3.1: Conduct stakeholder consultations	Department of Energy	Climate Change Department Attorney General's Office Consultant (supported by donor funding)	Feb-25	Mar-25	Apr-25	May-25	ADB, GOT, Donor Agencies	Stakeholder misalignment or limited participation	Wide participation and input from all relevant stakeholders	Number of stakeholders consulted	$20,000
	Activity 3.2: Review existing legislation and international best practices	Department of Energy	Climate Change Department Attorney General's Office Consultant (support by donor funding)	Mar-25	Apr-25	May-25	Jun-25	ADB, GOT	Incomplete legal reviews or missing key frameworks	Comprehensive legal review completed	Report on legal and best practice review	15,000

	Activity 3.3: Draft the comprehensive renewable energy policy	Department of Energy	Climate Change Department Attorney General's Office Consultant (support by donor funding)	May-25	Jul-25	Aug-25	Sep-25	ADB, GOT, bilateral donors	Delays in policy drafting	Policy draft completed and submitted for approval	Policy draft document	$25,000
	Activity 3.4: Define institutional roles and responsibilities	Department of Energy	Climate Change Department Attorney General's Office Consultant (support by donor funding)	Jul-25	Aug-25	Sep-25	Oct-25	GOT, Consultant funded by Donor	Lack of clarity on roles causing project delays	Clear definition of roles for all involved institutions	Documented roles and responsibilities	10,000

	Activity 3.5: Establish legal and regulatory frameworks	Department of Energy	Climate Change Department Attorney General's Office Consultant (support by donor funding)	Sep-25	Oct-25	Nov-25	Dec-25	GOT, AG's Office, Donors	Delays in updating legal frameworks	Legal and regulatory frameworks approved	Legal documents, updated regulations	30,000
	Activity 3.6: Secure government approval and legislative backing	Department of Energy	Climate Change Department Attorney General's Office Consultant (support by donor funding)	Dec-25	Jan-26	Feb-26	Mar-26	GOT	Delays in legislative processes	Policy and legislative approval secured	Government approval documents	10,000

	Activity 3.7: Implement public awareness and capacity-building programs	Department of Energy	Climate Change Department Attorney General's Office Tuvalu Media Services/	Feb-26	Mar-26	Apr-26	Jun-26	GCF, GOT, Donors	Low public engagement or understanding of new policies	Successful public awareness campaigns	Reach and engagement metrics	35,000
	Activity 3.8: Develop an implementation plan	Department of Energy	Climate Change Department Attorney General's Office	Apr-26	May-26	Apr-26	Jun-26	GOT, Consultant funded by Donor	Delays in implementation	Implementation is on time.	Completed implementation plan	20,000
	Activity 3.9: Monitor and evaluate policy implementation	Department of Energy	Climate Change Department	Ongoing	Ongoing	Aug-26	Jul-26	GOT, Consultant funded by Donor	Lack of monitoring mechanisms	Regular evaluation of the policy	Number of evaluations conducted, Positive impact assessments	10,000 (annually)

4: Upgrade grid infrastructure	Activity 4.1: Conduct technical assessments of existing grid infrastructure	TEC	Department of Energy Climate Change Dept.	Feb-25	Mar-25	Apr-25	May-25	ADB, World Bank, GCF, Italy, Japan	Inaccurate assessments leading to insufficient upgrades	Technical assessment report completed	Assessment report	40,000
	Activity 4.2: Develop a grid upgrade plan	TEC	Department of Energy Climate Change Dept.	Apr-25	May-25	Jun-25	Jul-25	ADB, World Bank, GCF, Donor, Italy, Japan	Delays in plan development or approval	Comprehensive grid upgrade plan completed	Grid upgrade plan	50,000
	Activity 4.3: Secure funding for grid upgrades	Department of Energy	TEC Ministry of Finance	Jun-25	Jan-26	Feb-26	Sep-26	GOT, Donor Agencies	Insufficient funds for grid upgrade	Sufficient funding secured for grid upgrade	Signed agreement for funding	800,000
	Activity 4.4: Upgrade transmission and distribution lines	TEC	Foreign company (funded by donor)	Sep-26	Oct-26	Nov-26	May-27	ADB, GCF, Donors, GOT	Delays in construction or issues with technical contractors	Completion of grid upgrade works	Completion of grid upgrade works	1,000,000

	Activity 4.5: Integrate smart grid technologies	TEC	Foreign company (funded by donor)	Jan-27	Feb-27	Mar-27	Jul-27	GCF, Italy, Japan	Technological barriers or delays in procurement	Successful integration of smart grid systems	Smart grid system operational	100,000
	Activity 4.6: Increase grid storage capacity	TEC	Foreign company (funded by donor)	Apr-27	May-27	Jun-27	Dec-27	GCF, Donors	Lack of adequate storage facilities	Expanded grid storage capacity	Storage capacity measured in MW	500,000
	Activity 4.7: Train local technicians and engineers for grid maintenance	Solar Energy Engineers (funded by donor)	TEC Department of Energy Private Sector	Jun-27	Jul-27	Aug-27	Sep-27	GCF, Donors, Technical Partners	Lack of local technical expertise	Trained local workforce capable of maintaining grid upgrades	Number of technicians trained, number of completed trainings	125,000
	Activity 4.8: Establish grid resilience measures	Solar Energy Engineers (funded by donor)	TEC	Aug-27	Sep-27	Oct-27	Dec-27	Donors, GOT	Vulnerability to climate impacts on grid infrastructure	Grid resilience measures successfully implemented	Resilience metrics, climate-proofing actions	40,000

	Activity 4.9: Monitor and evaluate grid performance	Solar Energy Engineers (funded by donor)	TEC	Ongoing	Ongoing	Jan-28	Ongoing	GCF, Donors, Bilateral Partners	Lack of monitoring mechanisms	Regular evaluation of the progress and impact of grid upgrade	Number of evaluations conducted, positive impact assessments	10,000 (annually)
	Activity 4.10: Explore regional grid connectivity	Solar Energy Engineers (funded by donor)	TEC	Jul-27	Aug-27	Sep-27	Dec-27	GCF, Donors, Bilateral Partners	Feasibility issues with regional connectivity	Completed feasibility study and partnerships for connectivity	Feasibility study report, partnership agreements	200,000
5: Strengthen institutional capacity through training programs.	Activity 5.1: Conduct a skills gap assessment	Department of Energy	All RE stakeholders	Feb-25	Mar-25	Apr-25	Mar-25	ADB, GOT, Donors	Insufficient data collected for accurate assessment	Detailed skills gap assessment completed	Skills gap report	10,000
	Activity 5.2: Develop a comprehensive training curriculum	Department of Energy	International Consultant (donor funded)	Mar-25	Apr-25	May-25	Jun-25	GCF, ADB, GOT	Curriculum fails to address key needs	Comprehensive training curriculum developed	training curriculum	20,000

	Activity 5.3: Establish partnerships with international organisations for training	Department of Energy	International Consultant (donor funded)	Apr-25	May-25	Jun-25	Jul-25	Donors, GCF, International partners	Lack of collaboration from international partners	Formalised partnerships for capacity-building	Number of partnerships formalised	10,000
	Activity 5.4: Implement technical training programs for local engineers and technicians	Department of Energy	International Consultant (donor funded)	Jun-25	Jul-25	Aug-25	Oct-25	GCF, International Donors	Low participation in training programs	Successful implementation of at least 3 technical training programs	Number of trained personnel, skills assessments	40,000
	Activity 5.5: Provide policy and regulatory training for government officials	Department of Energy	International Consultant (donor funded)	Aug-25	Sep-25	Oct-25	Nov-25	GCF, ADB, International partners	Low capacity among officials to implement policies	Successful policy training for at least 10 officials	Number of officials trained, Evaluation results	15,000

	Activity 5.6: Build project management and M&E capacity	Department of Energy	International Consultant (donor funded)	Oct-25	Nov-25	Dec-25	Jan-26	GCF, Donors, ADB	Limited capacity to track and manage projects	M&E capacity building for at least 5 project managers	Number of M&E frameworks established	20,000
	Activity 5.7: Establish a knowledge-sharing platform	Department of Energy	International Consultant (donor funded) Other R.E. stakeholders	Jan-26	Feb-26	Mar-26	May-26	GOT, Technical agencies	Platform may not be widely used or adopted by key stakeholders.	Successful development and launch of the platform, with active participation from all stakeholders.	Number of users, frequency of usage, platform engagement metrics	25,000
	Activity 5.8: Develop certification programs for renewable energy technicians	Department of Energy	International Consultant (donor funded)	May-26	Jun-26	Jul-26	Sep-26	GOT Technical agencies, consultant	Lack of interest or participation in the certification program by local technicians	Certification program is developed and implemented, with at least 15 participants certified	Number of certified technicians, completion rates	30,000

	Activity 5.9: Implement refresher training and continuous learning programs	Department of Energy	International Consultant (donor funded)	Jul-26	Aug-26	Sep-26	Ongoing	GOT Technical agencies, consultant	Low participation in refresher courses and continuous learning programs	Successful participation of at least 70% of trained personnel in refresher programs	Number of participants, completion rates, participant feedback	20,000
	Activity 5.10: Monitor and evaluate the effectiveness of training programs	Department of Energy	International Consultant (donor funded)	Ongoing	Ongoing	Aug-26	Ongoing	GOT	Inconsistent or inadequate monitoring and evaluation processes.	Comprehensive M&E framework established and implemented, with at least two evaluations per year	Number of evaluations, findings from assessments	15,000 (annually)
6: Enhance local technical expertise through	Activity 6.1: Conduct a technical skills gap analysis	Department of Energy	International Consultant (donor funded)	Feb-25	Mar-25	Apr-25	May-25	ADB, GOT, Donors	Inaccurate assessment of technical needs	Detailed skills gap assessment completed	Skills gap report	10,000

training programs.	Activity 6.2: Develop specialised training modules for renewable energy	Department of Energy	International Consultant (donor funded)	Mar-25	Apr-25	May-25	Jun-25	GCF, International Donors	Training modules may not meet local context	Effective training modules developed	Training module competition	25,000
	Activity 6.3: Partner with international agencies for technical training	Department of Energy	International Consultant (donor funded)	May-25	Jun-25	Jul-25	Sep-25	International Donors, ADB	Limited cooperation from international agencies	At least 2 partnerships with international agencies for training	Number of partnerships established	20,000
	Activity 6.4: Organise hands-on technical training for installation and maintenance	Department of Energy	International Consultant (donor funded)	Jul-25	Aug-25	Sep-25	Dec-25	GCF, ADB, Donors	Low attendance or engagement in technical training	At least 15 technicians trained	Number of trained technicians, training assessments	30,000

	Activity 6.5: Train local trainers for sustainable capacity building (train-the-trainers)	Department of Energy	International Consultant (donor funded) TEC	Sep-25	Oct-25	Nov-25	Dec-25	Donors, International Experts	Lack of local trainer engagement	Successful train-the-trainers program implemented	Number of trainers trained	15,000
	Activity 6.6: Certify local technicians and engineers	Department of Energy	International Consultant (donor funded) TEC Private Sector	Dec-25	Jan-26	Feb-26	Apr-26	GCF, Donors	Low participation in certification programs	Certification of at least 15 technicians and engineers	Number of certified professionals	20,000
	Activity 6.7: Develop an apprenticeship program	Department of Energy	International Consultant (donor funded) TEC	Jan-26	Feb-26	Jun-26		GCF, Donors	Limited interest in apprenticeship programs	Successful placement of at least 10 apprentices	Number of apprentices placed, Feedback from apprentices	25,000

	Activity 6.8: Provide refresher training and upskilling opportunities	Department of Energy	International Consultant (donor funded) TEC Private Sector	Jun-26	Jul-26	Aug-26	Ongoing	GOT, Local trainers	Low participation in refresher courses and upskilling programs	Successful implementation of refresher training with at least 75% trained technicians participating	Number of participants, completion rates, feedback from participants	25,000
	Activity 6.9: Create a local knowledge-sharing platform	Department of Energy	International Consultant (donor funded) TEC	Aug-26	Sep-26	Oct-26	Dec-26	GOT, Technical agencies	The platform may not gain sufficient traction or participation from local technicians	Full functioning platform with regular contributions from technicians and engineers	Number of users, frequency of usage, platform engagement metrics	20,000
	Activity 6.10: Monitor and evaluate the impact of technical training	Department of Energy	International Consultant (donor funded) TEC	Ongoing	Ongoing	Jan-27	Ongoing	GOT	Inconsistent or inadequate tracking of training outcomes	Comprehensive M&E framework established, with positive feedback and improveme	Number of evaluations conducted, participant feedback, improvement in	15,000 (annually)

										nts in technical expertise	technical skills	
7. Encourage Private Investment and Public Private Partnerships (PPPs) for Solar PV + BESS	Activity 7.1 Offer a 10-year tax holiday for RE investors.	Ministry of Finance, Department of Energy, Department of Business & Investments	Pacific Trade Invest	Start Date: Jan 2025	End Date: Dec 2025	Start Date: Jan 2026	End Date: Ongoing	Government of Tuvalu and PTI (for initial promotion and set-up)	Risk of low investor response due to limited local infrastructure or market size.	Increase in RE investment and partnerships with private firms.	Number of new RE investors and partnership agreements	$50,000
	Activity 7.1 Develop attractive, low-interest loan facilities for RE projects.	Development Bank of Tuvalu, Ministry of Finance, Departm	ADB, World Bank, IRENA	Start Date: Mar, 2025	End Date: Ongoing	Start Date: Cont. from Planning	End Date: Sept 2025	GCF, ADB, World Bank	Possible delays in securing loan terms from international funders.	Loan facilities established with at least 2 investors utilizing them.	Number of loans disbursed; investor feedback	$100,000

		ent of Energy										
	Activity 7.3: Organize investor engagement events and promotional campaigns.	Department of Energy, Ministry of Foreign Affairs, Labour & Trade	Pacific Trade Invest	April 2025	Ongoing	Continue from Planning phase	Dec 2025	GCF, ADB, USAID	Low interest from foreign investors	Successful events with at least 3 investor engagements per event	Number of events held; investor participation rates	$75,000
	Activity 7.4: Establish a PPP framework for Solar PV + BESS projects.	Ministry of Finance, Department of Energy, Attorney General's Office	Private Sector Organizations	April 2025	Ongoing	Continue from Planning Phase	Dec 2025	Government of Tuvalu, donor for technical assistance	Complexity in establishing a legal PPP framework	Formalized PPP framework; signed agreements	Existence of PPP framework; signed agreements	$150,000

8. Implement Training and Capacity Building for Private Sector Engagement	Activity 8.1: Provide technical and regulatory training on Solar PV + BESS for local businesses.	Department of Energy, Private Sector Organization	Pacific Trade Invest	Jan 2026	Ongoing	Ongoing	Ongoing	GCF, ADB, World Bank	Low participation from local businesses.	Increased capacity, with 15 businesses trained	Number of businesses trained; assessment scores	$50,000
	Activity 8.2 Establish an internship program focused on RE project management.	Department of Energy, Development Bank of Tuvalu	Pacific Trade Invest	April, 2026	Ongoing	Ongoing	Dec, 2026	GCF, ADB	Limited interest from interns	At least 10 interns trained and placed in RE projects	Number of internships completed; post-training evaluation	$40,000

Chapter 3: Technology Action Plan for Sector B - Transport

3.1 Sector overview

The transport sector in Tuvalu is pivotal for economic activities and social connectivity. However, it heavily relies on imported fossil fuels, making it a significant contributor to GHG emissions. This report outlines the current state of the sector, challenges it faces, and strategic actions outlined in the TAP to address climate change impacts. The transport sector in Tuvalu includes land and marine transport, with a focus on small vehicles and boats essential for inter-island connectivity. The sector is characterised by its dependence on fossil fuels, leading to environmental and economic vulnerabilities.

GHG Emissions Level and Trends

Current Emissions: The transport sector is one of Tuvalu's largest sources of GHG emissions.[2] According to the Tuvalu Climate Change Policy, emissions have been steadily rising with the increase in vehicle numbers and continued reliance on fossil fuels (Government of Tuvalu, 2015).

-Trends: Without intervention, emissions are expected to rise as the vehicle fleet grows to meet increasing mobility demands.

Vulnerability

Climate Impact: High vulnerability to climate change, including rising sea levels and extreme weather events, affecting infrastructure and mobility. Tuvalu's low-lying geography makes it particularly susceptible to climate change impacts such as sea-level rise and extreme weather events, which threaten transport infrastructure (SPREP, 2016).

Existing Policies and Measures

Table 16: Existing Policies and Measures

Policy Name	Enacted	Revised	Main Contents
National Renewable Energy Policy	2015	2021	Promotes the adoption of renewable energy technologies, including electric vehicles (EVs), to reduce carbon emissions.
Vehicle Emission Standards	2016	-	Sets limits on emissions for imported vehicles to mitigate pollution.
Sustainable Transport Initiative	2018	2022	Encourages the adoption of sustainable transport technologies and practices, aiming to reduce the sector's carbon footprint.

Current Technology Profile

Vehicles: Predominantly powered by fossil fuels, with a small number of hybrids.

EV Infrastructure: There is a limited presence of electric vehicle charging stations.

Selected Technologies

[2] https://unfccc.int/sites/default/files/NDC/2023-02/Tuvalus%20Updated%20NDC%20for%20UNFCCC%20Submission.pdf

Electric Vehicles (EVs): EVs have been identified as a key technology to lower emissions and reduce dependency on imported fuels. They offer potential environmental and economic benefits, aligning with Tuvalu's climate change mitigation goals.

Future Targets

EV Adoption Goal: The government aims for 20% of the national vehicle fleet to be electric by 2030. This target is part of a broader strategy to enhance sustainability and energy security (Tuvalu Renewable Energy Roadmap, 2020).

Challenges and Solutions in the Technology Action Plan

1. High Initial Costs
    - Challenge: The upfront cost of electric vehicles and the necessary infrastructure is a significant barrier.
    - Solution: Implement financial incentives and subsidies to reduce costs for consumers, making EVs more accessible.

2. Limited Charging Infrastructure
    - Challenge: The lack of charging stations limits EV adoption and convenience.
    - Solution: Develop a comprehensive network of charging stations strategically located across the islands to support EV use. To ensure sustainability and reduce dependency on fossil fuels, these charging stations can be powered by renewable energy (RE) sources, such as solar or wind. Implementing RE-powered charging stations would help minimize GHG emissions from the transport sector, aligning with Tuvalu's climate goals and commitment to clean energy transitions.

3. Public Awareness and Acceptance
    - Challenge: There is limited public understanding and scepticism about the benefits of EVs.
    - Solution: Conduct public education and awareness campaigns to promote the environmental and economic benefits of EV adoption.

4. Technical Expertise
    - Challenge: There is a shortage of skilled technicians to maintain and repair EVs.
    - Solution: Establish training programs to build local capacity in EV maintenance and repair.

5. Policy and Regulatory Support
    - Challenge: Supportive policies are needed to encourage EV integration.
    - Solution: Strengthen and enforce regulations that promote sustainable transport solutions, ensuring alignment with international best practices (United Nations Framework Convention on Climate Change, 2021).

Addressing these challenges through the Technology Action Plan will facilitate the transition to electric vehicles in Tuvalu. These efforts will contribute significantly to climate change mitigation, reduce GHG emissions, and enhance the resilience of the transport sector. By prioritising sustainable transport solutions, Tuvalu can achieve its environmental goals and improve the quality of life for its citizens.

3.2 Action Plan for Technology B1 - Electric Vehicle

3.2.1 Introduction

Aligned with the objectives outlined in the Tuvalu National Energy Policy (TNEP) and Intended Nationally Determined Contributions (INDCs), this chapter examines the barriers that hinder the adoption and diffusion of cleaner transportation technologies. The technologies under consideration include electric vehicles (EVs), hybrid vehicles, non-motorized transport options such as bikes and e-bikes, and hydrogen-powered shipping vessels for inter-island transport. Transitioning to these sustainable solutions is vital for decreasing GHG emissions, improving energy efficiency, and achieving long-term energy security in Tuvalu's transport sector.

Electric vehicles (EVs) have been prioritised due to their potential to lower GHG emissions, reduce fuel import dependency, and improve air quality. They offer significant environmental, economic, and social benefits, making them a strategic choice for Tuvalu's sustainable development goals.

3.2.2 Ambition for the TAP

The sector faces several key barriers to adopting clean transport technologies, including high initial capital costs, limited access to financing, and inadequate infrastructure. These financial constraints are compounded by institutional and regulatory hurdles, along with low public awareness of the benefits of transitioning to low-emission transportation. A comprehensive understanding of these barriers is required to design effective interventions that will support the sector's transformation.

To address these challenges, this action plan presents an enabling framework aimed at facilitating the widespread adoption of cleaner transport technologies. The proposed measures include the development of supportive financial mechanisms, targeted infrastructure investments, and capacity-building initiatives to develop a skilled workforce capable of operating and maintaining these technologies. Furthermore, regulatory reforms and policy adjustments will be crucial in creating a supportive environment for the integration of low-emission vehicles and sustainable transport systems.

The ambition is to deploy EV technology at a scale that transforms 20% of the vehicle fleet to electric by 2030. This transition aims to deliver substantial socio-economic and environmental benefits, such as decreased emissions, improved public health, and greater energy security.

3.2.3 Actions and Activities selected for inclusion in the TAP.

The impacts of climate change are particularly pronounced in Tuvalu, a low-lying island nation vulnerable to rising sea levels and extreme weather events. In response, the Government of Tuvalu has developed a Technology Action Plan (TAP) for the transport sector, emphasizing the adoption of electric vehicles (EVs) as a key strategy to mitigate greenhouse gas emissions, enhance energy security, and promote sustainable development. By transitioning to EVs, Tuvalu aims to not only reduce its carbon footprint but also create a more resilient transportation system that aligns with global climate goals.

Electric vehicles present a viable alternative to traditional fossil fuel-powered transportation, especially for island nations like Tuvalu, where the reliance on imported fuels contributes to both economic and environmental vulnerabilities. The TAP recognizes that embracing EV technology can stimulate local economies, create green jobs, and contribute to the broader vision of sustainable development.

1. Public Awareness and Education Programs

Public awareness and education programs aim to inform the population about the benefits of electric vehicles, including reduced emissions, lower operating costs, and contributions to a sustainable future. Workshops, seminars, and community engagement activities will be organised to demystify EV technology and highlight successful case studies from other regions. This initiative will also incorporate outreach through social media platforms, local radio, and print materials, ensuring a wide-reaching campaign that resonates with diverse demographics.

Justification: Awareness is crucial for the adoption of any new technology. Many residents may be unfamiliar with EVs, their benefits, and how they can integrate into daily life. Education initiatives will empower citizens to make informed decisions and foster a supportive environment for EV adoption. Furthermore, building local knowledge about EV maintenance and operation will help mitigate concerns about reliability and serviceability, encouraging a positive perception of EVs within the community.

Additionally, engaging schools in these educational efforts can instil a sense of responsibility in younger generations, promoting eco-conscious behaviour from an early age. This multifaceted approach to awareness will cultivate a culture of sustainability and reinforce the importance of individual actions in combating climate change.

2. Incentives for EV Purchase and Use
This action involves developing financial incentives such as tax breaks, subsidies, and low-interest loans for individuals and businesses that purchase electric vehicles. Additionally, incentives for the establishment of charging infrastructure will be introduced. A robust framework for these incentives will be designed, ensuring accessibility for all segments of society, including low-income households.

Justification: Financial barriers can deter EV adoption. By providing incentives, the government can lower the upfront costs associated with EVs, making them more accessible to a broader range of citizens and businesses. This approach also stimulates local economic growth through the development of green technologies. Studies have shown that financial incentives can significantly increase EV sales, demonstrating their effectiveness in promoting cleaner transportation options.

Moreover, by encouraging local businesses to invest in EV fleets, Tuvalu can enhance its economic resilience and decrease dependency on imported fuels. This not only promotes environmental benefits but also strengthens the local economy by keeping financial resources within the community. Incentives will also play a crucial role in fostering a competitive market for EVs and related technologies, attracting investments and innovation.

3. Development of Charging Infrastructure
A comprehensive network of charging stations will be established across Tuvalu's islands, ensuring that EV users have access to reliable charging facilities. This includes both public and private charging options. The plan will also involve installing fast-charging stations at strategic locations, such as ferry terminals, community centres, and popular tourist attractions, to facilitate convenience for both residents and visitors.

Justification:
The availability of charging infrastructure is a critical factor in the transition to electric vehicles. Without sufficient charging options, potential users may hesitate to invest in EVs. By prioritising the development of this infrastructure, the government will address one of the

main barriers to EV adoption. Furthermore, ensuring that charging stations are powered by renewable energy sources will enhance the sustainability of the entire EV ecosystem.

In addition to enhancing user convenience, the development of charging infrastructure can stimulate local businesses. Charging stations can be integrated with commercial establishments, encouraging customers to shop or dine while their vehicles charge. This creates a win-win scenario, where the community benefits economically, and the EV adoption rate increases due to improved accessibility.

4. Partnerships with Private Sector and NGOs
Engagement with the private sector and non-governmental organisations (NGOs) will be facilitated to foster collaboration in promoting electric vehicles. This could involve joint marketing campaigns, sharing of resources, and co-hosting educational events. Additionally, partnerships with research institutions will be sought to assess the local impacts of EV adoption and identify best practices.

Justification:
Collaboration with stakeholders can amplify outreach efforts and leverage additional expertise and resources. The involvement of private entities can also drive innovation and enhance service offerings related to EVs, such as maintenance and support. By creating a network of partnerships, Tuvalu can pool resources for research, outreach, and infrastructure development, ensuring a more efficient use of funds and expertise.

Moreover, NGOs can play a pivotal role in advocating for sustainable transportation solutions, helping to mobilise community support and participation. These partnerships can also facilitate the sharing of international best practices and technologies, ensuring that Tuvalu remains at the forefront of EV adoption and sustainability initiatives.

5. Pilot EV Projects
Pilot projects will be initiated to showcase the practical use of electric vehicles in various sectors, such as public transport, tourism, and waste management. These projects will serve as demonstration models to validate the technology and its benefits. Initial pilots could include electric buses for public transportation and EVs for community services, such as garbage collection and local delivery services.

Justification:
Pilot projects provide tangible examples of EVs in action, helping to build confidence among potential users. They also allow for the collection of data to evaluate the effectiveness and feasibility of wider EV adoption in Tuvalu. By highlighting successful outcomes from these pilot initiatives, the government can foster community enthusiasm and support for broader EV initiatives.

Moreover, these projects can serve as a testing ground for operational challenges, providing insights that inform future scaling efforts. Documenting the results of these pilot programs will also create valuable case studies that can be shared with other nations facing similar challenges, positioning Tuvalu as a leader in sustainable transportation solutions.

Activities Identified for Implementation of Selected Actions
1. Organise Workshops and Community Events
Schedule regular workshops across various islands to educate citizens about EVs, focusing on practical demonstrations and interactive sessions to engage participants actively.

Collaborate with schools and community centres to host informational sessions that include hands-on activities, such as EV maintenance demonstrations or test drives.

2. Design and Implement Financial Incentive Programs
Develop a framework for subsidies and tax incentives for EV purchases, ensuring that the application process is straightforward and accessible to all.
Partner with local banks and financial institutions to offer tailored loan products for EV buyers, promoting financial literacy and facilitating access to financing.

3. Conduct a Needs Assessment for Charging Stations
Survey the population to identify high-traffic areas for charging station placement, using geospatial analysis to determine optimal locations.
Collaborate with utility companies to assess grid capabilities and requirements, ensuring that the charging infrastructure is reliable and sustainably integrated into the energy system.

4. Establish Partnerships and Collaborative Networks
Create a stakeholder registry to engage local businesses, NGOs, and community organisations, fostering a collaborative environment for EV promotion.
Develop joint initiatives for educational campaigns and resource sharing, leveraging each partner's strengths to maximise impact.

5. Launch EV Pilot Programs
Select specific sectors (e.g., public transport, waste management) for initial pilot projects, ensuring diverse applications of EV technology.
Monitor and evaluate pilot outcomes to inform future scaling efforts, using data collected to refine strategies and enhance program effectiveness.

3.2.4 Actions to be Implemented as Project Ideas

Selected Actions for Project Ideas include:
1. Public Awareness and Education Programs
Building a foundation of knowledge is essential for long-term adoption. This action will ensure that the community is informed and engaged, addressing misconceptions and fostering a culture of sustainability.

2. Incentives for EV Purchase and Use
Financial incentives are a direct method to encourage purchases and overcome economic barriers. This action has the potential to significantly accelerate EV adoption, making it a priority project.

3. Development of Charging Infrastructure
A well-developed charging network is vital for facilitating EV use. Prioritising this action will ensure that potential users are not deterred by lack of access to charging facilities, thereby supporting a smoother transition to electric vehicles.

4. Pilot EV Projects
Pilot projects allow for real-world testing of EV applications and can help garner community support. These initiatives can demonstrate the practicality and benefits of EVs, leading to broader acceptance and integration.

The implementation of electric vehicles in Tuvalu's transport sector is an essential component of the country's Technology Action Plan to combat climate change. By focusing on public

awareness, financial incentives, infrastructure development, partnerships, and pilot projects,

Action	Description	Justification
Public Awareness and Education	Organise workshops and community events to educate on EV benefits and technology.	Builds foundational knowledge and fosters community support for EV adoption.
Incentives for EV Purchase	Develop financial incentives (tax breaks, subsidies, loans) for EV buyers.	Lowers economic barriers, making EVs accessible and stimulating local
Charging Infrastructure	Establish a network of charging stations across the islands.	Addresses accessibility concerns, ensuring convenience for EV users.
Partnerships with Private Sector	Collaborate with businesses and NGOs for joint initiatives and resource sharing.	Leverages expertise and amplifies outreach efforts for EV promotion.
Pilot EV Projects	Initiate pilot programs in sectors like public transport and waste management.	Demonstrates practicality and gathers data to inform broader EV adoption.

Tuvalu can foster a sustainable transport system that reduces emissions, enhances energy security, and sets a precedent for other nations facing similar challenges. The holistic approach laid out in this TAP positions Tuvalu not only as a proactive participant in global climate action but also as a leader in sustainable transportation practices, paving the way for a greener future.

Table 17: Summary of Actions to be implemented as Project Ideas

3.2.5 Stakeholders and Timeline for implementation of TAP

The successful implementation of the Technology Action Plan (TAP) for electric vehicles (EVs) in Tuvalu requires the collaboration of various stakeholders, each playing distinct roles to ensure the plan's effectiveness. The identified stakeholders include government agencies, private sector entities, non-governmental organisations (NGOs), community groups, and educational institutions. A well-coordinated approach among these stakeholders will be crucial for achieving the goals outlined in the TAP.

1. Government Agencies

- Ministry of Transport: This agency will be pivotal in formulating policies and regulations to support the TAP. It will oversee the development of legal frameworks for EV adoption, including standards for vehicle safety and performance. Additionally, the Ministry will coordinate inter-agency efforts to integrate EVs into the broader transport system, ensuring consistency in implementation across all sectors.
- Ministry of Environment: As the TAP aligns with Tuvalu's national climate objectives, the Ministry of Environment will monitor the environmental impacts of EV adoption. This agency will assess emissions reductions and report progress toward climate targets, providing essential data that can inform future policy adjustments and reinforce the importance of the TAP in mitigating climate change.

- Local Government Authorities: These authorities will play a key role in implementing local initiatives, facilitating community engagement, and ensuring that the benefits of EV adoption are felt at the grassroots level. They will handle permitting and zoning for charging infrastructure, ensuring that installations meet community needs and local regulations.

2. Private Sector Entities
   - Automotive Dealerships: Local dealerships will be instrumental in promoting EV sales. They will provide valuable information on the available models, financial incentives, and the long-term benefits of EV ownership. Furthermore, they can offer test drives and demonstrations to help potential buyers experience the advantages of EVs first-hand.
   - Charging Infrastructure Companies: These firms will be responsible for the technical aspects of establishing a reliable network of charging stations throughout Tuvalu. Their expertise will ensure that installations are optimised for accessibility and usability, thereby encouraging more residents to transition to electric vehicles. They will also play a crucial role in maintaining these facilities, ensuring they are operational and user-friendly.
   - Financial Institutions: Banks and microfinance organisations will develop tailored financial products that make EV ownership more affordable. Their involvement is vital in designing low-interest loans and understanding the specific economic challenges faced by potential EV buyers in Tuvalu. Additionally, financial institutions can help promote these products through marketing campaigns and community engagement.

3. Non-Governmental Organisations (NGOs)
   - Environmental NGOs: These organisations will advocate for the TAP and serve as community watchdogs to ensure that environmental standards are upheld. They will work to raise awareness about the importance of sustainable transport solutions, using their networks to reach diverse audiences. By engaging in grassroots activism, they will help to mobilise community support for EV initiatives and promote eco-friendly practices.
   - Community Development Organizations: Focused on empowering local populations, these NGOs will engage residents in discussions about the benefits of EVs. They will facilitate workshops and information sessions that cater to specific community needs and concerns. Their role in bridging the gap between government initiatives and local acceptance is essential for ensuring that the TAP is well-received.

4. Community Groups
   - Local Community Associations: Acting as liaisons between the government and residents, these associations will facilitate feedback on the TAP and help ensure that the voices of local populations are heard. They will organise community meetings to discuss the benefits and challenges of EV adoption, fostering an environment of collaboration and mutual support.
   - Youth Groups: Engaging young people in sustainability efforts is critical for long-term change. Youth groups will participate in educational outreach, helping to spread awareness about EVs among their peers and families. By fostering a culture of sustainability among younger generations, these groups will play a significant role in shaping future attitudes toward electric vehicles.

5. Educational Institutions
   - Schools and Universities: Educational institutions will play a pivotal role in disseminating knowledge about EVs and sustainability. They will be involved in

organising educational workshops and programs that inform students and their families about the benefits of electric vehicles. By integrating topics related to EV technology and climate change into the curriculum, schools can foster a generation of environmentally conscious citizens who are advocates for sustainable transportation.

Scheduling and Sequencing of Specific Activities

The implementation of the TAP involves a series of specific activities that must be scheduled and sequenced effectively. A detailed timeline allows for strategic planning and execution, ensuring that each activity supports the overall goals of the TAP.

Activity	Stakeholders Involved	Timeline	Nature and Scale of Activity
Organise Workshops and Community Events	Ministry of Transport, NGOs, Local Groups	Months 1-3	A series of workshops across all islands targeting different community demographics; estimated participation of 200+ residents per session.
Develop Financial Incentive Programs	Ministry of Finance, Financial Institutions	Months 2-4	Workshops and consultations with financial institutions to design tailored products; launch by Month 4.
Conduct Needs Assessment for Charging Stations and RE Needs	Local Authorities, Charging Companies, RE Experts	Months 2-5	Surveys and geospatial analysis across all islands to assess optimal locations and energy needs for charging stations; expected to take 3 months, with results compiled by Month 5.
Conduct Needs Assessment for Charging Stations	Local Authorities, Charging Companies	Months 2-5	Surveys and geospatial analysis across all islands; expected to take 3 months, with results compiled and shared by Month 5.
Establish Partnerships and Collaborative Networks	NGOs, Local Businesses, Educational Institutions	Months 1-6	Ongoing engagement through meetings and networking events; formal partnerships to be established by Month 6.
Launch EV Pilot Projects	Ministry of Transport, Local Transport Providers, NGOs	Months 5-12	Initial pilot programs focusing on public transport and community services; implementation in phases, starting in Month 5.
Promote Public Awareness Campaigns	NGOs, Community Groups, Educational Institutions	Months 1-12	Continuous campaign throughout the year utilising various media (social media, radio, print) to ensure widespread awareness.
Monitor and Evaluate Pilot Outcomes	Ministry of Environment, NGOs, Community Groups	Months 10-12	Data collection and analysis following pilot implementation, culminating in a comprehensive evaluation report by Month 12.

Table 18: Summary of Activities, Stakeholders & Timeline

Activity Sequencing and Justification

Months 1-3: Initial awareness and education activities lay the groundwork for community engagement. These early efforts are essential for building trust and generating interest in EV adoption. Workshops will provide a platform for discussing the benefits of EVs and addressing community concerns.

Months 2-4: The development of financial incentives should follow closely after initial awareness efforts, providing potential buyers with the necessary support as they become interested in purchasing EVs. Collaborations with financial institutions will ensure that the programs designed are accessible and appealing.

Months 2-5: Conducting the needs assessment for charging stations concurrently with financial program development ensures that charging infrastructure aligns with community needs. By gathering data early, the government can strategically place charging stations in areas of high demand.

Months 1-6: Establishing partnerships should occur throughout the initial phase to foster collaboration and leverage resources from various stakeholders. Networking events will facilitate relationship-building and ensure all parties are aligned in their objectives.

Months 5-12: Pilot projects begin once awareness and infrastructure assessments are completed, allowing for practical demonstrations of EV benefits and functionality. These projects will serve as real-world examples that can influence broader adoption.

Months 10-12: Monitoring and evaluation of pilot projects provide critical feedback that can inform further actions and adjustments to the TAP. Analysing data collected from the pilots will help identify successes and areas for improvement, ensuring that the TAP remains dynamic and responsive to the community's needs.

This structured approach ensures that each activity builds upon the previous ones, facilitating a cohesive and effective implementation of the TAP for electric vehicles in Tuvalu. By engaging stakeholders at every level and strategically sequencing activities, Tuvalu can maximise the impact of its efforts toward sustainable transportation.

3.2.6 Estimation of Resources Needed for Action and Activities

The successful implementation of the Technology Action Plan (TAP) for electric vehicles (EVs) in Tuvalu requires various resources, ranging from human capital and infrastructure to financial investments and technological support. Below is a detailed breakdown of the resources needed for each key action and activity identified in the TAP.

1. Human Resources -

Expert Personnel Skilled professionals, including transport engineers, environmental scientists, and project managers, are crucial for the effective execution of the TAP. This includes staff to oversee workshops, conduct needs assessments, and manage pilot projects.

Training and Support Staff: Additional personnel will be needed to facilitate training programs for community outreach, educational workshops, and partnership development. This includes local trainers who can engage effectively with the community.
Administrative Support: Dedicated administrative personnel will be essential for organising events, managing communications, and handling logistical aspects of various initiatives.

2. Infrastructure Resources
Charging Stations: Investment in charging infrastructure is vital. This includes the purchase and installation of charging units across the islands, ensuring they are strategically placed in high-traffic areas such as ferry terminals, schools, and community centres.
Workshop Venues: Locations for workshops and community events need to be identified and secured, which may include schools, community centres, and municipal buildings equipped with necessary facilities for engaging presentations and discussions.

3. Financial Resources
Funding for Incentives: Financial resources will be required to implement incentive programs for EV purchases. This may include budget allocations from the government, grants from international donors, or funding from NGOs.
Operational Funding: Sufficient budgetary support is needed to cover ongoing operational costs associated with the TAP, such as staffing, maintenance of charging stations, and promotional activities.

4. Technological Resources
Software and Systems: The development of platforms for monitoring EV adoption rates and usage of charging stations will require investment in appropriate software systems. This includes data management tools and user-friendly interfaces for community access.
Educational Materials: Development of informative resources such as brochures, online content, and educational kits that can be distributed during workshops and community events.

Estimation of Capacity Building Needs
To effectively carry out the actions and activities outlined in the TAP, significant capacity-building efforts will be necessary. This section outlines the specific needs for training, education, and institutional strengthening required for successful implementation.

1. Training for Stakeholders
Government Officials: Training programs will be essential for officials from the Ministry of Transport, the Ministry of Environment, and local authorities to familiarise them with EV technology, policies, and the management of the TAP. This includes workshops focused on regulatory frameworks, monitoring practices, and community engagement strategies.
Local Businesses: Training sessions for local dealerships and charging infrastructure providers on the benefits of EVs, financing options, and technical maintenance will be crucial for creating a knowledgeable network of local stakeholders.

2. Community Engagement Training
Community Leaders and NGOs: Workshops focused on effective communication strategies and community mobilisation will empower local leaders and NGO representatives to drive awareness campaigns and facilitate discussions about EV adoption.
Youth Programs: Educational initiatives aimed at engaging youth in sustainability and EV promotion will require resources for curriculum development and training for facilitators.

3. Technical Skills Development

EV Maintenance, Repair, and Spare Parts Supply Chain: Training programs focused on the maintenance and repair of electric vehicles will be essential for local mechanics and technicians, building local capacity to support EV adoption and reduce dependency on foreign expertise. Additionally, establishing a reliable supply chain for EV spare parts will be critical to ensure timely repairs and maintenance, minimizing vehicle downtime and enhancing the sustainability of EV operations. Collaborating with suppliers to secure affordable, readily available spare parts can further strengthen the local support infrastructure for EVs.
Charging Infrastructure Management: Technicians will need training in the installation and maintenance of charging stations, ensuring that local resources are capable of supporting the infrastructure over the long term.

Estimation of Costs of Actions and Activities
Estimating the costs associated with the implementation of the TAP is essential for securing funding and planning resources effectively. Below is a detailed cost estimation for each major action and activity, building on economic assessments and preliminary data.

1. Public Awareness and Education Programs
Estimated Cost: USD$50,000
Details: This includes costs for workshop materials, venue rentals, promotional materials, and facilitator fees. A series of community events across the islands will require a significant initial investment to ensure widespread outreach.

2. Financial Incentives for EV Purchase
Estimated Cost: USD$300,000
Details: This allocation would support direct subsidies, tax breaks, and low-interest loan programs aimed at increasing the affordability of EVs. The financial model will need to be sustainable, with periodic assessments to determine the effectiveness of these incentives.

3.Development of Charging Infrastructure
Estimated Cost: USD600,000
Details: The costs here encompass the purchase and installation of at least 20 charging stations, along with necessary electrical upgrades. This figure includes both hardware and installation costs, as well as ongoing maintenance.

4. Partnerships with Private Sector and NGOs
Estimated Cost: USD20,000
Details: Costs related to establishing partnerships, including meetings, collaborative events, and resource sharing. This includes administrative support for coordinating efforts among stakeholders.

5. Pilot EV Projects
Estimated Cost: USD200,000
Details: Funding will support the implementation of pilot programs in public transport and waste management. This includes vehicle leasing costs, operational support, and data collection efforts to evaluate effectiveness.

6. Monitoring and Evaluation of Pilot Projects
Estimated Cost: USD30,000
Details: This budget is earmarked for data collection tools, analysis software, and personnel involved in monitoring the outcomes of the pilot projects. A thorough evaluation process is critical for assessing success and informing future strategies.

Total Estimated Cost: USD1,300,000

The successful implementation of the TAP for electric vehicles in Tuvalu hinges on careful planning, resource allocation, and capacity building. By identifying the necessary human, infrastructural, financial, and technological resources, as well as estimating the costs associated with each action, Tuvalu can create a solid foundation for sustainable transport solutions. Addressing capacity-building needs will further enhance local expertise and engagement, ensuring that the community is equipped to support the transition to electric vehicles. With strategic investments and collaborative efforts among stakeholders, Tuvalu can advance toward its climate goals and foster a greener, more resilient future.

Table 19: List of Action and Activities, and Estimated Budget

Action/ Activity	**Description**	**Estimated Cost (USD)**	**Details**
Public Awareness and Education Programs	Workshops and community events to educate the public on EVs.	$50,000	Includes workshop materials, venue rentals, promotional materials, and facilitator fees.
Financial Incentives for EV Purchase	Subsidies, tax breaks, and low-interest loans for EV buyers.	$300,000	Funding to support direct financial incentives aimed at increasing EV affordability.
Development of Charging Infrastructure	Purchase and installation of charging stations across islands.	$600,000	Costs for hardware, installation, necessary electrical upgrades, and ongoing maintenance.
Partnerships with Private Sector and NGOs	Collaborative events and resource sharing among stakeholders.	$20,000	Administrative support and costs related to organising meetings and partnership activities.
Pilot EV Projects	Implementation of pilot programs in public transport and waste management.	$200,000	Funding for vehicle leasing, operational support, and data collection for evaluation purposes.
Monitoring and Evaluation of Pilot Projects	Assessing the effectiveness of pilot initiatives.	$30,000	Budget for data collection tools, analysis software, and personnel involved in monitoring efforts.
Total Estimated Cost		**$1,300,000**	

3.2.7 Management Planning

The implementation of the Technology Action Plan (TAP) for electric vehicles (EVs) in Tuvalu presents several potential risks that could impede progress. Identifying these risks and establishing effective contingency plans is crucial to ensuring the successful execution of the TAP.

Identified Risks

1. Financial Risks

Uncertain Funding Sources: There may be challenges in securing the necessary funding from government budgets, international donors, or private sector contributions. Economic downturns or competing budget priorities could impact the availability of funds.

Cost Overruns: Unexpected costs associated with infrastructure development or program implementation could strain financial resources.

2. Technical Risks

Infrastructure Challenges: The installation of charging stations may face logistical issues, such as site accessibility, local regulations, or technical failures during installation.

Maintenance and Support: Lack of local expertise in maintaining EVs and charging infrastructure could lead to prolonged downtimes and reduced user confidence.

3. Community Resistance

Lack of Awareness: Insufficient understanding of EV benefits may lead to community resistance or apathy toward adopting new technologies.

Cultural Barriers: Traditional preferences for gasoline vehicles may hinder the acceptance of EVs within certain community segments.

4. Environmental Risks

Climate Vulnerability: Tuvalu is prone to extreme weather events that could damage charging infrastructure and affect EV operations.

Resource Availability: Dependence on imported materials for infrastructure could be disrupted by global supply chain issues.

Contingency Plans

1. Financial Contingencies

Diverse Funding Strategies: Establish multiple funding avenues, including grants, loans, and public-private partnerships. Developing relationships with potential investors early can provide alternative funding sources.

Cost Management Protocols: Implement rigorous budgeting and financial oversight to monitor spending closely. Establish reserve funds for unforeseen expenses.

2. Technical Contingencies

Pilot Testing: Conduct pilot projects to identify potential technical issues before full-scale implementation. This allows for adjustments based on real-world challenges encountered during initial rollouts.

Capacity Building: Invest in training programs for local technicians and mechanics to ensure the community has the expertise necessary for maintenance and repairs. Partner with educational institutions for ongoing training.

3. Community Engagement Strategies

Awareness Campaigns: Develop comprehensive public awareness campaigns that focus on the environmental and economic benefits of EV adoption. Utilise social media, local radio, and community events to disseminate information widely.

Involvement in Decision-Making: Engage community members in discussions about the TAP and solicit their feedback. This can enhance buy-in and address cultural concerns directly.

4. Environmental Resilience

Site Assessments: Conduct thorough assessments of potential charging station locations to identify vulnerabilities to extreme weather. This will inform decisions about construction and maintenance strategies.

Flexible Infrastructure Solutions: Explore modular and portable charging solutions that can be quickly relocated or repaired in response to environmental changes.

Next Steps

A) Immediate Requirements to Proceed

1. Stakeholder Engagement

Establish Initial Meetings: Organise meetings with key stakeholders, including government agencies, private sector partners, and community leaders, to outline the TAP and secure commitment.

Build Collaborative Networks: Foster relationships among stakeholders to create a cooperative framework for implementing the TAP. Identify champions within the community who can advocate for EV adoption.

2. Funding Mobilisation

Finalise Budget Plans: Review and finalise detailed budget plans, aligning financial resources with the specific actions outlined in the TAP.

Grant Applications: Begin drafting grant proposals to secure funding from international climate funds and development agencies.

3. Training and Capacity Building

Develop Training Programs: Start designing training modules for local technicians, community leaders, and government officials to enhance their understanding of EV technology and management.

Schedule Workshops: Plan the first series of public awareness workshops to inform the community about the benefits of EVs and gather input for the TAP.

B) Critical Steps to Succeed

1. Implementation of Pilot Projects

Select Pilot Locations: Identify suitable locations for initial pilot projects in public transport and waste management sectors. This will provide practical examples of EV benefits and help address technical challenges.

Monitor and Evaluate: Set up monitoring frameworks to evaluate the pilot projects. Gather data on performance, community acceptance, and technical issues to inform future phases of the TAP.

2. Infrastructure Development

Assess Charging Station Sites: Conduct assessments of potential charging station sites to evaluate their feasibility and develop an installation timeline.

Initiate Construction: Begin the construction and installation of charging infrastructure as soon as sites are approved, and funding is secured.

3. Ongoing Community Engagement

Continuous Feedback Mechanism: Establish a mechanism for ongoing community feedback, such as surveys and town hall meetings, to adapt the TAP to evolving needs and concerns.

Highlight Success Stories: As pilots and infrastructure projects progress, highlight success stories through local media to build momentum and encourage broader community participation.

By focusing on these immediate requirements and critical steps, Tuvalu can enhance its efforts to implement the TAP for electric vehicles, ensuring a more sustainable and resilient transportation future. This structured approach will help maintain momentum and foster stakeholder commitment throughout the implementation process.

Table 20: Categorising Risks

Risk Category	***Identified Risks***
Economic Risks	*Uncertain Funding Sources: Challenges in securing necessary funding from government and private sectors.*
	- Cost Overruns: Unexpected costs in infrastructure development or program implementation.
Technical Risks	*- Infrastructure Challenges: Logistical issues in installing charging stations and potential technical failures.*
	- Maintenance and Support: Lack of local expertise for maintaining EVs and charging infrastructure.
Social Risks	*- Lack of Awareness: Insufficient understanding of EV benefits leading to community resistance.*
	- Cultural Barriers: Traditional preferences for gasoline vehicles hinder EV acceptance.
Regulatory Risks	*- Local Regulations: Potential delays or complications due to local regulations affecting infrastructure development.*
	- Environmental Compliance: Challenges in meeting environmental regulations during infrastructure setup.

3.2.8. TAP overview table: Electric Vehicles

Table 21: TAP Overview for Electric Vehicles (EV)

TAP overview table								
Sector	Transport							
Sub-sector	Electric Vehicles							
Technology	Electric Vehicles and Charging Infrastructure							
Ambition	To increase the adoption of electric vehicles by 50% over the next five years and reduce GHG emissions.							
Benefits	- Reduced greenhouse gas emissions - Improved air quality - Lower transportation costs - Enhanced energy security							
Action	Activities to be implemented	Sources of funding	Responsible body and focal point	Time frame	Risks	Success criteria	Indicators for Monitoring of implementation	Budget per activity (USD)
Action 1	Activity 1.1 1.1 Workshops and Community Events	Government budget, international grants, private sector investment	Ministry of Transport, Ministry of Environment	2024 - 2026	- Lack of community awareness - Uncertain funding sources	Increased community engagement and understanding of EV benefits	Number of workshops held, participant feedback, EV adoption rates	Action 1: $50,000
	Activity 1.2 Development of Educational Materials	Government budget, international grants	MHACCE	Months 1-2	Delays in material production	Materials produce	Number of materials distributed	$30,000

Action 2	Activity 2.1 Develop Incentive Programs	Government budget	Ministry of Finance	Months 1-4	Potential budget constraints	Incentive programs ready for rollout	Program details published and available to the public	$100,000
	Activity 2.2 Conduct Financial Workshops	Financial Institutions, Government budget	Ministry of Finance	Months 5-6	Low attendance or interest	Minimum of 100 participants	Participant surveys and feedback	$50,000
	Activity 2.3 Engage with Financial Institutions	Government budget, private sector	Ministry of Finance	Months 3-6	Limited interest from financial institutions	At least two financial products launched	Number of products offered to potential EV buyers	$150,000

3.3 Action Plan for Technology B2: Non-Motorised Transport (Bikes and E-Bikes)

3.3.1. Introduction

Tuvalu faces significant challenges in mitigating greenhouse gas emissions from its transport sector. To meet its commitments under the Nationally Determined Contributions (NDC) and the Tuvalu National Energy Policy (TNEP), transitioning to Non-Motorized Transport (NMT), specifically bicycles and e-bikes, is a key strategy. NMT provides a sustainable, low-cost solution that aligns with Tuvalu's goals to reduce reliance on fossil fuels, improve public health, and enhance environmental resilience.

3.3.2. Ambition for the TAP

The ambition of this action plan is to:

- Reduce GHG emissions by 30% by 2030 through the promotion of non-motorized transport.
- Achieve a 50% modal shift to non-motorized transport for short-distance urban travel by 2030.
- Establish a robust infrastructure and policy framework that supports non-motorized transport as a long-term, sustainable solution to transport-related emissions.

3.3.3. Actions and Activities Selected for Inclusion in the TAP

The promotion and adoption of Non-Motorized Transport (NMT), specifically bicycles and e-bikes, in Tuvalu face several barriers—economic, technical, social, and regulatory—that need to be addressed to ensure the successful implementation of the Technology Action Plan (TAP).

Economic Barriers

One of the main economic barriers to the widespread adoption of NMT in Tuvalu is the high upfront cost of purchasing bicycles and e-bikes, especially for low-income households. Additionally, the small market size and high cost of importing bicycles and e-bikes, as well as associated spare parts, increase the financial burden on potential users. The TAP will address these barriers by proposing government subsidies and financial incentives such as low-interest loans for the purchase of bicycles and e-bikes. Furthermore, the TAP will introduce tax exemptions on the importation of bicycles, e-bikes, and their components, reducing costs for consumers.

To support infrastructure development, international funding sources such as the Green Climate Fund (GCF) and the Global Environment Facility (GEF) will be tapped to help finance the construction of bike lanes, parking facilities, and other necessary infrastructure for non-motorized transport. These mechanisms will ensure the financial feasibility of building the required NMT infrastructure across Tuvalu.

Technical Barriers

Tuvalu lacks the necessary infrastructure to support the widespread adoption of NMT, such as dedicated bike lanes, secure bike parking facilities, and road safety measures for cyclists. The absence of such infrastructure presents a significant technical barrier. The TAP will address this by developing and constructing bike lanes and secure parking facilities in Funafuti and outer islands. This infrastructure will ensure the safety and convenience of cyclists, reducing accidents and making NMT a more attractive option for daily commuting.

In addition, there is limited local expertise in planning, designing, and maintaining NMT infrastructure. To overcome this, the TAP will implement capacity-building programs that train local engineers, urban planners, and technicians on how to design and manage NMT systems.

These programs will emphasise road safety measures, urban planning integration, and ongoing infrastructure maintenance. The TAP will also seek partnerships with international organisations to facilitate technical knowledge transfer and to ensure the long-term sustainability of NMT infrastructure.

Social and Cultural Barriers

A significant social barrier to the adoption of bicycles and e-bikes in Tuvalu is the public's low awareness of the benefits of non-motorized transport. Many citizens still prefer motorised vehicles, viewing them as more convenient and faster, despite the environmental and financial costs. To address this, the TAP will implement comprehensive public awareness campaigns to highlight the environmental, economic, and health benefits of adopting NMT. These campaigns will involve the use of local media, schools, community organisations, and local leaders to build community ownership and increase acceptance of NMT technologies.

The TAP will also include targeted campaigns aimed at children and youth, encouraging the next generation to adopt cycling as part of their daily routines. School programs will teach road safety, the benefits of cycling, and the role NMT can play in reducing emissions and promoting a healthier lifestyle.

Regulatory Barriers

Currently, Tuvalu does not have a dedicated regulatory framework that supports the development and widespread adoption of NMT. This lack of regulatory support is a significant barrier to the diffusion of bicycles and e-bikes as primary modes of transport. The TAP will work to develop a National Non-Motorized Transport Strategy within the framework of the Tuvalu National Energy Policy (TNEP). This strategy will include new policies that prioritise the construction of NMT infrastructure and provide incentives for private investment in NMT technologies.

The TAP will also introduce road safety regulations that protect cyclists and pedestrians, including speed limits and vehicle restrictions in certain urban areas to ensure the safety of NMT users. The integration of NMT into Tuvalu's urban and regional planning processes will ensure that bicycles and e-bikes are considered in future transportation development projects.

By addressing these economic, technical, social, and regulatory barriers, the TAP will help create an enabling environment for the adoption and diffusion of NMT, contributing to Tuvalu's goals of reducing GHG emissions and achieving sustainable, low-carbon transport by 2030.

3.3.4. Strategic Actions and Activities for NMT integration in Tuvalu Transport Sector

The TAP outlines several strategic actions and activities aimed at reducing reliance on fossil fuels and promoting the adoption of bicycles and e-bikes as part of Tuvalu's transition to a sustainable, low-carbon transport system. These actions are designed to address the economic, technical, social, and regulatory barriers identified earlier and create an enabling environment for NMT.

1. Developing Cycling Infrastructure

A key strategic action in the TAP is the development of cycling infrastructure to support the safe and widespread adoption of non-motorized transport. The initial phase will involve identifying key urban and rural areas where bike lanes and secure parking facilities can be constructed. The TAP proposes starting with pilot projects in Funafuti, where dedicated bike

lanes will be integrated into existing road networks. Secure bike parking facilities will be established at key public locations such as schools, markets, hospitals, and government offices to encourage the use of bicycles and e-bikes for daily commuting. These pilot projects will be scaled up based on demand and lessons learned from initial implementation, ensuring the cycling infrastructure becomes a permanent and integral part of Tuvalu's transport system.

2. Providing Financial Incentives for NMT Adoption
To reduce financial barriers, the TAP emphasises the importance of financial incentives for individuals and businesses to adopt bicycles and e-bikes. This includes launching a government subsidy program to make bicycles and e-bikes affordable for low-income households. Tax exemptions on the importation of bicycles, e-bikes, and spare parts will also be introduced to lower retail prices. These financial incentives aim to stimulate demand for NMT, particularly among populations who may find the initial cost of purchasing bicycles and e-bikes prohibitive. Additionally, partnerships with local financial institutions will offer low-interest loans, making NMT even more accessible to the public.

3. Capacity Building and Public Awareness Programs
Capacity building and public awareness are crucial to the successful implementation of NMT in Tuvalu. The TAP includes training programs for local engineers and urban planners to ensure they have the technical expertise to design, implement, and maintain NMT infrastructure. International partnerships with organisations experienced in sustainable transport will provide additional knowledge transfer and technical support.

In parallel, a comprehensive public awareness campaign will be launched to educate the public about the environmental, health, and financial benefits of cycling. This campaign will use media, schools, and community outreach programs to build public interest in NMT. Events like "Bike to Workdays" and community cycling competitions will further encourage the public to adopt NMT as a viable, attractive alternative to motorised transport.

4. Policy and Institutional Strengthening
A strong policy and regulatory framework are essential to promote NMT as part of Tuvalu's long-term transport strategy. The TAP will support the development of a National Non-Motorized Transport Strategy that integrates NMT into the Tuvalu National Energy Policy (TNEP). This strategy will include road safety regulations prioritising cyclists, such as speed limits in urban areas, and mandates for the inclusion of bike lanes in future urban planning projects.

Additionally, the policy will establish incentives for private sector participation, including subsidies for businesses that promote NMT, such as bicycle repair shops and rental services. These policies will ensure that the adoption of NMT is supported by a clear regulatory framework that encourages private investment and ensures long-term sustainability.

Table 22: Strategic Actions and Activities for NMT

Action	Activity	Description

1. Develop Cycling Infrastructure	**Activity 1.1**: Identify key areas for cycling infrastructure	Map and identify key urban areas in Funafuti and outer islands for bike lane and parking facility construction.
	Activity 1.2: Construct dedicated bike lanes	Build pilot bike lanes in Funafuti, ensuring safety and accessibility for cyclists.
	Activity 1.3: Install secure bike parking facilities	Establish bike parking at public facilities such as schools, markets, hospitals, and government offices.
	Activity 1.4: Establish a maintenance schedule	Create a regular inspection and repair schedule for bike lanes and parking facilities to ensure safety and usability.
2. Providing Financial Incentives for NMT Adoption	**Activity 2.1**: Develop and launch a government subsidy program	Implement subsidies for low-income households to reduce the upfront cost of purchasing bicycles and e-bikes.
	Activity 2.2: Provide tax exemptions and reduce import duties	Offer tax exemptions on bicycles, e-bikes, and related parts to lower consumer costs and increase accessibility.
	Activity 2.3: Establish partnerships for low-interest loans	Collaborate with local financial institutions to provide low-interest loans for the purchase of bicycles and e-bikes.
3. Capacity Building and Public Awareness Programs	**Activity 3.1**: Conduct capacity-building workshops for engineers and urban planners	Organise training programs to equip local engineers and urban planners with the skills to design and maintain cycling infrastructure.
	Activity 3.2: Launch a national public awareness campaign	Develop educational materials and media campaigns to promote the benefits of cycling and e-bikes, targeting schools and communities.
	Activity 3.3: Organise public cycling events	Host events such as "Bike to Workdays" and community cycling competitions to build enthusiasm and promote NMT.

4. Policy and Institutional Strengthening	**Activity 4.1**: Develop a National Non-Motorized Transport Strategy	Draft a comprehensive strategy for NMT that integrates into the **Tuvalu National Energy Policy (TNEP)** and long-term transport planning.
	Activity 4.2: Implement road safety regulations	Enforce regulations prioritising cyclists, including speed limits and traffic rules to protect NMT users in urban areas.
	Activity 4.3: Include NMT in urban planning	Ensure that NMT is included in all urban and regional planning projects, with specific allocations for bike lanes and parking facilities.

Each of the identified actions requires specific activities to ensure their successful implementation. These activities are designed to operationalize the selected actions and address the barriers identified.

3.3.5. Stakeholders and Timeline for Implementation of TAP

The successful implementation of the Technology Action Plan (TAP) for Non-Motorized Transport (NMT) in Tuvalu will require active collaboration among various stakeholders, each contributing to the development, execution, and sustainability of NMT projects. Below is an outline of the key stakeholders, along with their respective roles in the implementation of the TAP.

1. Government of Tuvalu

- The Government of Tuvalu will play a central role in driving policy development, coordinating infrastructure projects, and providing financial support for NMT initiatives. The government's primary responsibilities include:
- Policy Development and Regulation: Developing and implementing a National Non-Motorized Transport Strategy that prioritises the integration of NMT in urban planning and transport systems. This will include developing road safety regulations that protect cyclists and ensure the infrastructure is built to high safety standards.
- Coordination and Oversight: The government will lead inter-ministerial coordination to ensure NMT is aligned with the Tuvalu National Energy Policy (TNEP) and the country's climate goals under the Nationally Determined Contributions (NDC).
- Financial Support: Providing subsidies, tax incentives, and financial support to encourage the adoption of bicycles and e-bikes, while mobilising funds for NMT infrastructure development.

Key government bodies involved:

- Ministry of Transport, Energy, and Tourism (MTET): Lead agency responsible for NMT policy development and project coordination.
- Ministry of Finance: Overseeing financial incentives such as subsidies, tax exemptions, and securing international funding for infrastructure projects.
- Local Governments and Island Councils: Coordinating with local authorities to plan and implement cycling infrastructure in communities.

2. Private Sector

Private sector entities will play a vital role in supplying bicycles, e-bikes, and related services, as well as supporting infrastructure development and innovation. Their responsibilities include:

- Supply and Distribution: Importing and retailing bicycles, e-bikes, and spare parts, ensuring their availability to the public. The private sector will also provide after-sales services such as maintenance and repairs.
- Partnerships and Investment: Collaborating with local governments to develop bike rental services, parking facilities, and storage units in key urban areas. Additionally, private businesses may invest in cycling-related infrastructure and services.

Private sector participants may include:

- Retailers and Importers: Focused on providing bicycles and e-bikes at affordable prices through partnerships with international suppliers.
- Small and Medium Enterprises (SMEs): Supporting local maintenance services and cycling-related infrastructure projects, such as bike repair stations and parking services.

3. Local Communities and Civil Society Organizations

The participation of local communities and civil society organizations (CSOs) is essential for ensuring the successful deployment and long-term sustainability of NMT projects. Their roles include:

- Public Engagement and Support: Working with local leaders, CSOs, and community organisations to build public awareness of the benefits of NMT, and to encourage participation in NMT programs.
- Cycling Promotion and Participation: Community-based organisations will lead awareness campaigns, cycling events, and educational programs in schools to promote the adoption of bicycles and e-bikes.
- Community-Led NMT Projects: Community organisations will be instrumental in supporting pilot NMT projects and promoting local ownership of cycling infrastructure and services.

Key roles for civil society:

- NGOs and CSOs: Supporting the execution of public awareness campaigns and helping to promote cycling events.
- Educational Institutions: Incorporating NMT awareness and cycling safety education into school curriculums.

4. International Partners and Donors

- International donors and development organisations will provide the financial and technical assistance necessary for the successful implementation of the TAP. Their roles include:
- Funding and Financial Support: Organisations such as the Green Climate Fund (GCF), Global Environment Facility (GEF), and United Nations Development Programme (UNDP) will provide grants, loans, and financial support to help build cycling infrastructure and subsidise the adoption of bicycles and e-bikes.
- Technical Expertise and Capacity Building: International partners will support knowledge transfer through training programs for local engineers and urban planners, as well as technical assistance in designing safe and efficient NMT systems.
- Monitoring and Evaluation: International partners will assist with developing monitoring and evaluation frameworks to track the effectiveness of NMT projects and adjust strategies as needed.

Key international stakeholders:

- GCF, GEF: Providing financial assistance for infrastructure and capacity-building programs.
- UNDP, UNEP: Supporting technical expertise and capacity-building efforts for NMT integration.

5. Research and Academic Institutions

Research and academic institutions will contribute to the technical advancement of NMT in Tuvalu through research, capacity building, and project monitoring. Their roles include:

- Research and Development (R&D): Conducting studies on road safety, infrastructure design, and the environmental impact of NMT to improve the efficiency and effectiveness of cycling infrastructure.
- Capacity Building: Partnering with government and private sectors to provide training programs for local engineers and urban planners.
- Monitoring and Evaluation: Supporting the development of frameworks to monitor NMT adoption and its impact on emissions reductions and public health.

Institutions involved:

- University of the South Pacific (USP): Providing technical support, research, and academic training related to sustainable transport solutions.

The implementation of the TAP will be phased to ensure that key milestones are achieved efficiently and that lessons from initial projects are integrated into future efforts.

Table 23: Timeline for Implementation of TAP

Action	Short Term (1-2 years)	Medium Term (3-5 years)	Long Term (6-10 years)
Cycling Infrastructure Development	Identify key areas and initiate pilot bike lane projects in Funafuti	Expand cycling infrastructure to other islands and rural areas	Complete cycling infrastructure across the country
Financial Incentives for NMT Adoption	Launch subsidy programs and provide tax exemptions on bicycles and e-bikes	Scale up financial incentives to cover a larger portion of the population	Establish long-term funding mechanisms to support NMT adoption
Public Awareness Campaigns	Develop and launch public awareness campaigns promoting cycling and e-bikes	Expand campaigns to schools, community groups, and businesses	Maintain public engagement and promote NMT as a long-term solution

Capacity Building and Technical Training	Initiate training programs for local engineers and urban planners	Continue capacity building and technical assistance programs	Ensure sustainability through ongoing capacity-building efforts
Policy and Institutional Development	Draft and implement the National Non-Motorized Transport Strategy	Review and adjust policies based on project results and public feedback	Regularly update policies and ensure compliance through government oversight

3.3.6. Estimation of Resources Needed for Action and Activities

The successful implementation of the Technology Action Plan (TAP) for Non-Motorized Transport (NMT) in Tuvalu will require significant financial resources from both domestic and international sources. The estimated cost of implementing the NMT TAP is approximately $2.5 million, which will cover infrastructure development, capacity building, public awareness campaigns, and policy development. Financial sustainability is critical to ensuring the long-term success of the TAP.

Below is a breakdown of the estimated costs for the key actions in the TAP, along with potential funding sources. These estimates reflect the need for infrastructure development, capacity building, and ongoing public awareness and policy implementation.

Table 24: Estimated Cost

Action	Estimated Cost (USD)	Funding Source(s)
Feasibility Study	$150,000	GEF, Bilateral Aid
Pilot NMT Infrastructure Development	$700,000	GCF, Private Sector, Bilateral Partners
Full Infrastructure Development	$1,000,000	GCF, GEF, Government of Tuvalu, International Development Partners
Capacity Building & Training	$300,000	UNEP, GEF, International NGOs, Bilateral Partners
Public Awareness Campaigns	$200,000	International NGOs, GEF, GCF, Bilateral Aid

Policy Development and Implementation	$150,000	Government of Tuvalu, Bilateral Aid
Development of Low-interest finance products for bikes and e-bikes	$100,000	GEF, Development Bank of Tuvalu, Bilateral Aid
Insurance Product Development for Bikes and e-bikes	$75,000	Private Sector Partnerships, GCF, Local Financial Institutions

3.3.7. Estimation of Capacity Building Needs

Capacity building is essential for the successful implementation and long-term sustainability of the NMT TAP in Tuvalu. The plan will focus on building local expertise and skills in key areas such as infrastructure design, urban planning, road safety, and public awareness. To ensure the successful adoption and integration of NMT into Tuvalu's transport systems, the following capacity-building initiatives will be undertaken:

- Technical Training for Engineers and Urban Planners: Training programs will be designed for local engineers and urban planners to develop skills in designing, constructing, and maintaining cycling infrastructure such as bike lanes and secure parking facilities. These programs will be delivered in partnership with international organisations experienced in sustainable urban mobility.
- Public Sector Capacity Building: Government officials and policymakers will receive training on how to integrate NMT into the national transport policy framework, including the development of regulations to ensure cyclist safety and the promotion of NMT-friendly urban planning practices. Additionally, this training will focus on incorporating NMT considerations into broader energy and climate change policies, such as the Tuvalu National Energy Policy (TNEP) and Nationally Determined Contributions (NDC).
- Public Awareness and Community Engagement: Community leaders, civil society organisations (CSOs), and educators will be trained on how to run public awareness campaigns that highlight the environmental, health, and economic benefits of NMT. Training will focus on organising public events like "Bike to Workdays" and developing educational materials for schools and communities to foster long-term behaviour change towards non-motorized transport.
- Private Sector Engagement and Technical Support: Local businesses involved in the sale, repair, and maintenance of bicycles and e-bikes will receive training on technical aspects of bicycle and e-bike servicing, spare parts management, and financial models for offering affordable NMT products and services to the public.

Table 25: Capacity-building Activities Planned

Activity	Target Audience	Description

Technical Training for Infrastructure	Local engineers, urban planners	Training on designing and maintaining bike lanes, parking facilities, and road safety measures for NMT
Government Policy and Planning Support	Government officials, policymakers	Training on developing and implementing NMT policies and integrating NMT into national energy and transport strategies
Public Awareness and Community Engagement	CSOs, community leaders, educators	Training on running public campaigns, organising cycling events, and integrating NMT into school curriculums
Private Sector Technical Training	Retailers, SMEs, importers	Training on bicycle and e-bike repair and maintenance, spare parts management, and business development

3.2.7.1. Estimations of Costs for Actions and Activities

The total estimated cost for implementing the NMT TAP in Tuvalu, based on the actions and activities outlined, is approximately $2.5 million. This cost estimate is based on economic assessments and barrier analysis conducted during the development of the Barrier Analysis and Enabling Framework (BAEF) report, which identified key measures to overcome the barriers to NMT adoption. The funding will be sourced from a combination of domestic and international partners, including multilateral climate funds, bilateral aid, and private sector investments.

The estimated costs cover the following components:

- Infrastructure Development: This includes the design, construction, and maintenance of bike lanes, parking facilities, and other related infrastructure needed to support cycling in Tuvalu.
- Capacity Building: Training programs will focus on building the technical expertise of local engineers, planners, policymakers, and the private sector to ensure the long-term sustainability of NMT systems.
- Public Awareness Campaigns: Costs for media campaigns, school programs, and community engagement initiatives to promote the benefits of NMT and encourage widespread adoption.
- Policy and Regulatory Development: Funding to support the creation and implementation of a national Non-Motorized Transport Strategy, road safety regulations, and incentives for private sector participation.

3.2.8. Management Planning

The Management Planning section of the NMT Technology Action Plan (TAP) focuses on ensuring the implementation process is well-organised, risks are effectively managed, and strategic actions are taken to achieve the plan's objectives. As a small island developing state, Tuvalu faces unique challenges, including limited financial and technical resources, and social

resistance to adopting new transport modes. This section outlines the identified risks, contingency measures, and the next steps needed to ensure the successful implementation of NMT initiatives.

3.2.8.1. Risks and Contingency Planning

The economic, technical, and social conditions in Tuvalu require a proactive approach to risk management. The following key risks have been identified as potential challenges to the successful implementation of the NMT TAP, along with proposed contingency measures to mitigate these risks.

1.Economic Risks:

- Identified Risk: Tuvalu's reliance on international funding poses an economic risk, as fluctuating financial support or a sudden increase in the cost of imported bicycles and e-bikes could hinder adoption.
- Contingency Plan: Tuvalu will secure long-term financial support through international mechanisms such as concessional loans and grants from the Green Climate Fund (GCF) and Global Environment Facility (GEF). Additionally, government subsidies and tax exemptions for NMT will remain in place to stabilise market prices and promote accessibility.

2.Technical Risks:

- Identified Risk: Limited local technical expertise in NMT infrastructure design, construction, and maintenance could result in poorly executed projects and lack of ongoing support.
- Contingency Plan: Technical capacity-building programs will be launched, supported by international partners like UNDP and UNEP, focusing on training local engineers and urban planners. These programs will include on-the-job training and workshops on infrastructure management and maintenance. Regular assessments will ensure the quality and sustainability of bike lanes and related infrastructure.

3.Social Risks:

- Identified Risk: Resistance to non-motorized transport may arise due to the public's preference for motorised vehicles, as bicycles and e-bikes may be perceived as less convenient or practical.
- Contingency Plan: A robust public awareness campaign will educate citizens about the environmental, health, and economic benefits of NMT. Community involvement will be encouraged through cycling events, educational programs in schools, and direct participation in pilot projects. These initiatives will build public support and normalise the use of bicycles and e-bikes for everyday transportation.

4.Regulatory Risks:

- Identified Risk: Delays in the development and implementation of supportive policies and regulations for NMT could slow down adoption and infrastructure development.
- Contingency Plan: Early and consistent engagement with policymakers will be critical. A dedicated policy advocacy team within the Project Management Unit (PMU) will work closely with government bodies to expedite the creation of a National Non-Motorized Transport Strategy. Temporary regulations, such as tax breaks for NMT users and incentives for infrastructure investment, will be introduced to accelerate progress.

3.2.9. Next Steps

To ensure the successful rollout of the NMT TAP, several critical steps need to be taken to address immediate requirements and set the foundation for long-term success. These steps will guide the government and key stakeholders in committing resources and implementing the necessary actions for NMT development in Tuvalu.

1. Immediate Requirements to Proceed

a. Securing Funding:

- Critical Action: The primary priority is securing funding from international donors and climate finance mechanisms, such as GCF, GEF, and bilateral partners. The Ministry of Transport, Energy, Transport, Tourism and Innovation (MTECCI) will lead these negotiations to ensure adequate capital for infrastructure development, capacity building, and public awareness campaigns.

b. Conducting Feasibility Studies:

- Critical Action: A feasibility study is essential to assess the suitability of different urban and rural areas for NMT infrastructure, including bike lanes and parking facilities. The study will also evaluate potential social, environmental, and financial impacts to ensure sustainable project outcomes.

c. Establishing the Project Management Unit (PMU):

- Critical Action: A Project Management Unit must be established within the MTECCI to coordinate all NMT TAP activities. The PMU will be responsible for monitoring progress, managing resources, and ensuring alignment with national energy and transport goals. The PMU will work closely with a Project Steering Committee that includes key stakeholders, such as government ministries, NGOs, and international partners.

d. Engagement with Stakeholders:

- Critical Action: Early engagement with the private sector and local communities will be essential to attract investment and build public support for NMT. Public-Private Partnerships (PPPs) will help share the financial burden, while community engagement will foster local ownership of cycling infrastructure and services.

2. Critical Steps to Succeed

a. Policy and Regulatory Framework Development:

- Critical Action: The development of a National Non-Motorized Transport Strategy is crucial for the long-term success of the TAP. This policy will include road safety regulations, incentives for NMT adoption, and urban planning requirements for integrating NMT infrastructure into future transport projects.

b. Capacity Building and Technical Training:

- Critical Action: Capacity building will focus on equipping local engineers, urban planners, and government officials with the technical skills needed to manage NMT projects. This training will be supported by international partners and will cover areas such as infrastructure design, maintenance, and NMT policy development.

c. Infrastructure Development:

- Critical Action: The construction of bike lanes, parking facilities, and other NMT infrastructure is a key element of the TAP. Partnerships with the private sector and international donors will be crucial in financing and developing this infrastructure to support widespread NMT adoption.

d. Public Awareness and Community Engagement:

- Critical Action: An ongoing public awareness campaign will be critical to building support for NMT. The campaign will focus on the environmental, health, and economic benefits of adopting bicycles and e-bikes as daily transport. Community engagement through schools and local organisations will help ensure long-term behaviour change.

e. Continuous Monitoring and Evaluation (M&E):

- Critical Action: A comprehensive Monitoring and Evaluation (M&E) framework will be established to track the progress of NMT projects. The PMU will be responsible for collecting data on infrastructure usage, emissions reductions, and public engagement. Regular evaluations will ensure that goals are being met, and adjustments are made to optimise the success of the TAP.

TAP Overview: Shift to Bikes, E-Bikes & Non-motorized transport.

Table 26: TAP Overview Table for Non-Motorised Transport (Bikes and E-Bikes)

TAP overview table								
Sector	Transport							
Sub-sector	Transport							
Technology	Non-Motorised Transport (Bikes and E-Bikes)							
Ambition	Promote Widespread adoption of bicycle and e-bikes, replacing at least 50% of short distance urban travel by 2030							
Benefits	Reduce GHG emission, enhanced energy security, reduced reliance on imported fossil fuels							
Action	Activities to be implemented	Sources of funding	Responsible body and focal point	Time frame	Risks	Success criteria	Indicators for Monitoring of implementation	Budget per activity (USD)
1. Feasibility Study for NMT Infrastructure	Activity 1.1: Conduct feasibility studies to identify viable areas for cycling infrastructure (bike lanes, parking)	GEF, Bilateral Aid	Ministry of Transport, Tourism, Energy, Communications and Innovation (MTECCI)	Short term	Lack of technical data or resources	Completion if feasibility study and identification of sites	Feasibility study report, list of viable sites	**USD 150,000**

	Activity 1.2: Assess potential environmental and social impacts of infrastructure development				Delays in conducting studies	Completion of Environmental and Social Impact Assessment (ESIA)	ESIA report	
	Activity 1.3: Evaluate economic feasibility of NMT adoption in Funafuti and other key locations.				Funding shortfalls	Economic feasibility study completed	Feasibility report	
2. Pilot NMT Infrastructure Development	Activity 2.1 Construct pilot bike lanes in Funafuti and install bike parking facilities in public areas	National Budget, GCF, GEF	Ministry of Transport, Tourism, Energy, Communications and Innovation (MTECCI)	Medium Term	Lack of funding and construction days	Completion of pilot bike lanes and parking	Number of pilot projects completed lane length	**USD 700,000**
	Activity 2.2: Identify and secure suitable locations for bike				Land ownership issues	Secured locations for bike lanes and parking	Signed agreements for land allocation	

	lanes and parking facilities							
	Activity 2.3: Establish and operate pilot bike rental programs				Limited public interest	Pilot rental program launched	Number of rentals, public participation rates	**USD 100,000**
3. Full-Scale NMT Infrastructure Development	Activity 3.1: Expand bike lanes and parking to other islands and rural areas	GCF, GEF, International Partnerships	Ministry of Transport, Tourism, Energy, Communications and Innovation (MTECCI)	Long-term	Land acquisition, insufficient funding	Expanded network of bike lanes and parking	Total length of bike lanes, number of parking facilities built	**USD 1,000,000**
	Activity 3.2: Build bike parking facilities in schools, government offices, and commercial centres				Delays in project approvals	Parking facilities established in key areas	Number of facilities built	
4. Capacity Building and Training	Activity 4.1: Provide subsidies and low-interest loans for bicycle	Government Budget,	Ministry of Transport, Tourism, Energy,	Short-term	Lack of financial resources,	Number of bicycles and e-bikes sold	Number of subsidies disbursed	**USD 250,000**

Programs	and e-bike purchases	GCF, GEF	Communications and Innovation (MTECCI)		limited uptake		Uptake rate	
	Activity 4.2: Reduce import duties on bicycles, e-bikes, and spare parts				Delays in policy implementation	Reduction in bicycle and e-bike prices	Import duties reduced, number of imported units	
	Activity 4.3: Partner with local banks to offer low-interest loans for NMT purchases				Limited interest from financial institutions	Partnerships established Loan schemes launched	Number of loans issued	
5. Public Awareness and Policy Advocacy	Activity 5.1: Launch national public awareness campaigns on the benefits of NMT	International NGOs, GCF, Government Budget	Ministry of Transport, Tourism, Energy, Communications and Innovation (MTECCI)), NGOs	Medium-term	Low public engagement, resistance to change	Campaign launched, increased public interest	Number of public events, survey results	**USD 200,000**

	Activity 5.2: Engage schools and community organisations in promoting cycling and e-bikes				Lack of participation from schools and communities	Successful school and community engagement	Number of events, participation rates	
	Activity 5.3: Organise "Bike to Workdays" and community cycling events				Low participation	Successful events with high participation	Number of events, number of participants	**USD 50,000**
6. Scale-up Biogas Production	Activity 6.1: Train engineers and planners on NMT infrastructure design and maintenance	GEF, International Partnerships	Ministry of Transport, Tourism, Energy, Communications and Innovation (MTECCI)	Short-term	Lack of technical expertise	Training programs developed and completed	Number of participants, training completion rate	**USD 200,000**
	Activity 6.2: Provide training for private sector on bicycle maintenance and repair services				Lack of interest from private sector	Established bicycle repair and maintenance services	Number of certified technicians, repair shops set up	

7. Monitoring and Evaluation of Biogas Integration	Activity 7.1: Develop M&E framework to track progress and NMT adoption	GEF, Government Budget	Ministry of Transport, Tourism, Energy, Communications and Innovation (MTECCI), International Partners	Ongoing	Inadequate data collection and reporting	M&E framework established, regular reporting	Periodic reports, adoption rates, emissions reductions	**USD 100,000**
	Activity 7.2: Conduct annual reviews of NMT projects and adjust strategies as needed				Lack of timely data and feedback	Successful project reviews, adaptive strategies	Number of reviews, adjustments made	
	Activity 7.3: Measure the impact of NMT on GHG emissions reductions				Data gaps and insufficient impact analysis	Emission reductions measured and reported	GHG emission reduction metrics, impact reports	

Chapter 4: Specific Project Ideas

4.1 Project Ideas for the Energy Section

4.1.1 Small-Scale Biogas Pilot Facility for Energy and Waste Management

Tuvalu's energy sector faces significant challenges due to its near-total dependence on imported fossil fuels, primarily for electricity generation and transport. The volatility of global fuel prices makes this reliance unsustainable both economically and environmentally, with imported fossil fuels accounting for a significant share of the country's greenhouse gas (GHG) emissions. At the same time, Tuvalu faces growing waste management problems, with organic waste from households and agriculture contributing to environmental degradation. Given Tuvalu's vulnerability to climate change and its commitment under the Paris Agreement to reduce GHG emissions, it is essential to explore renewable energy sources that can address these dual challenges of energy insecurity and waste management.

Specific Project Ideas

The Small-Scale Biogas Pilot Facility project will be developed as part of Tuvalu's broader strategy to transition to renewable energy and manage organic waste more efficiently. By converting organic waste into biogas, this project aims to provide a sustainable, clean energy source while simultaneously reducing the environmental impacts of waste. This pilot project builds on feasibility studies and consultations with local stakeholders, which have demonstrated the technical and economic potential for biogas production in Tuvalu, given the availability of organic waste feedstock. The project also aligns with Tuvalu's Nationally Determined Contributions (NDC) under the Paris Agreement, which sets targets for reducing GHG emissions and increasing the use of renewable energy by 2025.

Objectives

The primary objective of the project is to establish a fully operational small-scale biogas pilot facility that converts organic waste into usable energy, thereby demonstrating the feasibility of biogas technology in Tuvalu. Specifically, the project aims to:

- Reduce GHG emissions by utilising biogas as an alternative to fossil fuels.
- Improve Tuvalu's energy security by producing energy locally from renewable sources.
- Support waste management efforts by reducing the amount of organic waste sent to landfills.
- Build technical capacity within Tuvalu to operate and maintain biogas facilities through targeted training programs.
- Engage local communities in sustainable waste collection practices, thereby fostering public support for renewable energy initiatives.

These objectives are realistic given Tuvalu's existing commitment to renewable energy development and the availability of local organic waste as a biogas feedstock. The pilot project will also create the necessary technical and institutional foundations for the future expansion of biogas technology across Tuvalu.

Outputs and Measurable Indicators

The project will produce several tangible outputs, which will serve as key performance indicators (KPIs) to measure its success. These outputs are realistic and feasible, considering Tuvalu's current economic and environmental conditions:

- The construction of a small-scale biogas facility that processes organic waste from households and agriculture.
- The production of biogas sufficient to meet the cooking and electricity needs of approximately 50 households.
- A 10% reduction in organic waste sent to landfills, contributing to improved waste management practices.
- The creation of five local jobs focused on biogas plant operation, waste collection, and plant maintenance.
- A measurable reduction in GHG emissions resulting from the replacement of fossil fuel-based energy with biogas.

Relationship to the Country's Sustainable Development Priorities

The Small-Scale Biogas Pilot Facility is directly aligned with Tuvalu's sustainable development priorities, particularly its goal of achieving 100% renewable energy by 2025 as outlined in the Tuvalu National Energy Policy (TNEP). The project contributes to Tuvalu's commitment to reducing its reliance on imported fossil fuels, enhancing energy security, and addressing climate change by lowering GHG emissions. This project is also critical to meeting Tuvalu's Nationally Determined Contributions (NDCs) under the Paris Agreement, which call for the promotion of renewable energy sources and a reduction in the country's overall carbon footprint.

Additionally, the project supports Tuvalu's waste management goals by converting organic waste into energy, thus helping to reduce the environmental burden of waste disposal. This is particularly important in an island nation like Tuvalu, where land is limited, and the improper disposal of organic waste contributes to pollution and environmental degradation. By integrating waste management with energy production, the project represents an innovative and holistic approach to sustainable development.

Project Deliverables: Value and Benefits

The Small-Scale Biogas Pilot Facility project will deliver multiple tangible and intangible benefits. Key deliverables include:

- Energy Security: By producing energy locally, Tuvalu will reduce its dependence on imported diesel fuels, thereby improving the country's energy independence and resilience.
- Environmental Benefits: The project will contribute to the reduction of GHG emissions by displacing fossil fuel-based energy with renewable biogas. In addition, the diversion of organic waste from landfills will reduce the environmental pollution associated with waste decomposition.
- Economic and Social Impact: The project will create jobs and foster local expertise in renewable energy technologies, providing long-term economic benefits to the community. Moreover, the project's focus on public awareness and engagement will help build support for renewable energy initiatives.
- Scalability and Replicability: The pilot project will serve as a proof of concept, demonstrating the feasibility of biogas technology in Tuvalu. If successful, the project could be scaled up to other areas of the country or replicated in other SIDS with similar environmental and economic conditions.

Project Scope and Feasibility

The project is scoped to build and operate a pilot biogas facility in one of Tuvalu's communities with high organic waste generation. This pilot project will be used to demonstrate the feasibility of biogas technology in the country and provide a learning model for future biogas projects. The facility will process organic waste from households and agricultural activities,

converting it into biogas for cooking and electricity needs. Given the availability of feedstock (organic waste) and Tuvalu's strong commitment to renewable energy development, the project is both technically and financially feasible.

The project will also benefit from existing international partnerships with donors and technical experts, who will provide financial and technical support. This includes contributions from the Green Climate Fund (GCF) and bilateral aid partners, who have expressed interest in supporting Tuvalu's renewable energy transition.

Project Activities

The project will involve several key activities:

- Site Selection and Feasibility Study: A detailed study will be conducted to identify the most suitable location for the facility, based on feedstock availability and community engagement.
- Facility Construction: The biogas facility will be built using both local labour and international expertise to ensure that it meets technical standards for efficiency and safety.
- Capacity Building: A comprehensive training program will be implemented to equip local engineers and technicians with the skills needed to operate and maintain the facility.
- Public Awareness Campaigns: Community engagement activities will be conducted to educate the public on the benefits of biogas and encourage their participation in waste collection efforts.
- Monitoring and Evaluation: Continuous monitoring systems will be installed to track the plant's energy output, waste reduction, and GHG emission savings.

Timelines

The project will be implemented over a period of two years, with the following timeline:

- Quarter 1 (Year 1): Completion of the feasibility study and site selection.
- Quarter 2-3 (Year 1): Facility construction and equipment procurement.
- Quarter 4 (Year 1): Commissioning of the facility and initiation of biogas production.
- Year 2: Full operation of the plant, capacity building initiatives, and ongoing community engagement efforts.
- Year 3: Mid-term evaluation to assess project performance and inform future scaling opportunities.

Budget and Resource Requirements

The total estimated budget for the project is USD 450,000, which will cover:

- Site selection and feasibility studies: $50,000.
- Construction and procurement of equipment: $300,000.
- Capacity building and training programs: $50,000.
- Public awareness campaigns and community engagement: $20,000.
- Monitoring and evaluation systems: $30,000.
- Funding will be sourced from the Green Climate Fund (GCF), private sector contributions, and bilateral aid from international partners such as UNEP.

Measurement and Evaluation

The success of the project will be measured using several key performance indicators, including:

- Biogas production: The volume of biogas produced on a monthly basis.
- Waste diversion: The amount of organic waste processed by the facility and diverted from landfills.

- GHG emission reductions: Quantified reductions in emissions compared to fossil fuel-based energy generation.
- Job creation: The number of jobs created and filled by local residents.
- Public participation: The level of community engagement in waste collection and project support.
- Regular progress reports will be prepared and submitted to the relevant stakeholders, and a comprehensive mid-term evaluation will be conducted at the end of the second year.

Challenges and Complications

The project may face several potential challenges, including:

- Land acquisition issues: Delays in securing land for the facility could affect the project timeline.
- Technical expertise gaps: A lack of local expertise in biogas technology could lead to operational challenges, though this will be mitigated through comprehensive training programs.
- Community resistance: There may be initial resistance from the local population, especially regarding waste collection practices, but this will be addressed through targeted public awareness campaigns.
- Feedstock supply: Fluctuations in organic waste availability could impact the plant's efficiency, making feedstock collection a critical component of the project's success.

Responsibilities and Coordination

The project will be managed by the Project Management Unit (PMU) within the Ministry of Energy, with the following responsibilities:

- Department of Energy: Overall project coordination and oversight, ensuring that milestones are met.
- International Consultants: Technical support and expertise in facility design and construction.
- Local Government: Support with land acquisition and coordination of waste collection activities.
- Community Leaders: Engaging local communities and ensuring active participation in the project.
- International Donors: Providing financial support and technical assistance.

This collaborative approach will ensure that the project is implemented smoothly and that all stakeholders are actively involved in its success. The Small-Scale Biogas Pilot Facility will serve as a critical step toward Tuvalu's energy transition and sustainable development goals, offering a model for future renewable energy projects in the country.

4.1.2. Project Title: Renewable Energy Expansion: Integration of 5.7 MW Solar PV with 3 MW/14 MWh BESS to the National Grid by 2030

Introduction/Background

This project aims to help Tuvalu achieve its ambitious target of reaching 100% renewable energy by 2030 by focusing on the diffusion and integration of Solar PV (national grid) + Battery Energy Storage Systems (BESS). The project was developed as part of the broader Technology Action Plan for the energy sector and in response to Tuvalu's vulnerabilities to climate change, reliance on imported diesel, and national commitment to sustainable development under international climate agreements like the Paris Agreement. Building on the success of initial Solar PV installations funded by the Asian Development Bank (ADB),

World Bank, and other bilateral partners, this project seeks to expand solar energy capacity and integrate energy storage solutions to ensure a reliable and resilient power supply.

Objectives

The primary objectives of this project are:

1. Deploy 5.7 MW of Solar PV integrated with 3 MW/14 MWh of BESS to the national grid by 2030.

2. Reduce reliance on fossil fuel imports and lower greenhouse gas emissions by transitioning to 100% renewable energy.

3. Ensure energy security and grid stability by incorporating BESS for efficient energy storage and supply management.

4. Enhance technical capacity within Tuvalu to manage and maintain renewable energy systems locally.

Outputs and Measurable Indicators

- Increased Renewable Energy Capacity: 5.7 MW of Solar PV installed and integrated with 3 MW/3.5 MWh of BESS by 2030.

- Reduction in Fossil Fuel Consumption: At least 90% reduction in diesel imports by 2030.

- GHG Emissions Reduction: Estimated reduction of 20,000 tons of CO2 annually by 2030.

- Increased Grid Stability: Reduction in grid outages and frequency fluctuations through efficient BESS integration.

- Technical Workforce Training: At least 15 local technicians certified in solar energy and BESS maintenance.

Relationship to Tuvalu's Sustainable Development Priorities

This project is aligned with Tuvalu's National Energy Policy, which targets a 100% renewable energy transition by 2030, and the Tuvalu Climate Change Policy that emphasises reducing the country's carbon footprint and enhancing climate resilience. Additionally, the project supports National Outcome 19: Quality and Affordable Energy Supply from Te Kete: Tuvalu's National Strategy for Sustainable Development (2021–2030), which prioritises the provision of reliable and affordable energy to all citizens, including those in traditional and remote settings. Renewable energy supply is a key priority under this strategy, as Tuvalu aims to reduce its high dependency on costly fuel imports, assess appropriate energy mixes, and install suitable solar energy services across the outer islands as well as Funafuti. This project directly contributes to Tuvalu's Intended Nationally Determined Contributions (INDC) under the Paris Agreement and supports the country's socio-economic development priorities by reducing energy costs, enhancing energy security, creating local jobs in the renewable energy sector, and attracting greater investment in renewable energy solutions.

Project Deliverables (Value/Benefits/Messages)

- Energy Independence: Reduced reliance on costly and volatile fossil fuel imports, providing Tuvalu with energy sovereignty.

- Economic Savings: Lower energy costs for the government and consumers due to the transition to cheaper solar energy.

- Environmental Benefits: Significant reduction in greenhouse gas emissions, contributing to global climate change mitigation.

- Resilience to Climate Change: Improved grid resilience, ensuring a stable energy supply even during extreme weather events.

- Job Creation: Development of the local renewable energy sector through training and employment opportunities for technicians and engineers.

Project Scope and Possible Implementation

- Scope: This is a national project aimed at transforming Tuvalu's energy sector. It will involve both the expansion of solar energy capacity and the modernization of grid infrastructure to support renewable energy integration. The project will focus on deploying Solar PV + BESS across all islands, with a particular emphasis on the national grid in Funafuti.

- Feasibility: The project builds on past successful deployments of Solar PV funded by the ADB and World Bank, making it feasible in terms of technical and financial support. However, securing full funding for Stages 2 and 3 is crucial for the project's full-scale implementation.

Project Activities

1. Technical Assessments: Conduct assessments to identify grid infrastructure needs and optimal Solar PV sites.

2. Solar PV and BESS Procurement: Purchase and install 5.7 MW of Solar PV and 3 MW/14 MWh of BESS.

3. Grid Modernization: Upgrade transmission and distribution lines, including the integration of smart grid technologies.

4. Capacity Building: Provide technical training and certification programs for local engineers and technicians.

5. Public Awareness Campaigns: Engage the public and local businesses in awareness programs to promote the benefits of solar energy.

6. Monitoring and Evaluation: Establish M&E systems to track project progress and ensure long-term sustainability.

Timelines

This table outlines the step-by-step timeline for implementing Solar Photovoltaic (PV) systems paired with Battery Energy Storage Systems (BESS) in Tuvalu's energy sector. It includes a detailed schedule for planning, funding, infrastructure development, and operational phases, indicating the responsible parties for each phase and the potential risks. The timeline aligns with Tuvalu's goal to achieve a 100% renewable energy target by 2030, marking critical milestones and dependencies to ensure successful integration into the national grid.

This strategic approach aims to provide a reliable, sustainable, and resilient energy system, reducing dependence on imported fuels and enhancing energy security in the face of climate-related challenges.

Table 27: Timeline for the implementation of Solar PV (National Grid) + BESS

Q1 2025 - Q2 2026: - Drafting Project Proposals and Securing Funding: - Conduct donor outreach, prepare detailed project proposals, and secure the necessary funding for Stages 2 and 3 of the Solar PV + BESS deployment. - Estimated time to secure funding: 1.5 years (until Q2 2026).
Q3 2026: - Technical Assessments and Grid Upgrade Planning: - Once funding is secured, conduct technical assessments to identify grid infrastructure needs and finalise grid upgrade plans to support the integration of Solar PV + BESS systems.
Q1 2027: - Begin Procurement of Solar PV + BESS Equipment: - Initiate the procurement process for Solar PV panels, BESS components, and other required infrastructure based on the technical assessments and grid upgrade plans.
Q3 2027: - Start Installation of Solar PV + BESS Systems: - Begin installing Solar PV systems and integrating BESS with the national grid. Focus on completing the first phase of deployment in Funafuti.
Q2 2028: - Complete Phase 1 of Solar PV Deployment (2 MW) and BESS Integration: - Ensure that at least 2 MW of Solar PV and corresponding BESS systems are operational and integrated into the national grid.
2029-2030: - Scale Up to Full 7.6 MW of Solar PV and 3 MW/14 MWh of BESS: - Expand the system to its full capacity with additional Solar PV installations (up to 7.6 MW) and BESS integration (3 MW/14 MWh).
2029-2030: - Full Grid Integration, Capacity Building, and M&E:

- Complete grid upgrades and ensure full integration of Solar PV + BESS. Continue capacity- building programs for local technicians and engineers, and establishing robust monitoring and evaluation (M&E) systems to track project progress and ensure sustainability.

Budget/Resource Requirements

Total Estimated Budget (USD):

- 24,680,000 is allocated for the full deployment of Solar PV + BESS (Stages 2 and 3), upgrading the current grid infrastructure and integration, reviewing and updating the Energy Policy and legislative framework, training of technicians and all renewable energy (R.E.) stakeholders, and establishing a comprehensive Monitoring & Evaluation (M&E) framework.
- Potential funding sources: ADB, World Bank, bilateral partners (Italy, Japan, MFAT-NZ), Green Climate Fund (GCF).
- Resource Requirements:
    - Staff: Department of Energy, Tuvalu Electricity Corporation (TEC), Climate Change Department.
    - Consultants: International consultants for project design, grid integration, training, and M&E.
    - Partners: Collaboration with international donors and financial institutions.

Measurement/Evaluation

- Installation Progress: Percentage of Solar PV and BESS systems installed (MW).
- Reduction in Diesel Imports: Measured reduction in fuel imports for power generation.
    - GHG Emissions Reduction: Annual reductions in CO2 emissions.
    - Grid Performance: Metrics on grid stability and outage frequency.
    - Training Success: Number of certified local technicians and engineers.

Possible Complications/Challenges

- Funding Delays: Securing full funding for the entire project may take longer than expected, leading to delays in implementation.
- Technical Challenges: Integration of large-scale Solar PV with the existing grid could face technical challenges, especially during peak demand periods.
- Climate Risks: Extreme weather events may disrupt installation or damage infrastructure.
- Capacity Gaps: Lack of local technical expertise may slow down installation and maintenance efforts, despite capacity-building programs.

Responsibilities and Coordination

- Primary Responsibility: Department of Energy, in collaboration with the Tuvalu Electricity Corporation (TEC).
- Secondary Stakeholders:
    - Ministry of Finance: Securing funding and budget allocation.

- Ministry of Foreign Affairs: Engaging international donors and partnerships.
- Climate Change Department: Ensuring alignment with climate policies and sustainability goals.
- International Donors: Providing financial and technical assistance.

4.2 Project Ideas for the Transport Sector

4.2.1. Project Title: Transitioning to Electric Vehicles (EVs) for Sustainable Transportation in Tuvalu

Introduction/Background

This project aims to facilitate the transition to electric vehicles (EVs) in Tuvalu, aligning with the country's commitment to sustainable development and climate resilience. As Tuvalu faces challenges such as rising fuel costs, environmental degradation, and vulnerabilities to climate change, this initiative seeks to promote EV adoption as part of a broader strategy to reduce greenhouse gas emissions and enhance energy security. Building on initial pilot projects and community interest, the project will focus on establishing the necessary infrastructure, providing public awareness, and building local capacity for EV maintenance and support.

Objectives

1. Deploy a network of EV charging stations across Tuvalu to support the adoption of electric vehicles by 2030.
2. Reduce reliance on imported fossil fuels for transportation and decrease greenhouse gas emissions by transitioning to electric mobility.
3. Enhance local technical capacity for EV maintenance and repair to ensure sustainable operation.
4. Increase public awareness and acceptance of electric vehicles as a viable alternative for transportation.

Outputs and Measurable Indicators

i. Increased EV Adoption: Target of 100 electric vehicles registered by 2030.
ii. Charging Infrastructure: Establishment of at least 10 public EV charging stations across the main islands.
iii. Reduction in Fossil Fuel Consumption: Achieve a 30% reduction in gasoline and diesel consumption for transportation by 2030.
iv. Community Engagement: Conduct at least 5 public awareness campaigns, reaching a minimum of 1,500 residents.
v. Technical Training: Certify at least 20 local technicians in EV maintenance and repair.

Relationship to Tuvalu's Sustainable Development Priorities

This project aligns with Tuvalu's National Energy Policy and the Climate Change Policy, emphasising the importance of reducing carbon footprints and promoting renewable energy solutions. It supports the objectives outlined in Te Kete: Tuvalu's National Strategy for Sustainable Development (2021–2030) by ensuring access to sustainable transportation options. The project also contributes to Tuvalu's Intended Nationally Determined Contributions (INDC) under the Paris Agreement, promoting sustainable economic growth while addressing the impacts of climate change.

Project Deliverables (Value/Benefits/Messages)

a. Sustainable Transportation: Reduced dependence on imported fossil fuels, providing energy security and independence.
b. Economic Benefits: Lower transportation costs for households and businesses due to the transition to electric vehicles.
c. Environmental Impact: Significant reductions in greenhouse gas emissions, contributing to global efforts against climate change.
d. Job Creation: Development of the local EV sector through training and employment opportunities for technicians and engineers.
e. Community Resilience: Enhanced adaptability to climate change through cleaner and more sustainable transportation options.

Project Scope and Possible Implementation

Scope: The project will encompass the deployment of EV charging stations, promotion of electric vehicle use, and capacity building for local technicians. It will focus on urban areas with the highest transportation needs and expand to outer islands as infrastructure develops. Feasibility: Preliminary assessments indicate community interest and readiness for EV adoption. Collaborations with local and international partners will be essential for technical and financial support.

Project Activities

1. Market Assessment: Analyse current transportation patterns and potential demand for electric vehicles.
2.Charging Station Installation: Identify sites and install at least 10 public EV charging stations.
3. Partnership Development: Collaborate with EV manufacturers and local businesses for vehicle procurement and support.
4. Capacity Building: Implement training programs for local technicians in EV maintenance and repair.
5. Public Awareness Campaigns: Launch educational initiatives to promote the benefits of electric vehicles to the community.
6. Monitoring and Evaluation: Establish M&E systems to track project progress and impact.

Timelines

Table 28: Time for the implementation of EV

Year	Activity
Q1 2025 - Q2 2026	Market Assessment and Stakeholder Engagement: Conduct assessments and secure partnerships.
Q3 2026	Charging Station Installation Planning: Identify sites for charging stations and finalise installation plans.

Q1 2027	Begin Procurement of EVs and Equipment: Initiate procurement processes for charging equipment and vehicles.
Q3 2027	Start Installation of Charging Stations: Begin installing charging stations across the main islands
Q2 2028	Complete Initial Charging Station Deployment: Ensure at least 5 charging stations are operational
2029-2030	Scale Up EV Adoption and Technical Training: Expand public awareness and complete training for local technicians

Budget/Resource Requirements

- Total Estimated Budget: $2,500,000 for the installation of charging infrastructure, public awareness campaigns, technical training, and project management.
- Potential Funding Sources: ADB, World Bank, bilateral partners (Japan, MFAT-NZ), Green Climate Fund (GCF).
- Resource Requirements:
  - Staff: Department of Energy, Tuvalu Electricity Corporation (TEC).
  - Consultants: International consultants for project design and training.
  - Partners: Collaboration with international donors and EV manufacturers.
- Measurement/Evaluation
- Installation Progress: Percentage of charging stations installed and operational.
- EV Registration: Number of electric vehicles registered in Tuvalu.
- Reduction in Fuel Consumption: Measured reduction in gasoline and diesel imports for transportation.
- Training Success: Number of certified local technicians in EV maintenance.

Possible Complications/Challenges

Funding Delays: Securing full funding for the entire project may take longer than expected.
Infrastructure Limitations: Existing grid capacity may need upgrades to support EV charging.
Public Acceptance: Resistance to adopting electric vehicles due to cultural or economic factors.
Capacity Gaps: Limited local expertise in EV technology could hinder maintenance efforts.

Responsibilities and Coordination

Primary Responsibility: Department of Energy, in collaboration with the Tuvalu Electricity Corporation (TEC).
Secondary Stakeholders:

- Ministry of Finance: Securing funding and budget allocation.
- Ministry of Foreign Affairs: Engaging international donors and partnerships.
- Climate Change Department: Ensuring alignment with climate policies and sustainability goals.
- Local Communities: Engaging in awareness and training initiatives to promote EV adoption.

This project seeks to establish a sustainable transportation system in Tuvalu, ultimately contributing to the nation's broader climate and energy goals while enhancing local resilience and economic stability.

4.2.2. NMT Infrastructure Development for Sustainable Urban Transportation in Funafuti

Project Description:
This project focuses on building dedicated infrastructure to support Non-Motorized Transport (NMT) in Funafuti, Tuvalu's capital. By developing bike lanes, secure parking, and other necessary facilities, the project aims to provide safe, accessible pathways for cyclists and pedestrians. This infrastructure initiative is part of Tuvalu's broader strategy to transition to a sustainable, low-emission transportation system and aligns with the country's National Energy Policy and NDC commitments.

Objectives:
- Construct safe, dedicated bike lanes and secure parking to support NMT adoption.
- Reduce traffic congestion and improve urban mobility in Funafuti.
- Create a model for sustainable infrastructure development that can be replicated in other areas.

Outputs and Measurable Indicators:
- Construction of pilot bike lanes in Funafuti and installation of secure bike parking in key public areas.
- Reduction in traffic congestion in Funafuti, improving accessibility and transport efficiency.
- Increase in bicycle and e-bike usage, aiming for a 20% adoption rate in the project area within two years.

Project Activities:
- Feasibility Study: Assess potential locations for bike lanes and parking facilities.
- Infrastructure Development: Construct bike lanes and parking facilities in public areas, including schools, government offices, and markets.
- Capacity Building: Train local engineers and planners to design, implement, and maintain NMT infrastructure.
- Monitoring and Evaluation: Track infrastructure usage, adoption rates, and the impact on urban mobility and emissions.

Budget:
- Feasibility Study: $100,000
- Infrastructure Development: $600,000
- Capacity Building: $100,000
- Monitoring and Evaluation: $200,000

Funding Sources: GCF, GEF, Government of Tuvalu, International Development Partners

Possible Complications/Challenges:
- Land acquisition: Delays in securing land for bike lanes and parking facilities.
- Technical capacity: Limited expertise in NMT infrastructure may create implementation challenges.

Responsibilities and Coordination:
- Lead Agency: Ministry of Transport, Tourism, Energy, Communication and Innovation (MTTECI)
- Local Governments: Assist with land acquisition and infrastructure development.

- International Donors: Provide funding and technical assistance (GCF, GEF).

4.2.3. Pilot Project on Promotion of NMT in Funafuti

Project Description:
This pilot project aims to encourage the adoption of Non-Motorized Transport (NMT) by promoting the use of bicycles and e-bikes in Funafuti. Through subsidies, public awareness campaigns, and community engagement, the project will highlight the benefits of NMT, reduce dependency on motorized vehicles, and support a shift toward sustainable, low-emission transport options.

Objectives:
- Reduce GHG emissions by promoting bicycles and e-bikes to replace fossil-fuel-based transport for short-distance travel.
- Increase public health by encouraging physical activity through cycling.
- Raise public awareness of NMT benefits to build cultural acceptance and adoption.

Outputs and Measurable Indicators:
- Subsidies for bicycles and e-bikes to increase ownership among low-income households.
- Public awareness campaigns reaching 80% of Funafuti's population through media, schools, and community events.
- Target 30% of Funafuti's population adopting NMT within two years.

Project Activities:
- Financial Incentives: Provide subsidies and low-interest financing for the purchase of bicycles and e-bikes, with a focus on low-income households.
- Public Awareness Campaigns: Partner with schools, community leaders, and local media to promote the benefits of NMT.
- Community Engagement Events: Organize events like "Cycling Days" to promote NMT, encourage adoption, and collect community feedback.
- Capacity Building: Train community members in bicycle maintenance and basic repair, creating local expertise and job opportunities.

Budget: $500,000
- Financial Incentives (subsidies, low-interest financing): $200,000
- Public Awareness Campaigns: $200,000
- Community Engagement Events and Capacity Building: $100,000

Funding Sources: GCF, International NGOs, Bilateral Aid

Possible Complications/Challenges:
- Public resistance: Cultural resistance to non-motorized transport may slow adoption.
- Funding gaps: Delays in securing international funding may impact implementation.

Responsibilities and Coordination:
- Lead Agency: Ministry of Transport, Tourism, Energy, Communication and Innovation (MTTECI)
- Private Sector Partners: Provide bicycles and e-bikes for purchase or rental, and offer maintenance services.

- Civil Society Organizations (CSOs): Support public awareness campaigns and organize community events.

Chapter 5: Cross-Cutting Issues

5.1 Capacity Building and Technical Expertise

The successful implementation of the Technology Action Plan (TAP) hinges significantly on the development of robust capacity building and technical expertise. Outlined below are the critical barriers related to capacity and expertise and proposes enabling policies and actions that can enhance skills and knowledge across multiple sectors.

Key Barriers to Capacity Building and Technical Expertise

One of the primary barriers is the *limited technical knowledge* among local technicians and stakeholders regarding electric vehicle technologies, maintenance, and charging infrastructure. This knowledge gap can lead to inefficiencies and increased operational costs, ultimately hindering the deployment and maintenance of technological infrastructure. Without sufficient expertise, local technicians may struggle to address technical issues, leading to prolonged downtimes and reduced public confidence in technologies.

In addition, there is a *lack of sufficient training programs* that adequately cover the latest advancements in technology. Many existing programs may focus on outdated content or lack practical components that allow for hands-on learning. This inadequacy can prevent local workers from acquiring the necessary skills to perform repairs and maintenance effectively, perpetuating reliance on external experts.

Another significant barrier is the *weak institutional frameworks* that do not prioritise or integrate capacity building for emerging technologies. Fragmented responsibilities among various government agencies can complicate efforts, resulting in inefficiencies and missed opportunities for knowledge sharing. Coordinated approaches are vital to ensure that capacity building is systematic and aligned with national goals.

Moreover, *cultural resistance to change* can pose a challenge. Communities may prefer traditional vehicles, leading to scepticism about the benefits of technology. This resistance can inhibit the uptake of training programs and the adoption of technologies, further perpetuating existing barriers.

Proposed Enabling Policies and Actions

To address these barriers, several enabling policies and actions can be implemented.

Development of Comprehensive Training Programs

Establishing formal training programs that focus on technology, maintenance, and charging infrastructure is crucial. Collaborating with technical institutes and universities to design curricula that meet industry standards will ensure that local technicians gain both theoretical knowledge and practical skills. Additionally, incorporating internships and apprenticeships in collaboration with local businesses will provide real-world experience, resulting in a skilled workforce capable of supporting the various sectors.

Establishment of Centres of Excellence

Creating dedicated Centres of Excellence for Electric Mobility will serve as hubs for training, research, and development in technology. These centres can partner with educational institutions to facilitate workshops, seminars, and certification courses, while also engaging international experts for knowledge-sharing sessions. This centralised approach will foster continuous skill development and innovation in technology.

Incorporation of EV Training in Educational Curricula
Integrating technology and sustainability education into existing curricula at all educational levels is essential. By collaborating with the Ministry of Education to develop age-appropriate content, students can learn about the importance of sustainable transport, including the life cycle of electric vehicle (EV) batteries and the critical need for responsible battery recycling after end-of-life. Organizing competitions and projects focused on renewable energy, EV technology, and sustainable practices will further engage students, fostering an understanding of sustainable transport and preparing them for future opportunities in this evolving field.

Public Awareness Campaigns
Launching public awareness campaigns is necessary to educate communities about the benefits and the skills needed for their maintenance and operation. Utilising various communication platforms, including social media and local events, can effectively reach diverse audiences. Highlighting success stories from local technicians and businesses that have embraced technology will also foster a positive perception and encourage participation in training programs.

Strengthening Institutional Coordination
Enhancing collaboration among government agencies, educational institutions, and the private sector will create a cohesive approach to capacity building. Establishing a multi-stakeholder advisory committee focused on electric mobility can facilitate regular meetings and knowledge sharing, ensuring that efforts are aligned, and resources are effectively utilised.

Monitoring and Evaluation Framework
Developing a robust monitoring and evaluation framework will allow for assessing the effectiveness of training programs and capacity-building initiatives. Establishing clear indicators to measure skill acquisition, participant feedback, and job placement rates will provide data-driven insights that inform continuous improvement.

Addressing capacity building and technical expertise is essential for the successful implementation of the Technology Action Plan for Climate Change in Tuvalu. By overcoming barriers related to knowledge gaps, training availability, and institutional frameworks, Tuvalu can foster a skilled workforce ready to embrace electric mobility. The proposed enabling policies and actions aim to create a supportive ecosystem for skill development, enhance public awareness, and facilitate the adoption of electric vehicles. Through a concerted effort across sectors, Tuvalu can realise its climate change ambitions while empowering its citizens with the skills needed for a sustainable future.

5.2 Public Awareness and Social Acceptance

The successful implementation of Tuvalu's Technology Action Plan (TAP) for renewable energy and sustainable transport requires more than just technical and financial resources. Public awareness and social acceptance are essential factors that can make or break the transition to technologies such as Solar PV, Battery Energy Storage Systems (BESS), Biogas, Electric Vehicles (EVs), and Non-motorized Transport. Tuvalu, as a Small Island Developing State (SIDS), faces unique challenges in terms of public engagement due to its relatively small population, dispersed geography, and cultural practices. Therefore, developing strategies that

foster public understanding and support is critical to achieving the country's Nationally Determined Contributions (NDCs) and ensuring long-term sustainability of the projects.

Public awareness serves to educate and inform the population about the benefits of renewable energy and sustainable transport technologies, while social acceptance ensures that these technologies are embraced and integrated into the community's way of life. Without widespread public buy, -in, even the most technically sound and economically viable projects could face significant barriers, including public resistance, misinformation, and a lack of participation.

Challenges to Public Awareness and Social Acceptance in Tuvalu

Tuvalu faces several challenges related to public awareness and social acceptance of new technologies:

1. Limited Knowledge of New Technologies:

Many of the technologies included in the TAP, such as Solar PV, biogas, and EVs, may be unfamiliar to large portions of the population. This lack of knowledge can lead to scepticism about their benefits, reliability, and safety. For example, biogas technology, which relies on the conversion of organic waste into energy, may face resistance if people are not adequately informed about how it works and its potential to reduce both waste and GHG emissions.

2. Cultural and Behavioural Resistance:

Tuvalu's reliance on diesel generators for electricity and traditional transport methods has been long-standing. The introduction of renewable energy sources and changes in transportation habits, such as the use of electric vehicles or non-motorized options, may be met with resistance. Changing deep-rooted practices requires not only technical solutions but also cultural adaptation and education.

3. Economic Perception:

The perception that renewable energy technologies, such as solar PV or electric vehicles, are expensive and inaccessible may hinder social acceptance. While the long-term benefits of these technologies are clear, the upfront costs might be seen as prohibitive by the local population, particularly if there is insufficient understanding of the economic incentives, subsidies, or long-term savings associated with these technologies.

4. Health and Safety Concerns:

In some cases, new technologies are met with concerns about safety, especially when the public does not fully understand their operation. For instance, Battery Energy Storage Systems or biogas plants may raise concerns about accidents, environmental impacts, or health risks.

Strategies for Increasing Public Awareness and Social Acceptance in Tuvalu

To address the barriers outlined above, a coordinated and context-specific public awareness strategy must be integrated into the TAP for renewable energy and sustainable transport. The following strategies are proposed to ensure that the population understands and accepts the new technologies being introduced under the TAP.

1. Community Engagement and Education Campaigns

Effective public awareness starts with community engagement. In a small island nation like Tuvalu, communities are tightly knit, and local leaders, including village elders and church leaders, hold significant influence. Campaigns should be designed to leverage the influence of these local leaders to disseminate information about renewable energy technologies and sustainable transport options.

Public education campaigns should focus on:

- The economic benefits of renewable energy, including the long-term savings associated with solar PV and biogas systems.
- The environmental and health benefits of reducing reliance on diesel generators and moving to clean energy.
- Explaining how biogas technology works, particularly how organic waste is collected and converted into energy, thus helping the community see waste as a resource.
- Showcasing the reliability and safety of renewable energy technologies, such as Battery Energy Storage Systems and Electric Vehicles.
- Targeted efforts should be made to involve youth groups, schools, and community organisations in the awareness campaign. Schools can serve as excellent platforms for demonstrating renewable energy in action, with initiatives such as installing solar panels on school buildings or showcasing electric vehicles as part of the school transportation system.

2. Demonstration Projects

Demonstration projects are crucial for increasing social acceptance by showing tangible benefits and operational success. In the case of Tuvalu, demonstration projects should include:

- Community-level solar PV installations: Solar panels on public buildings, like community centres and schools, will show the population how solar energy reduces energy bills and provides reliable power.
- Biogas pilot plants: A biogas plant can demonstrate the conversion of organic waste into energy, reducing the burden of waste management while producing clean energy. Communities should be actively involved in these projects, not just as observers but as participants in waste collection, operation, and maintenance.
- Public charging stations for electric vehicles: Visible infrastructure, such as EV charging stations, will signal a tangible commitment to sustainable transport and help familiarise the public with electric vehicle technology.
- These projects will act as proof-of-concept for broader technology adoption and provide opportunities for community members to experience first-hand how these systems work.

3. Financial Incentives and Subsidy Awareness

One of the key barriers to the adoption of renewable energy technologies and electric vehicles is the perception of high upfront costs. To counter this, public awareness campaigns should include clear and accessible information on available subsidies, grants, and low-interest loans provided by the government or international donors.

Efforts should focus on:

- Promoting subsidy programs that lower the initial investment required for solar PV systems, biogas installations, and electric vehicles.
- Demonstrating the long-term savings from reduced energy bills, fuel costs, and maintenance compared to fossil fuel-based systems.
- Ensuring the public understands the potential for community-based ownership of energy projects, where the cost burden is shared among community members, allowing for collective benefits.

4. Capacity Building and Technical Training

Building technical capacity is essential to both ensuring the smooth operation of new technologies and fostering trust in their reliability. Public acceptance of renewable energy

technologies will increase as people see that local technicians are trained and available to maintain and operate the systems.

Key steps include:

- Developing local training programs for engineers, technicians, and mechanics focused on the operation and maintenance of solar PV, battery energy storage, and biogas systems.
- Providing hands-on training through partnerships with international organisations and technical experts.
- Establishing certification programs that recognize local expertise, giving the public confidence that the technologies can be managed domestically without relying exclusively on external assistance.

5. Transparent Communication and Reporting

Ensuring transparent communication about the progress of projects and the measurable benefits of these technologies is critical to maintaining public trust. Regular updates on project successes, energy savings, and environmental benefits should be shared through community meetings, local media, and government websites.

Public awareness and social acceptance are not just complementary to the technical and financial aspects of the Technology Action Plan (TAP)—they are essential to its success. By creating tailored public awareness campaigns, engaging communities through demonstration projects, providing clear financial incentives, and building local technical capacity, Tuvalu can ensure the long-term sustainability and social acceptance of the proposed renewable energy and sustainable transport technologies.

For Tuvalu, achieving public acceptance means not only educating the population but also creating a culture of active participation in the country's shift toward 100% renewable energy and sustainable transport systems. Public trust, awareness, and engagement will pave the way for the smooth integration of these technologies, leading to greater energy security, reduced emissions, and a more resilient future for Tuvalu.

5.3 Financing and Economic Considerations

The integration of renewable energy technologies such as biogas, solar PV + BESS, electric vehicles (EVs), and non-motorized transport into Tuvalu's energy and transport sectors necessitates robust financing mechanisms and sound economic strategies. This section explores the financing challenges and opportunities, focusing on actions and strategies for ensuring the successful implementation of the Technology Action Plan (TAP) across these critical sectors.

Key Financing Challenges

Tuvalu faces several unique economic and financial challenges, including:

- High Upfront Capital Requirements: Renewable energy technologies like biogas plants, solar PV systems, and EV infrastructure require substantial upfront investment. These costs are further magnified by Tuvalu's geographic remoteness and reliance on imported equipment.
- Limited Domestic Financing: As a small island economy, Tuvalu lacks extensive domestic financial resources, and the private sector has been slow to engage in renewable energy projects.

- Vulnerability to External Economic Shocks: Tuvalu's economy is highly sensitive to global price fluctuations, particularly in the energy sector, which complicates long-term planning for renewable energy adoption.

Opportunities for Financing

Despite the challenges, Tuvalu has access to significant international funding opportunities, including:

1. International Climate Financing: Global financing mechanisms such as the Global Environment Facility (GEF), Green Climate Fund (GCF), and concessional loans from multilateral institutions like the Asian Development Bank (ADB) and World Bank are critical. These institutions offer grants, loans, and technical support for infrastructure development and capacity building.
2. Bilateral and Multilateral Donor Support: Donor countries and organisations dedicated to climate resilience in Small Island Developing States (SIDS) offer vital financial assistance. Bilateral funding from partners like Japan and New Zealand plays a crucial role in funding specific renewable energy projects.
3. Public-Private Partnerships (PPPs): To diversify funding sources, Tuvalu should promote PPPs, allowing the private sector to invest in renewable energy infrastructure while sharing the financial risks with the government.

Economic Considerations

Several economic factors will influence the feasibility and sustainability of renewable energy technologies in Tuvalu. Careful financial planning is necessary to ensure that these technologies deliver long-term economic and environmental benefits:

- Cost-Benefit Analysis: Each technology requires a detailed cost-benefit analysis to determine its long-term value. For example, the installation of solar PV + BESS systems and biogas plants may have high initial costs, but their potential to reduce diesel imports and improve energy security offers significant long-term savings.
- Return on Investment (ROI): Transitioning to renewable energy will generate returns in the form of reduced fuel imports, lower greenhouse gas (GHG) emissions, and improved energy security. Additionally, renewable energy projects will create local employment opportunities, contributing to economic growth.
- Sustainability of Funding: Securing long-term funding for these projects will require diversifying financial sources and engaging with multiple international donors. This strategy ensures that Tuvalu is not overly reliant on a single funding source and mitigates potential financial risks.

Risk Management and Mitigation Strategies

Several economic risks could impact the implementation of renewable energy projects. Effective risk management is essential to ensure the success of the TAP:

1. Funding Diversification: Tuvalu must continue engaging with multiple international donors to ensure that projects have sustainable funding. By exploring various funding mechanisms, such as concessional loans, grants, and PPPs, the government can reduce its reliance on a single financial source.
2. Government Incentives: Offering financial incentives, such as tax breaks and low-interest loans, can encourage private sector participation in renewable energy projects, thus reducing the financial burden on the government.
3. Capacity Building: Training local engineers and technicians will reduce Tuvalu's reliance on external technical expertise and ensure the long-term sustainability of renewable energy projects.

Ensuring adequate financing and addressing economic challenges are critical to the successful deployment of renewable energy technologies in Tuvalu. By leveraging international funding, promoting private sector involvement, and managing financial risks effectively, Tuvalu can transition towards a more sustainable and resilient energy and transport system. The TAP's implementation will contribute to Tuvalu's long-term energy security, economic stability, and climate resilience.

5.4 Policy and Regulatory Framework

A coherent policy and regulatory framework are crucial for enabling the development and integration of renewable energy technologies, including biogas, Solar PV + BESS, electric vehicles (EVs), and non-motorized transport in Tuvalu's energy and transport sectors. This section outlines the key cross-cutting policy and regulatory challenges, opportunities, and recommended actions that will facilitate the successful implementation of the Technology Action Plan (TAP).

Key Policy Challenges

Tuvalu faces several critical policy and regulatory challenges that can impede the successful deployment of renewable energy technologies across multiple sectors:

- Lack of Comprehensive Renewable Energy Regulations: The current regulatory framework for renewable energy is underdeveloped, with gaps in policies addressing biogas, solar PV, and transport technologies.
- Limited Financial Incentives for Renewable Energy Investment: There are insufficient financial mechanisms in place, such as tax incentives, subsidies, or preferential loans, to encourage private sector investment in renewable energy and sustainable transport solutions.
- Outdated Transport Regulations: Policies governing the transport sector do not sufficiently accommodate the integration of electric vehicles (EVs) and non-motorized transport, creating barriers for the adoption of sustainable transportation alternatives.

Opportunities for Policy Enhancement

Despite these challenges, several opportunities exist for Tuvalu to create an enabling policy environment that supports the widespread adoption of renewable energy and sustainable transport technologies:

1. Development of a National Renewable Energy and Transport Policy: A comprehensive National Renewable Energy and Sustainable Transport Policy can provide the strategic direction required to transition to 100% renewable energy and sustainable mobility solutions. This policy should set clear targets for biogas, solar PV + BESS, EVs, and non-motorized transport, aligning with Tuvalu's broader climate goals.
2. Establishment of Financial Incentives: Introducing a suite of financial incentives, including tax breaks, subsidies, and low-interest loans, can drive investment in renewable energy and sustainable transport. These incentives should target both the private sector and international investors, encouraging the development of renewable energy infrastructure and low-emission transport systems.
3. Regulatory Reforms to Accelerate Project Approval: Streamlining the regulatory process for renewable energy projects by simplifying and expediting approvals will reduce delays. Establishing a dedicated Renewable Energy and Transport Regulatory Body can ensure timely and coordinated regulatory oversight, facilitating the smooth rollout of projects across the energy and transport sectors.

Crosscutting Policy and Regulatory Considerations

The policy and regulatory framework for renewable energy and transport technologies must address several cross-cutting issues that span both sectors:

- Technical Standards for Renewable Energy and EVs: Clear technical standards must be developed for biogas, solar PV, battery storage, and EV charging infrastructure. These standards will ensure the safety, reliability, and performance of renewable energy systems and transport technologies.
- Public and Private Sector Collaboration: Policies must foster collaboration between the public and private sectors. Government-led initiatives, supported by private investment, can accelerate the deployment of biogas plants, solar PV systems, and EV infrastructure. Public-private partnerships (PPPs) will be critical in this process, and policies should define the roles and responsibilities of each stakeholder.
- Incorporation of Climate Resilience Goals: Tuvalu's policy framework should integrate renewable energy and sustainable transport goals with its broader climate resilience strategy, as outlined in the Nationally Determined Contributions (NDCs) under the Paris Agreement. This will ensure that renewable energy deployment contributes to both emissions reductions and increased resilience to climate change impacts.

Proposed Policy Actions and Measures

To address the regulatory and policy gaps that hinder the adoption of renewable energy and sustainable transportation Masterplan, the following actions are recommended:

Table 29: Timeline for the implementation of NMT

Action	Description	Timeline	Responsible Body
National Biogas Policy Development	Create a national biogas policy to regulate production, ensure safety standards, and mandate biogas use in cooking and electricity generation.	Short-term	Department of Energy
EV and Non-Motorized Transport Policy	Introduce policies to incentivize EV adoption and promote non-motorized transport through urban planning and infrastructure development.	Medium-term	Ministry of Transport
Renewable Energy Incentive Program	Develop a package of financial incentives, including tax exemptions and subsidies, to encourage investment in biogas, solar PV, and EV infrastructure.	Short-term	Ministry of Finance, Department of Energy

Streamline Project Approval Processes	Establish a **Renewable Energy and Transport Regulatory Body** to oversee and expedite regulatory approvals for renewable energy projects.	Medium-term	Renewable Energy and Transport Authority
Incorporation of Climate Goals in Policy	Ensure that renewable energy and sustainable transport policies align with Tuvalu's NDC goals, reducing GHG emissions while enhancing climate resilience.	Short-term	Ministry of Environment
Set Renewable Energy and Transport Targets	Establish legally binding targets for renewable energy and sustainable transport, aiming for 100% renewable energy in electricity by 2025.	Long-term	Department of Energy, Ministry of Transport

Risk Management and Mitigation Strategies

The development and implementation of a robust policy and regulatory framework are subject to several risks, including political resistance, lack of institutional capacity, and delays in legislative processes. To mitigate these risks, the following strategies are recommended:

Inclusive Stakeholder Engagement: Engaging stakeholders from government, the private sector, civil society, and local communities will be crucial in building consensus around renewable energy and transport policies. This inclusive approach will help reduce resistance and increase buy-in from key actors.

Capacity Building for Regulatory Authorities: Strengthening the capacity of regulatory bodies, particularly the Renewable Energy and Transport Regulatory Body, will ensure that they can effectively manage project approvals and enforce regulations. Technical assistance from international organisations will be vital for building this capacity.

Ongoing Monitoring and Evaluation: Establish a Monitoring and Evaluation (M&E) Framework to track the progress of policy implementation and adjust strategies as necessary. Regular feedback from stakeholders and project developers will help identify bottlenecks and areas for improvement.

A well-designed policy and regulatory framework are essential for enabling the successful integration of renewable energy and sustainable transport technologies in Tuvalu. By developing clear standards, introducing financial incentives, and streamlining regulatory processes, Tuvalu can overcome key barriers to renewable energy and transport adoption. Aligning these policies with the country's climate goals will ensure that the transition to renewable energy contributes to both economic growth and environmental sustainability.

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Annexures

Annex I: List of TNA Mitigation Stakeholders

List of participants of TNA Mitigation Stakeholders			
	Name	**Designation**	**Organisation**
1	Simona Kilei	Director	Department of Energy
2	Fakalogo Houati	Renewable Energy Specialist	Department of Energy
3	Mafalu Lotolua	General Manager	Tuvalu Electricity Corporation
4	Taaku Sekielu	Ag. General Manager	Tuvalu Electricity Corporation
5	Jamie Ovia	Mitigation Adviser	Climate Change Department
6	Lae Peleti	Senior Statistician	Central Statistics Department
7	Scott Pelesala	Senior Fisheries Officer	Tuvalu Fisheries Department
8	Siila Tapuaiga	Captain/ Master	Tuvalu Marine & Ports Services
9	Nito Lipine	Acting Director	Tuvalu Marine & Ports Services
10	Telaulini Niuatui		Civil Aviation
11	Seleta Taupo	Member	Tuvalu National Council of Women
12	Talua Nivaga	Secretary General	Fuliigafou Youth Association
13	Lemau Afamasaga	Technical Adviser	NDMO
14	Davis Vaea	Disaster Policy Officer	NDMO
15	Talafou Esekia	Disaster Recovery Officer	NDMO
16	Siliako Letueti	Waste Management Officer	Department of Waste Management

17	Reuben Kausea	Information and Knowledge Management Officer	Department of Environment
18	Faatupu Simeti	Project Coordinator	Tuvalu Third National Communications Project - Climate Change Department
19	Vaiaoga Lameko	Project Coordinator	Readiness 1 Project - Climate Change Department
20	Sulufaiga Uota	Project Coordinator	FASTNETT Project, Department of Energy
21	Sokotia Kulene	Director	Gender Affairs Department
22	Salesa Salesa	Communications Campaign Officer	Gender Affairs Department
23	Richard Gorkrun	Project Officer	Tuvalu Climate Action Network
24	Sania Teisini	Director	Customs & Revenue Department
25	Temukisa Pesega	General Manager	Development Bank of Tuvalu

Annex II. Framework for Ranking Measures for inclusion as Actions selected for the TAP - Solar PV (national grid) + BESS.

Framework for ranking measures of promoting Solar PV (national grid) + BESS for inclusion as Actions selected for inclusion in the TAP			
Measures	**Considerations**	**Assessment**	**Initial Ranking with Rationale**
Reduce import tariffs and taxes on solar PV + BESS Components	Effectiveness	Highly effective, as existing zero-tax policies reduce the cost of Solar PV + BESS components, fostering wider technology adoption.	**Rank = 8** **Rationale** = While Tuvalu already has zero tariffs and taxes on renewable energy products, maintaining and expanding these exemptions ensures affordability and access to essential components, further incentivizing the adoption of renewable energy technologies.
	Efficiency	Highly efficient due to streamline processes and the pre-existing regulatory framework, which already imposes zero tariffs and taxes and R.E. products	
	Interactions with other measures	Strong positive interactions with financial incentives (subsidies, PPPs) and awareness campaigns, reducing financial barriers across the board.	
	Suitability within country/sector	Highly suitable, aligning with Tuvalu's national energy policies and R.E. energy targets.	
	Benefits and costs	High benefit-to-cost ratio, with minimal costs due to the zero-tax policy and significant long-term socio-economic and environmental benefits.	
Subsidise Solar PV + BESS projects through Government and donor support.	Effectiveness	High effective subsidies reduce financial barriers, making Solar PV + BESS projects more accessible to a broad range of stakeholders.	**Rank = 2** **Rationale** = Subsidies help make renewable energy more accessible for both households and businesses

	Efficiency	Moderately to high efficiency, depending on how well the subsidy program is structured and managed. Administrative costs could impact overall efficiency.	by reducing financial barriers. It is crucial for increasing adoption rates and reducing reliance on fossil fuels, especially when combined with international donor support.
	Interactions with other measures	Strong interaction with zero-tax policies, public-private partnerships, and financial instruments, creating a favourable environment for deployment.	
	Suitability within country/sector	Highly suitable, especially given Tuvalu's dependency on donor funding and its national renewable energy goals. Subsidies align with policy priorities.	
	Benefits and costs	High benefits, including increased adoption, reduced emissions, and energy security, but with moderate costs that require careful financial planning.	
Encourage public-private-partnerships	Effectiveness	Low effectiveness in the short term due to the absence of PPP frameworks, a weak private sector, and limited foreign investment.	**Rank = 12** **Rationale** = Due to Tuvalu's weak private sector and lack of established PPP frameworks, this measure is less feasible in the short term. While it has potential, significant groundwork needs to be laid before it can become a reliable financing and operational model.
	Efficiency	Low efficiency in the short term, as setting up PPP frameworks would require significant time, resources, and regulatory reforms.	
	Interactions with other measures	Potentially strong interaction with subsidies, foreign aid, and financial instruments, but limited by the weak local private sector.	

	Suitability within country/sector	Low suitability in the current economic climate, as Tuvalu's economy is dominated by the public sector and lacks a strong private sector and foreign investment.	
	Benefits and costs	High long-term benefits if successful, but significant short-term costs due to the need for regulatory and institutional capacity building.	
Attract international donor support	Effectiveness	Highly effective, with proven success in attracting funding from ADB, World Bank, UAE, MFAT (NZ). Donor support is crucial due to large-scale projects.	**Rank = 1** **Rationale:** Tuvalu heavily relies on international donor funding due to its limited local financing capacity. With successful past projects funded by ADB, World Bank, UAE, and MFAT, this measure is critical for securing the necessary capital to continue renewable energy expansion, especially given the high costs of infrastructure development.
	Efficiency	Moderately to high efficiency due to past success in securing funding, although the process of securing donor support can be time-consuming.	
	Interactions with other measures	Strong interaction with financial measures such as subsidies and PPPs, as well as non-financial measures like capacity-building and public awareness campaigns.	
	Suitability within country/sector	Highly suitable for Tuvalu's context, as the country relies heavily on international funding to achieve its renewable energy and climate change goals.	
	Benefits and costs	High benefits, including financial relieve for the government, reduced reliance on diesel, and capacity building. Costs are primarily administrative and manageable.	

Strengthen institutional capacity through training programs.	Effectiveness	It's effective given Tuvalu's struggles with the lack of local technical expertise, and ensuring long-term sustainability of Solar PV + BESS.	**Rank = 5** **Rationale** = Building the capacity of the Department of Energy and other institutions is critical for effective project management, regulatory oversight, and long-term sustainability of renewable energy projects. A strong institutional framework will drive all other measures.
	Efficiency	Moderate short-term efficiency due to initial setup costs, but highly efficient in the long term as reliance on foreign expertise decreases.	
	Interactions with other measures	Strong interaction with donor support, public-private partnerships, grid upgrades, and public awareness campaigns, enhancing overall project success.	
	Suitability within country/sector	Highly suitable given Tuvalu's current capacity gaps and the long-term goals of energy independence and sustainable development.	
	Benefits and costs	High benefits in terms of workforce development and operational efficiency, with moderate initial costs that can be offset through donor support.	
Develop a comprehensive renewable energy policy.	Effectiveness	Effective in providing regulatory clarity and streamlining the development and implementation of Solar PV + BESS.	**Rank = 3** **Rationale** = A unified policy framework is critical to ensure that all renewable energy initiatives are coordinated, streamlined, and aligned with Tuvalu's national energy goals. It provides regulatory certainty, attracts
	Efficiency	Moderate short-term efficiency due to upfront administrative costs, but highly efficient in the long term by simplifying decision-making and reducing project delays.	

	Interactions with other measures	Strong interaction with financial incentives, donor funding, capacity building, and grid infrastructure upgrades, as it aligns efforts across sectors.	investment, and facilitates long-term planning.
	Suitability within country/sector	Highly suitable, as Tuvalu's R.E. goals require a unified and coherent policy framework to guide future investments and projects.	
	Benefits and costs	High benefits in terms of regulatory stability, reduced emissions, and energy security, with moderate development costs that are outweighed by long-term gains.	
Enhance local technical expertise through training programs.	Effectiveness	Very effective as it addresses the skills gap in Tuvalu and ensures long-term project sustainability.	**Rank = 6** **Rationale** = Local technical expertise is needed to ensure the long-term success and maintenance of Solar PV + BESS systems. By training local engineers and technicians, Tuvalu can reduce reliance on costly foreign consultants, ensuring projects are sustainable and locally managed.
	Efficiency	Moderate short-term efficiency due to initial setup costs, but highly efficient in the long run.	
	Interactions with other measures	Strong interaction with other capacity building and technical measures.	
	Suitability within country/sector	Highly suitable as it directly addresses the local expertise shortage.	
	Benefits and costs	High benefits, with moderate initial costs that decrease over time.	
Upgrade grid infrastructure.	Effectiveness	Highly effective, as it addresses the core technical limitations in integrating renewable energy into the national grid.	**Rank = 4** **Rationale** = A modern, resilient grid is essential for

	Efficiency	Moderate short-term efficiency due to high costs but highly efficient in the long -term as operational costs are reduced.	integrating renewable energy systems like Solar PV + BESS. Without grid upgrades, even well-funded projects may fail to deliver reliable power, making this a top priority for ensuring successful renewable energy implementation.
	Interactions with other measures	Strong interaction with technical and capacity building measures.	
	Suitability within country/sector	Highly suitable, as grid modernization is critical for renewable energy integration.	
	Benefits and costs	High benefits with significant upfront costs but sustainable in the long term.	
Climate proof infrastructure.	Effectiveness	Highly effective, as it directly addresses the physical vulnerabilities that threaten the longevity of R.E. systems.	**Rank = 9** **Rationale =** Given Tuvalu's vulnerability to climate change, protecting renewable energy infrastructure from extreme weather and sea-level rise is essential. However, while critical for long-term sustainability, this measure comes after ensuring that the necessary systems are in place.
	Efficiency	Moderate in the short term due to high initial costs, but highly efficient in the long term.	
	Interactions with other measures	Strong interaction with infrastructure-related and financial measures.	
	Suitability within country/sector	Yes, directly addresses Tuvalu's climate vulnerabilities.	
	Benefits and costs	The benefits include resilience of energy infrastructure, reduced risk of damage, and long-term sustainability of renewable energy systems. The costs are significant initially but are justified by the long-term protection and reduced repair costs.	
Conduct community awareness campaigns	Effectiveness	Highly effective in increasing public support and promoting widespread adoption of renewable energy technologies.	**Rank = 10** **Rationale** = Raising public awareness about the benefits of renewable

	Efficiency	Highly efficient, as campaigns are cost-effective and have a broad impact on public perception and adoption of renewable energy.	energy can help increase adoption rates. While important, it is slightly lower in priority compared to measures that directly influence the financial and technical capacity to implement projects.
	Interactions with other measures	Strong interaction with financial incentives and capacity-building measures.	
	Suitability within country/sector	Highly suitable, as it supports public engagement and adoption of renewable energy.	
	Benefits and costs	High benefits with low costs, making it a highly cost-effective measure.	
Link renewable energy to Climate change educational programs.	Effectiveness	Highly effective, as it educates future leaders and citizens on the importance of renewable energy in combating climate change.	**Rank = 11** **Rationale** = Educating future generations about renewable energy and its role in combating climate change is important for long-term behavioural change. However, this is more of a long-term impact measure and ranks lower than immediate technical and financial measures.
	Efficiency	Highly efficient, as the integration into existing programs requires minimal financial investment.	
	Interactions with other measures	Strong interaction with public awareness campaigns and capacity-building efforts.	
	Suitability within country/sector	Highly suitable, as it supports broader environmental education and sustainability goals.	

	Benefits and costs	Linking renewable energy to climate change education programs provides long-term benefits such as increased public awareness, behavioural change, and community engagement with relatively low costs. The upfront investment in educational materials and outreach is minimal compared to the broad and lasting impact on renewable energy adoption and climate change mitigation. It is a highly cost-effective measure.	
Develop credit lines and green financing mechanisms	Effectiveness	Highly effective due to the existing Clean Loans at the Development Bank of Tuvalu, which offer affordable financing options and can be further expanded to increase adoption of Solar PV + BESS projects.	**Rank = 7** **Rationale** = Access to affordable financing is crucial for scaling renewable energy projects, and the Development Bank of Tuvalu's Clean Loans offer a strong foundation. Expanding these mechanisms can greatly increase the adoption of Solar PV + BESS, especially among local businesses and households.
	Efficiency	Highly efficient, with existing systems in place and low operational costs for expanding credit lines.	
	Interactions with other measures	Strong interaction with subsidies, donor funding, and PPPs, creating a comprehensive financial ecosystem for RE projects.	
	Suitability within country/sector	Highly suitable, as the measure aligns with Tuvalu's RE objectives and addresses local financing needs.	

	Benefits and costs	High benefits in terms of increased RE adoption and reduced financial barriers, with moderate administrative costs that are outweighed by long-term gains.	

Annex Ⅲ. Framework for Ranking Measures for inclusion as Actions selected for the TAP - biogass

Framework for ranking measures of promoting Biogas for inclusion as Actions selected for inclusion in the TAP			
Measure	**Consideration**	**Assessment**	**Initial Ranking with Rationale**
1. Government subsidies for biogas production	**Effectiveness**: Reduces upfront costs for infrastructure development.	**Highly Effective** due to Tuvalu's limited financial resources and high infrastructure costs. Provides immediate relief and encourages local and international investments.	**RANK 1** **Rationale**: Subsidies reduce financial barriers and are critical to enabling pilot projects and infrastructure development, making biogas technology accessible to local communities and private investors.
	Efficiency: Immediate impact through direct financial support.		
	Interaction: Positive interaction with private sector investment and international donor support.		
	Suitability: High suitability for Tuvalu, as it directly addresses the challenge of high capital costs.		
	Benefits and Costs: High benefits with moderate costs covered by subsidies.		
2. Attract international	**Effectiveness**: Crucial for securing large-scale funding.	**Highly Effective** as Tuvalu has a track	**RANK 2** **Rationale**: International

donor support (e.g., GCF, GEF)	**Efficiency**: High efficiency if successfully secured but can be time-consuming.	record of attracting international donor support for similar projects. These funds are necessary for infrastructure and capacity-building initiatives.	donor support is critical to filling the financial gap for biogas infrastructure and operational costs, ensuring long-term project success.
	Interaction: Strong interaction with subsidies and capacity-building measures.		
	Suitability: Highly suitable given Tuvalu's reliance on external financing for capital-intensive projects.		
	Benefits and Costs: High benefits; administrative costs are manageable.		
3. Capacity building and training programs	**Effectiveness**: Builds local expertise, essential for sustainability.	**Very Effective** because building technical capacity reduces reliance on external expertise, improving project sustainability in the long run.	**RANK 3** **Rationale**: Developing local technical expertise is vital to ensuring that biogas plants are managed and maintained effectively, reducing long-term reliance on foreign consultants
	Efficiency: High long-term efficiency as local operators become self-sufficient.		
	Interaction: Strong interaction with technical and operational measures.		
	Suitability: Highly suitable, addressing Tuvalu's local expertise gap.		
	Benefits and Costs: High benefits with moderate costs, declining over time as local expertise increases.		
4. Develop biogas infrastructure	**Effectiveness**: Critical to the operation of biogas technology.	**Highly Effective** as infrastructure	**RANK 4** **Rationale**: Infrastructure

(storage, digesters)	**Efficiency**: High efficiency in the long term, though costly upfront.	development is essential for the successful operation of biogas projects, but the high initial costs are a key barrier.	development is foundational to biogas implementation, though its high cost means it will need substantial financial support from international donors and the government.
	Interaction: Necessary for interaction with biogas production facilities and distribution.		
	Suitability: Highly suitable for Tuvalu's energy transition goals.		
	Benefits and Costs: High benefits, but high initial costs requiring significant capital investment.		
5. Public awareness and engagement campaigns	**Effectiveness**: Effective in increasing public support and participation.	**Highly Effective** for raising awareness and encouraging community participation in biogas feedstock collection and plant operation.	**RANK 5** **Rationale**: Public engagement is crucial for ensuring community buy-in and waste management participation. The relatively low cost of awareness campaigns makes them a highly efficient measure.
	Efficiency: Highly efficient and cost-effective.		
	Interaction: Strong interaction with community involvement and waste management initiatives.		
	Suitability: Highly suitable, given the need for community participation in biogas projects.		
	Benefits and Costs: High benefits at relatively low costs.		
6. Develop a national biogas policy with financial incentives	**Effectiveness**: Provides regulatory clarity and promotes investment.	**Effective** as it creates the enabling environment for biogas adoption, but policy development requires upfront	**RANK 6** **Rationale**: A national biogas policy is critical for providing the regulatory certainty needed for investment and long-term sustainability, but
	Efficiency: Moderate short-term efficiency, highly efficient in the long term.		

	Interaction: Interacts strongly with private sector investment and donor funding.	regulatory and institutional changes.	its development will take time and resources.
	Suitability: Highly suitable, as it provides the necessary framework for biogas development.		
	Benefits and Costs: High benefits with moderate development costs.		
7. Tax incentives for biogas investments	**Effectiveness**: Reduces long-term costs for investors.	**Moderately Effective** as tax incentives encourage investment but are less immediate than subsidies.	**RANK 7** **Rationale**: Tax incentives support private sector participation but are less critical in the short term compared to direct subsidies and grants.
	Efficiency: High long-term efficiency, but less immediate impact compared to direct subsidies.		
	Interaction: Positive interaction with other financial incentives and investment measures.		
	Suitability: Suitable for encouraging private sector participation.		
	Benefits and Costs: High benefits with relatively low costs for the government.		

Annex IV. Framework for Ranking Measures for inclusion as Actions selected for the TAP - Electric Vehicles

Framework for ranking measures for promoting Electric Vehicles (EVs) for inclusion as Actions selected for inclusion in the TAP			
Measure	**Consideration**	**Assessment**	**Initial Ranking with Rationale**
1. Government incentives for EV purchases	**Effectiveness**: Encourages adoption by reducing upfront costs.	Highly Effective due to Tuvalu's economic context, providing immediate financial relief to consumers and businesses.	**RANK 1** **Rationale**: Incentives significantly lower the financial barrier for EV adoption, making them accessible to a larger population and driving demand for EVs.
	Efficiency: Immediate impact on sales.		
	Interaction: Positive interaction with local dealerships and importers.		
	Suitability: Highly suitable for Tuvalu's market conditions, as it directly addresses high vehicle costs.		
	Benefits and Costs: High benefits with moderate government expenditure.		
2. Development of EV charging infrastructure	**Effectiveness**: Essential for supporting the adoption of EVs.	Highly Effective, as the availability of charging stations directly influences the feasibility of EV usage.	**RANK 2** **Rationale**: Developing a robust charging network is critical for easing range anxiety and ensuring convenient access to charging, promoting widespread EV adoption.
	Efficiency: High long-term efficiency.		
	Interaction: Supports both private and public EV initiatives.		
	Suitability: Highly suitable as it aligns with the goal of promoting sustainable transportation.		
	Benefits and Costs: High benefits; requires significant investment.		
3. Public awareness and education campaigns	**Effectiveness**: Increases knowledge	Very Effective in changing perceptions	**RANK 3** **Rationale**: Awareness

	and acceptance of EVs.	and educating the public about the benefits of EVs and sustainability.	campaigns are essential for fostering community support and encouraging potential users to consider EVs, thus enhancing overall adoption rates.
	Efficiency: Cost-effective and impactful.		
	Interaction: Strong interaction with local communities and stakeholders.		
	Suitability: Highly suitable for engaging the community in the transition to electric mobility.		
	Benefits and Costs: High benefits at relatively low costs.		
4. Capacity building for local technicians	**Effectiveness**: Essential for maintaining EV infrastructure and providing local support.	Highly Effective, as developing local expertise reduces reliance on foreign technicians and enhances project sustainability.	**RANK 4** **Rationale**: Investing in training local technicians ensures the long-term operation and maintenance of EV systems, which is vital for sustainability.
	Efficiency: High long-term efficiency.		
	Interaction: Strong connection with EV operations and local job creation.		
	Suitability: Highly suitable, addressing the skills gap in Tuvalu's workforce for new technologies.		
	Benefits and Costs: High benefits with moderate training costs.		
5. Government policies to support EV integration	**Effectiveness**: Establishes a regulatory framework for EV adoption.	Effective in creating the necessary legal and institutional environment for promoting EVs and attracting investment.	**RANK 5** **Rationale**: A clear policy framework is crucial for encouraging investment in EV
	Efficiency: Moderate short-term efficiency,		

	highly efficient long-term. **Interaction:** Interacts positively with funding initiatives and public-private partnerships. **Suitability:** Highly suitable, providing the necessary governance for effective EV integration. **Benefits and Costs:** High benefits with moderate development costs.		technology and ensuring alignment with broader sustainability goals.
6. Tax incentives for EV imports	**Effectiveness:** Reduces costs for businesses and consumers importing EVs. **Efficiency:** High long-term efficiency. **Interaction:** Positive interaction with government funding measures. **Suitability:** Suitable for promoting EV imports and private sector involvement. **Benefits and Costs:** High benefits with relatively low government costs.	Moderately Effective as it incentivizes the private sector to participate in EV adoption.	**RANK 6** **Rationale:** While important for encouraging importers and consumers, tax incentives have a more gradual impact compared to direct incentives for EV purchases.
7. Pilot projects for EV deployment	**Effectiveness:** Demonstrates viability and benefits of EV technology. **Efficiency:** Moderate efficiency. **Interaction:** Strong interaction with local stakeholders and potential investors. **Suitability:** Suitable for testing various EV	Effective for generating local interest and confidence in EVs through real-world applications.	**RANK 7** **Rationale:** Pilot projects can help gauge community response and operational challenges but require funding and time to implement fully.

	technologies and solutions in the Tuvaluan context.		
	Benefits and Costs: Moderate benefits with varying costs depending on scale.		

Annex V. Framework for Ranking Measures for inclusion as Actions selected for the TAP - Shift to Bikes, E-Bikes and Non-Motorized transport.

Framework for ranking measures of promoting NMT for inclusion as Actions selected for inclusion in the TAP			
Measure	**Consideration**	**Assessment**	**Initial Ranking with Rationale**
1. Development of Cycling Infrastructure (Bike Lanes and Parking)	Effectiveness: Critical for reducing reliance on motorised vehicles by creating safe spaces for cyclists. Efficiency: High impact, but infrastructure requires moderate to high upfront investment Interaction: Positive interaction with urban planning, construction, and international donor funding. - Suitability: Highly suitable for Tuvalu, addresses core barriers of safety for NMT users. - Benefits and Costs: High benefits in terms of safety and long-term emission reduction, with moderate costs for construction.	Cycling infrastructure provides long-lasting, high-impact results by ensuring that cycling is a safe and viable mode of transport. With dedicated bike lanes and parking, NMT adoption becomes more attractive and practical. Though it requires significant upfront investment, the long-term benefits far outweigh the costs.	Ranked 1st Infrastructure is fundamental to promoting NMT and ensures safety, leading to increased adoption of bicycles and e-bikes. Critical to the success of other measures.
2. Financial Incentives for NMT Adoption (Subsidies, Tax Exemptions)	Effectiveness: Reduces upfront costs for individuals purchasing bicycles and e-bikes. Efficiency: Immediate impact through direct financial support. Interaction: Positive interaction with private sector investment and international donor support. Suitability: High suitability for Tuvalu, as it directly addresses the challenge of high capital costs for individuals.	Financial incentives remove the economic barrier to adopting bicycles and e-bikes, encouraging rapid uptake. Subsidies and tax exemptions make NMT more affordable for the public. This measure requires moderate resources but results in	Ranked 2nd Financial incentives address the critical issue of affordability, helping to drive widespread adoption of bicycles and e-bikes in the short term.

	Benefits and Costs: High benefits for adoption rates, with moderate costs covered by subsidies.	immediate increases in NMT usage.	
3. Public Awareness and Engagement Campaigns	Effectiveness: Raises awareness and builds public support for NMT. Efficiency: Cost-effective way to influence public behaviour. Interaction: Strong interaction with schools, local leaders, media, and community organisations. Suitability: Very suitable for Tuvalu, where cultural and behavioural shifts are needed to support NMT. Benefits and Costs: High benefits for behaviour change, with low to moderate costs for media and public outreach campaigns.	Public awareness campaigns are essential for changing perceptions of cycling and promoting the benefits of NMT. These campaigns influence public attitudes toward cycling and help foster a culture of non-motorized transport. Costs are low compared to the high potential for behaviour change.	Ranked 3rd Public awareness is critical to support infrastructure and financial measures. Without public buy-in, other initiatives may not be fully effective.
4. Training and Capacity Building for Engineers, Planners, and Private Sector	Effectiveness: Builds long-term technical capacity for planning, implementing, and maintaining NMT infrastructure. Efficiency: Moderate impact, but crucial for sustainable NMT adoption. Interaction: Strong interaction with international technical experts and local institutions. Suitability: Highly suitable, ensuring local capacity for future NMT expansion. Benefits and Costs: High long-term benefits, with moderate costs covered through international partnerships.	Capacity building is essential for ensuring that local engineers and urban planners have the skills needed to design and maintain NMT infrastructure. It ensures sustainability but requires a longer-term approach. International partners can support technical expertise transfer.	Ranked 4th While it is critical for long-term success, capacity building has a delayed impact compared to immediate infrastructure or financial incentives.
5. NMT Policy Development and Integration into Urban Planning	Effectiveness: Ensures long-term institutional support for NMT through regulations and policies. - Efficiency: High impact at a relatively low cost. - Interaction: Strong interaction with government planning bodies and regulatory authorities. - Suitability: Very suitable, as it institutionalised NMT and aligns with national transport and climate policies.	Policy development is necessary for embedding NMT into Tuvalu's broader urban planning and climate policies. It ensures that NMT is supported by regulation and planning mandates, which is critical for long-term sustainability.	Ranked 5th Policy development provides long-term benefits but may not have an immediate impact on NMT adoption compared to infrastructure and financial measures.

	- Benefits and Costs: High benefits with low implementation costs but, may take longer to see results.		
6. Establishment of Bike Rental Programs	Effectiveness: Provides access to bicycles without requiring ownership. Efficiency: Moderate impact; requires continuous investment to maintain operations. Interaction: Interaction with the private sector for rental operations and local government for infrastructure. Suitability: Suitable in urban areas but limited in smaller, rural regions. - Benefits and Costs: Moderate benefits, with moderate to high operational costs for maintaining the rental service.	Bike rental programs offer an accessible option for people who cannot afford to buy bicycles. However, these programs require significant ongoing operational support to ensure sustainability and public interest. They may work best in high-density urban areas like Funafuti.	Ranked 6th Bike rental programs provide an alternative to ownership but face challenges in sustainability and uptake, especially in low-density or rural areas.
7. Road Safety Education and Cycling Safety Regulation	Effectiveness: Improves road safety for cyclists and reduces accidents. Efficiency: Low-cost measure that improves safety for NMT users. Interaction: Strong interaction with schools, local authorities, and community organisations. Suitability: Suitable for ensuring safety, particularly with the development of NMT infrastructure. - Benefits and Costs: High benefits in reducing accidents with low implementation costs.	Road safety education and regulations ensure that cyclists are safe, especially in areas where motorised traffic may still dominate. This measure supports the broader NMT goals by improving the safety and confidence of cyclists.	Ranked 7th Road safety measures are crucial, but their impact is dependent on the successful implementation of infrastructure and public adoption of NMT.