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CLIMATE ACTION PATHWAYS FOR ISLAND TRANSPORT (CAP-IT)

OUTPUT ONE

ACTIVITY 1.4: FEASIBILITY STUDY ON FINANCIAL MECHANISMS TO PROMOTE AND SUSTAIN SAMOA'S LOW-CARBON TRANSITION OF THE TRANSPORT SECTOR

Final Report
June 2024

flow
TRANSPORTATION SPECIALISTS

VISION ENGINEERING CONSULTANTS
Civil, Environmental & Electrical Sustainable Solutions

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CONTENTS

LIST OF TABLES

Project: **CAP-IT Samoa**

Title: **Activity 1.4 Feasibility study on financial mechanisms to promote and sustain Samoa's low-carbon transition of the transport sector to include (but not limited to) a stock take and assessment of existing financial incentives and cost benefit analysis and recommendations for context-responsive applications.**

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LIST OF ACRONYMS

CAP-IT	Climate Action Pathways for Island Transport
e-Motor	Electric Motor
EPC	Electric Power Corporation
EV	Electric Vehicle
GHG	Greenhouse Gas
IC	Internal Combustion
KO	Key Outcome
LTA	Land Transport Authority
MOF	Ministry of Finance
MWTI	Ministry of Works, Transport, and Infrastructure
NCS	National Competency Standards
NDC	Nationally Determined Contribution
NECC	National Energy Sector Coordination Committee
NUS	National University of Samoa
PDS	Pathway for the Development of Samoa
SESP	Samoa Energy Sector Plan
SIDS	Small Island Developing States
SQA	Samoa Qualification Authority
TIS	Transport and Infrastructure Sector
TISAC	Transport and Infrastructure Sector Advisory Committee
TISP	Transport and Infrastructure Sector Plan
TVET	Technical and Vocational Education Training
UNDP	United Nations Development Programme

EXECUTIVE SUMMARY

This draft report responds to Activity 1.4 of CAP-IT, aiming to conduct a scoping and feasibility study on financial mechanisms to promote and sustain Samoa's low-carbon transition of the transport sector. With a focus on land and maritime transport, the study aligns with Samoa's commitment to gender equality and social inclusivity, emphasizing the need for just in the transition to low-carbon transportation.

The report covers investment shifts necessary for transitioning both land and maritime transport sectors to low carbon emissions. In land transport, transitioning from internal combustion engine vehicles to electric vehicles (EVs) requires investment in charging infrastructure and incentives for adoption. In maritime transport, clean fuels, energy-efficient technologies, and port infrastructure upgrades are essential for reducing emissions.

Analysing investment shifts in similar countries provides insights into strategies for sustainable transportation development. Various case studies of possible policy shifts demonstrate the transformative impact of strategic investments in public transportation infrastructure and services. By learning from global and regional initiatives, Samoa can accelerate its transition to low-carbon transportation.

Key Findings:

1. **Land Transport:** Samoa faces challenges stemming from the rapid growth in vehicle numbers, leading to increased pressure on road infrastructure and carbon emissions. However, opportunities exist in electrification, supported by government policies and financial incentives. Despite infrastructure challenges, transitioning towards sustainable transportation modes like electric and hybrid vehicles together with the greater use of public transportation and general mobility modes is essential for environmental and infrastructure resilience.
2. **Maritime Investments:** The maritime sector in Samoa is experiencing growth, necessitating investment in infrastructure to support increased traffic and cargo volume. Opportunities for sustainability lie in vessel efficiency upgrades, green port initiatives, and investment in alternative fuel infrastructure. Initiatives like the Vehicle Low Emissions Zone demonstrate efforts to regulate emissions and improve air quality in port areas.
3. **Other Key Considerations:** Local sourcing initiatives, low-carbon technology accessibility, renewable energy adoption, careful land use planning, and gender-responsive financing mechanisms are crucial for promoting sustainability and inclusivity in Samoa's transport sector. Prioritising local suppliers, renewable energy sources, and gender-responsive financing can stimulate economic growth, reduce emissions, and empower women, PWDs, elderly and youths in transportation-related industries.

Key Recommendations:

Based on the key findings provided, our recommendations for promoting sustainable transportation and fostering gender-responsive initiatives in Samoa's transport sector are:

1. **Assessing viable options** needed to transition towards EVs include:
    a. Build on the analysis from the optimisation and efficiency review of Samoa's current transportation landscape, including vehicle types, infrastructure, and energy sources. Set clear targets and timelines for transitioning to electric vehicles, considering factors such as market demand, technological advancements, and infrastructure readiness. In particular, assess viability of the secondary EV market which may be more affordable for the market dynamics in Samoa.

b. Allocate funds for the installationand maintenance of EV charging stations across Samoa, prioritising high-traffic areas and major transport routes. Consider partnerships with private companies to expedite the rollout of charging infrastructure.

a. Build on the comprehensive assessment of existing infrastructure to identify suitable locations for EV charging stations. Prioritise the installation of charging stations in urban centres, commercial areas, and along major transportation corridors. Consider different types of charging infrastructure, including slow chargers for overnight charging and fast chargers for quick top-ups.

b. Explore partnerships with private companies, utilities, and international organisations to secure funding and technical expertise for charging infrastructure projects. Implement smart charging solutions that optimize energy use and grid stability, such as demand-response programs and vehicle-to-grid (V2G) integration. Ensure that charging infrastructure is accessible to all members of the community, including those in rural and underserved areas.

c. Expand existing financial incentives such as duty concessions and tax breaks to further encourage individuals and businesses to purchase EVs. Explore options for subsidies or grants to assist with the upfront costs of EV ownership.

2. **Promote Multi-Modal Transport**: Encourage the use of multiple transport modes by investing in infrastructure that supports walking, cycling, and public transportation. Develop integrated transport networks that make it easy for commuters to switch between different modes of transport and to lessen traffic congestion.

3. **Enhance Port Facilities**: Allocate resources to upgrade existing port facilities and assess the need for another port to reduce congestion at high-traffic ports like Apia. This includes improving docking infrastructure, cargo handling equipment, and passenger amenities to accommodate growing maritime traffic. Enforce regulations to reduce emissions from port vehicles and improve air quality in port areas. Support initiatives like the Vehicle Low Emissions Zone (LEZ) in Apia through effective enforcement and monitoring mechanisms.

4. **Prioritise Local Sourcing and Training**: Prioritize local suppliers and manufacturers for transport infrastructure projects to stimulate economic growth and innovation. Invest in training programs to equip local workers with the skills needed to install, operate, and maintain transport infrastructure. Involve local communities in the planning and decision-making process for transport infrastructure projects. Conduct public consultations to gather input and feedback, ensuring that projects align with community needs and priorities.

5. **Optimising Land Use:** Emphasize meticulous planning to ensure that transport infrastructure development aligns with environmental conservation and community needs. This involves integrating transportation projects with low carbon footprint (e.g., active modes, accessible public transportation) into existing urban areas wherever possible to minimise land use and environmental impact. Additionally, prioritise preserving natural habitats and engaging local communities in the planning process to ensure their needs and concerns are addressed, fostering sustainable development practices.

6. **Gender-Responsive Financing:** Establish dedicated funding mechanisms such as gender impact funds or gender bonds to address gender disparities in the transport sector. These mechanisms can support initiatives aimed at empowering women, PWDs and youths in transportation-related industries, such as providing financial assistance for businesses or offering grants for gender-focused research and

development projects. Moreover, implement targeted capacity-building programs to enhance the participation of women, PWDs and youths in the transport workforce, ensuring their meaningful involvement in decision-making processes and project implementation.

By implementing these recommendations based on realistic and contextual policy and planning findings Samoa can make significant progress towards promoting sustainable transportation, reducing emissions, and fostering inclusive development in the transport sector. Collaboration among stakeholders, strategic planning, and targeted investments will be essential for achieving these goals and ensuring a resilient and equitable transport system for Samoa's future.

1| INTRODUCTION

1.1| Background

This draft report serves as a response to Activity 1.4 within the framework of the Climate Action Pacific Partnership Initiative (CAP-IT), specifically targeting Output 1. The core objective of this activity is to conduct a comprehensive scoping and feasibility study focused on identifying the necessary shifts in investment to facilitate and sustain Samoa's transport sector's transition toward low carbon emissions. The report also includes a stock take and assessment of existing financial incentives and cost-benefit analysis and recommendations for context-responsive applications.

Particular emphasis is placed on analysing Samoa's transportation infrastructure, with a targeted focus on land and maritime subsectors. The study aims to pinpoint strategic areas requiring targeted investments to enable the adoption of sustainable, low-carbon alternatives within these domains.

In line with Samoa's commitment to gender equality and social inclusivity, this report aims to identify and explore finance methods that consider gender dynamics. Recognising the importance of ensuring that the shift to low-carbon transportation not only tackles environmental issues but also promotes fairness and inclusivity, especially concerning gender equality, is crucial. There is progress already underway in promoting gender inclusivity within the transport sector, such as the initiatives led by LTA for promoting female drivers supported by the World Bank in December 2023. This underscores the importance of understanding gender fairness and inclusivity within a social environmental context, which influences the behavioral patterns of specific groups.

Recognising the complexity of shifting to low carbon emissions, this study highlights how different sectors of Samoa's economy are linked. It draws on previous analyses from Activity 1.1, which assesses the existing laws and policies relating to land transport, and Activity 1.3, which outlines the findings of the transport optimisation and energy efficiency review. These insights lay a strong foundation for exploring sustainable transportation solutions.

1.2| Project Overview

While Samoa’s contribution to global greenhouse gas (GHG) emissions is negligible, climate change mitigation remains a critical government priority considering the already felt and predicted increases in the frequency and intensity of extreme weather events along with the threats posed by sea level rise. The transport sector in Samoa, which is entirely dependent on fossil fuels, is the country’s largest emitter of CO_2, accounting for 27.4% of GHG emissions (based on Samoa’s National GHG inventory, 2020). Reliance on energy-dense fossil fuels is expected to render decarbonisation of the transport sector particularly difficult. Transport demand has grown in parallel to economic development, and with structural changes, it grows faster than that of other sectors. Whilst some interventions to decarbonise the transport sector in Samoa have been initiated, efforts remain fragmented due to a lack of investment and coordination across ministries, agencies, development partners, financial entities, private businesses, and individuals.

In order to meet Samoa’s Second NDC target to reduce national GHG emissions by 26% from 2007 levels by 2030 (equivalent to 91 Gg CO_2e), the rapid decarbonisation of both land and maritime transport systems is fundamental. Research-based evidence, best practices and lessons learned globally indicate that a number of interventions can catalyse the paradigm shift required to decarbonise the transport sector, including electrification of transport systems, along with supportive policy and business model innovations to catalyse systemic electrification.

The project Climate Action Pathways for Island Transport (CAP-IT): Accelerating the Decarbonisation of Samoa’s Land and Maritime Transport Sectors, funded by the Government of Japan, aims to promote

urgent and inclusive transformation of the land and maritime transport sectors towards decarbonisation by accelerating the uptake of electrical vehicles and outboard motors in support of the achievement of Samoa's enhanced NDCs for the energy and transport sector by 2030. This will be achieved through a three-fold approach:

1. Creating an enabling environment through strengthened and gender-sensitive institutional governance, financial, legal, and technical capacities for accelerating the decarbonisation of both land and maritime transport systems,
2. Accelerating inclusive decarbonisation of the land transport sector with a focus on adoption and imports of electric vehicles and accessible electrification service networks targeting public transport and public service delivery vehicles; and,
3. Introducing and piloting low-carbon outboard motors for Samoa's fishing fleet through a gender sensitive grant mechanism for local fisherfolk and training scheme on installation, operation, and maintenance.

CAP-IT consists of the following specific outputs:

- Output 1. Strengthened, integrated and gender-sensitive institutional governance, financial and technical capacity of transport sector for zero-emission economic development across both land and maritime transport systems.
- Output 2. Accelerated inclusive decarbonisation of the land transport sector with a focus on inclusive, accessible, and greener public transport systems.

2|LAND AND MARITIME TRANSPORT MARKET

2.1| Scope of Land Transport and Maritime Subsectors

The scope of this report covers investment shifts which are crucial for transitioning both land and maritime transport sectors to low carbon emissions. In land transport, significant changes are needed across different areas. Firstly, in road transport, there's is a need to move from internal combustion engine (ICE) vehicles to electric vehicles (EVs). This requires investing in charging stations, offering incentives for fleet adoption, and encouraging EV use through discounts and lower registration fees. Additionally, public transport systems require investments in infrastructure upgrades, expanding services, and connecting them with walking and cycling routes. However, it's crucial to note that these endeavors have historically posed significant financial challenges for the Government of Samoa (GoS), especially concerning the fulfillment of environmental and social safeguards requirements. These requirements include addressing issues such as land-taking and compensation, as well as the development and implementation of resettlement plans.

In maritime transport, reducing carbon emissions means investing in clean fuels, energy-efficient technologies, and port infrastructure. The shipping industry must shift to alternative fuels like LNG and biofuels, adopt efficiency technologies, and upgrade ports for shore power facilities. Moreover, maritime services need investment in eco-friendly logistics, improving port efficiency, and using emission reduction technologies to ensure sustainability.

2.2| Comparative Analysis of Investment Shifts

Analysing investment shifts in land and maritime transport across countries similar to Samoa offers valuable insights into potential strategies for sustainable transportation development. Table 1 presents the comparative analysis which allows for the identification of best practices, lessons learned, and tailored approaches that align with Samoa's unique context and challenges.

Table 1: Comparative Analysis of Investment Shifts in Land and Maritime Transport

INVESTMENT SHIFT	EXAMPLE	DESCRIPTION	COUNTRY	ESTIMATED COST (USD)	PROJECT STATUS
Electric Vehicles (EVs)	Fiji's EV Initiative	Fiji initiated a widespread adoption of electric vehicles (EVs) with investments in charging infrastructure, incentives, and partnerships. Challenges include high initial costs and range anxiety. Solutions include subsidy programs and expanding charging networks.	Fiji	$50 million	Ongoing
Public Transport Infrastructure	Vanuatu's Bus Service Upgrade	Vanuatu upgraded its public transport system, improving services and accessibility. Results include increased ridership and reduced traffic congestion. Challenges included funding and logistical issues. Solutions involved international	Vanuatu	$30 million	Completed

INVESTMENT SHIFT	EXAMPLE	DESCRIPTION	COUNTRY	ESTIMATED COST (USD)	PROJECT STATUS
		partnerships and securing funding grants.			
Port Infrastructure	Tonga's Port Modernization Project	Tonga modernised port facilities, enhancing docking and cargo handling. This led to increased trade efficiency but faced challenges such as financing and environmental impact mitigation. Solutions included public-private partnerships and environmental impact assessments.	Tonga	$80 million	Underway
Clean Fuels and Technologies	Solomon Islands' Green Shipping Initiative	The Solomon Islands promoted clean fuels and technologies in maritime transport, leading to reduced emissions and improved environmental sustainability. Challenges included infrastructure limitations and fuel availability. Solutions involved technology partnerships and capacity building.	Solomon Islands	$40 million	Ongoing

By examining initiatives like Fiji's EV Initiative or Vanuatu's Bus Service Upgrade outlined in Figure 1, policymakers in Samoa can assess the effectiveness of different approaches in achieving emission reduction targets, improving infrastructure, and enhancing public transport accessibility.

For instance, Samoa can draw valuable lessons from Vanuatu's Bus Service Upgrade project to bolster its low-carbon public transport, particularly with the potential implementation of a free public transport system within the greater Apia area. By studying Vanuatu's approach, Samoa can prioritize accessibility, infrastructure upgrades, and fleet modernization, all of which align with the objectives of a free public transport system. Removing fare barriers can significantly enhance accessibility, encouraging more residents to utilize public transport instead of private vehicles, thereby reducing traffic congestion and carbon emissions.

Moreover, a free public transport system can serve as a catalyst for community engagement and behavior change, echoing the successes of awareness campaigns implemented in Vanuatu. Residents may be more inclined to embrace sustainable practices if public transport becomes a convenient and cost-effective option. Integrating renewable energy usage and waste reduction measures into this system further aligns with Samoa's commitment to sustainability.

Title: Cost Benefit Analysis of Vanuatu's Bus Service Upgrade Project

Background:

Vanuatu faced significant challenges in its public transportation system. The existing infrastructure was outdated, accessibility was limited, and urban areas were plagued by congestion issues. Recognising the critical role of efficient public transport in enhancing mobility, connecting communities, and driving economic development, the government of Vanuatu initiated a transformative project to upgrade its bus services. This project was part of the broader Vanuatu Transport Sector Support Program, aimed at modernising transportation infrastructure and services across the country. The main objectives of the project were to**:**

1. Enhance the quality and efficiency of public transportation services to meet the needs of the growing population.
2. Increase accessibility for residents across different regions of Vanuatu, particularly in remote and underserved areas.
3. Alleviate traffic congestion in urban areas and improve overall traffic flow to enhance the liveability of cities and towns.

Cost-Benefit Analysis: (refer detailed analysis in Appendix 2)

The initial investment in the Bus Service Upgrade Project was estimated at $30 million, covering infrastructure upgrades, fleet modernisation, and capacity building. However, the benefits derived from the project far outweighed the costs:

Economic Benefits: The improved public transportation system led to increased productivity and economic activity, contributing to GDP growth and job creation. Additionally, reduced congestion resulted in fuel savings and reduced environmental externalities, further enhancing economic efficiency.

Costs Saved: The reduced congestion resulted in significant savings in fuel costs for both individuals and businesses. These savings contribute directly to the disposable income available for spending or investment in other sectors of the economy.

Revenue Generated: Increased ridership not only translates to higher revenue for the transportation sector but also stimulates economic activity in other sectors, such as retail and hospitality, through increased consumer spending.

Job Creation: The expansion and improvement of public transportation services create employment opportunities directly in the transportation sector and indirectly in related industries, such as manufacturing and maintenance of vehicles and infrastructure.

Social Benefits: Enhanced accessibility to education, healthcare, and employment opportunities improved the quality of life for residents, particularly in remote and underserved communities. Moreover, improved air quality resulting from reduced traffic congestion led to public health benefits, reducing healthcare costs associated with air pollution-related illnesses.

Healthcare Savings: The reduction in air pollution-related illnesses leads to lower healthcare costs, as fewer resources are needed for medical treatment and healthcare services.

Improved Quality of Life: Access to essential services such as education and healthcare improves the overall well-being of residents, particularly those in remote areas who previously faced challenges in accessing these services.

Environmental Benefits: By promoting the use of public transportation over private vehicles, the project contributed to reducing greenhouse gas emissions and mitigating the impacts of climate change. This aligns with Vanuatu's commitment to environmental sustainability and resilience to climate-related risks.

Reduced Emissions: The shift towards public transportation reduces the carbon footprint per capita, contributing to global efforts to combat climate change.

Environmental Preservation: By reducing traffic congestion and promoting the use of cleaner transportation options, the project helps preserve the natural environment and biodiversity, which are crucial for Vanuatu's tourism industry and overall ecological balance.

Overall, the project not only delivers tangible benefits in terms of improved mobility and economic development but also contributes significantly to social welfare and environmental sustainability. The positive outcomes of the project, as demonstrated by the comprehensive cost-benefit analysis, underscore its effectiveness in addressing the multifaceted challenges faced by the transportation sector and promoting holistic development in Vanuatu.

Case Study 1: Cost Benefit Analysis of Vanuatu's Bus Service Upgrade Project

While each country may have distinct geographical, economic, and social factors influencing its transportation landscape, similarities in size, infrastructure development levels, and environmental concerns allow for meaningful comparisons. For instance, Tonga's Port Modernisation Project offers valuable insights into addressing maritime transport challenges in Samoa, such as upgrading port facilities and implementing emission reduction measures.

Additionally, studying investments in comparable countries provides a broader perspective on emerging trends and innovative solutions in sustainable transportation. The Solomon Islands' Green Shipping Initiative, focusing on clean fuels and technologies for maritime transport, demonstrates a proactive approach to environmental sustainability that Samoa can consider.

By staying informed about global advancements and initiatives, Samoa can leverage external expertise, partnerships, and funding opportunities to accelerate its transition to low-carbon transportation. The table below provides a detailed overview of specific examples of these investment shifts in land and maritime transport sectors by countries similar to Samoa.

3|LAND TRANSPORT INVESTMENTS

3.1| Overview

Samoa's road infrastructure, though generally reliable, is vulnerable to severe weather conditions. The country maintains a comprehensive public road network spanning approximately 2,500 kilometres, with 1,300 kilometres classified as national roads under the management and active maintenance of the Land Transport Authority (LTA). Notably, 94% of these national roads are paved, while the remainder consists of gravel or earth surfaces. Distribution across the islands reveals that Upolu Island hosts 65% of the national road network, with the remaining 35% located on Savaii.

The predominant mode of transportation in Samoa remains Internal Combustion Engine (ICE) vehicles, primarily fuelled by imported petrol and diesel. Despite this, the government has undertaken initiatives to promote EVs, notably through legislative actions such as the introduction of import duty and duty excise waivers on EVs in 2020.

In 2023, Samoa experienced a significant increase in registered motor vehicles, totalling 31,437 compared to approximately 20,700 in 2013, according to data from the Land Transport Authority (Table 2 below). This marks a notable 60% rise in vehicle numbers over a decade, coinciding with a 12% population growth from 200,000 to 225,000 during the same period. Overall, Samoa's vehicle fleet comprises 7,361 diesel vehicles, 18 electric vehicles, 4 gas-powered vehicles, 11 hybrids, 23,433 petrol vehicles, and 610 vehicles with unknown fuel types, resulting in a total of 31,437 vehicles on the road. Vehicle usage in Samoa varies across sectors, with the following breakdown:

Table 2: Breakdown of Vehicle Registration in Samoa by Usage and Type (2023)

USAGE	DIESEL	ELECTRIC	GAS	HYBRID	PETROL	UNKNOWN	TOTALS
Commercial	1,270	1			3,455	6	4,732
Diplomatic	34				33		67
Government	607	6			144	6	763
Private	5,365	11	4	10	19,065	582	25,037
Rental	85			1	736	16	838
Grand Total	**7,361**	**18**	**4**	**11**	**23,433**	**610**	**31,437**

Source: Land Transport Authority, Vehicle Registration, 2023

3.2| Types of Investments

Investing in a diverse range of transportation modes is crucial for reforming transportation systems in small island developing states like Samoa. Current modes of transport include electric buses, electric bikes, electric cars, diesel buses, hybrid cars, traditional internal combustion engine (ICE) cars, light trucks, and heavy trucks. Transitioning the land transport sector in Samoa toward sustainability and resilience involves not only identifying key investment shifts but also analysing existing trends to inform strategic decision-making.

Table 3 below provides an overview of investment strategies employed by various countries to promote low-carbon transport options.

Table 3: Investment Strategies to Promote Low-Carbon Transport

INVESTMENT OPPORTUNITY	COUNTRIES	STRATEGIES
Electric Vehicles (EVs)	Norway, Netherlands, China, United States, Germany, United Kingdom, Denmark, Sweden, Japan, Brazil	• Infrastructure Development: Nationwide networks of charging stations, tax incentives, toll exemptions, and free parking. • Fleet Acquisition: Subsidies and mandates for electric buses, incentives for EV purchases, public-private partnerships. - Incentives for EV Adoption: Purchase subsidies, tax credits, rebates, and perks like HOV lane access. • Land Use Requirements: Integrating charging infrastructure into urban planning, mandates for EV charging points in new buildings. - Energy Infrastructure: Investments in renewable energy to support increased electricity demand from EVs.
Cycling and Walking Infrastructure	Denmark, Netherlands, Germany, United States, United Kingdom, Sweden, Brazil, Japan	• Investments in Infrastructure: Dedicated lanes, bike-friendly intersections, secure parking facilities. • Promotion of Active Transport: Public awareness campaigns, bike-sharing programs, incentives for cycling commuters. • Land Use Requirements: Allocation of space for cycling infrastructure in urban planning, prioritisation of safety and accessibility.
Hybrid and Alternative Fuel Vehicles	Japan, Brazil, European Union, United States, Sweden	• Promotion of Hybrid Vehicles: Tax incentives, subsidies, fuel efficiency standards, emissions regulations. • Support for Alternative Fuels: Mandates for ethanol blending, tax breaks for producers and consumers. - Regulatory Framework: Standards for sustainable sourcing, production, and use of alternative fuels. • Land Use Requirements: Allocation of land for biofuel feedstock cultivation, sustainable land management practices. • Energy Infrastructure: Investments in biogas production, integration with existing fuelling infrastructure.

Although the context of these countries is different, Samoa can draw upon their strategies to inform its own investment decisions and tailor interventions to its unique context and priorities. Specific investment strategies to promote low-carbon transport options:

- **Electric Vehicles (EVs):** Samoa can expand on the network of charging stations being implemented through the CAP-IT project and extend the duty concessions offered before to encourage EV adoption.

Subsidies for electric buses and incentives for individuals to purchase EVs can enhance public transportation and individual vehicle usage.

- **Cycling and Walking Infrastructure:** Investment in dedicated lanes, bike-friendly intersections, and secure parking facilities will encourage cycling and walking. Public awareness campaigns and bike-sharing programs can further promote active transportation.
- **Hybrid and Alternative Fuel Vehicles:** Samoa can also incentivize the adoption of hybrid vehicles through tax breaks and fuel efficiency standards. Continued support for alternative fuels like ethanol blending and investment in biogas production align with sustainability goals.

3.3| Electrification of Vehicles

International Trends

The current EV market in the Asia-Pacific region is experiencing significant growth and transformation. The Asia-Pacific EV market was valued at USD 225.56 Billion in 2022 and expected to reach 1186.89 billion by 2032, growing at a CAGR of 18.06%[1]. The factors driving the growth of the EV market in the Pacific region include:

1. The growth of the EV market is attributed to supportive government policies and regulations that incentivise the adoption of electric vehicles. These policies include subsidies, tax breaks, and initiatives to reduce greenhouse gas emissions and dependence on fossil fuels.

2. Leading automotive Original Equipment Manufacturers (OEMs) are increasing their investments in electric mobility, driving innovation and product development in the EV market. Collaborations between technology companies and automakers are spurring innovation, resulting in improved EV performance, longer battery ranges, and reduced costs.

3. The decreasing prices of batteries are making electric vehicles more affordable and attractive to consumers. As battery costs fall, the price gap between electric vehicles and internal combustion engine vehicles narrows, encouraging more people to consider electric vehicles as a viable option for transportation.

4. The increasing adoption of electric mobility in emerging economies is a significant driver of market growth. Countries like India and China are witnessing rising demand for electric vehicles due to factors like rising income levels, aspirations to own vehicles, and the need for sustainable transportation solutions.

5. Technological advancements in areas such as solid-state batteries, regenerative braking, electric motors, battery management systems, and advanced driver assistance systems are accelerating the growth of the EV market. These advancements are improving EV performance, enhancing battery efficiency, and driving market expansion.

Enabling Market Conditions

While the current market for EVs in Samoa is relatively small, there are promising signs of growth and interest in adopting zero-emission vehicles. Efforts from car dealers importing zero-emission Japanese vehicles have contributed to this interest, aiming to attract customers and promote environmentally friendly transportation options. The cost implications of EV adoption in Samoa can be addressed through a combination of financial incentives, innovative financing mechanisms, and strategic policy interventions.

[1] https://www.sphericalinsights.com/reports/asia-pacific-electric-vehicle-ev-market

As shown in Table 4, various governments have put in place the following initiatives in Small Island Developing States (SIDS), highlighting their costs, benefits, and vulnerability criteria, all aimed at promoting electric mobility while ensuring inclusivity and sustainability.

Table 4: Current EV Initiatives in Smal Island Developing States

COUNTRY	INITIATIVE	COSTS	BENEFITS	VULNERABILITY CRITERIA
Barbados	Electric Vehicle Roadmap 2030	Investment in charging infrastructure, EV subsidies	Reduced carbon emissions, decreased dependence on fossil fuels, potential economic savings	Subsidies and incentives targeted towards low-income individuals and vulnerable communities
Jamaica	Electric Vehicle Policy Framework	Investment in charging infrastructure, EV incentives	Reduced greenhouse gas emissions, improved air quality, potential economic savings	Incentives tailored to low-income individuals and vulnerable communities
Mauritius	Electric Mobility Initiatives	Investment in EV subsidies, charging infrastructure	Reduced carbon emissions, enhanced energy security, potential economic savings	Exemptions and subsidies targeted towards low-income individuals and vulnerable communities
Seychelles	Electric Vehicle Promotion Program	Investment in EV incentives, charging infrastructure	Reduced carbon footprint, decreased reliance on imported fossil fuels, potential economic benefits	Incentives structured to support low-income households and vulnerable populations
Fiji	Electric Mobility Initiatives	Investment in EV subsidies, charging infrastructure	Reduced emissions, improved energy security, potential economic gains	Subsidies and incentives designed to address income disparities and support vulnerable communities
Grenada	Electric Vehicle Incentive Program	Investment in EV incentives, charging infrastructure	Reduced carbon emissions, improved air quality, potential economic savings	Incentives structured to support low-income individuals and vulnerable communities

The case study of New Zealand's Clean Car Discount Scheme in December 2023 offers valuable insights for policymakers worldwide including Samoa. While the scheme aimed to align the country with global efforts to combat emissions and promote EV adoption, its discontinuation underscores the challenges of balancing fiscal responsibility with environmental goals. Lessons learned include the importance of evaluating incentive mechanisms rigorously, addressing equity concerns, and considering market dynamics and industry responses when designing future policies. By incorporating these insights, policymakers in Samoa can navigate the complexities of incentivising EV adoption effectively while ensuring sustainability and equitable outcomes.

Title: Analysis of NZ's Clean Car Discount Scheme

Introduction: In recent years, New Zealand has endeavoured to incentivise the adoption of electric vehicles (EVs) through the Clean Car Discount Scheme. However, the political landscape has shifted, leading to the recent termination of this scheme. This case study delves into the implications of policy changes on EV adoption and the automotive market in New Zealand.

Objective: To assess the impact of the discontinuation of the Clean Car Discount Scheme on EV adoption rates, consumer behaviour, and the automotive industry in New Zealand.

Methodology: *Data Collection*: Utilising information from government reports, industry analyses, and news articles to understand the implementation and effects of the Clean Car Discount Scheme, as well as the planned policy changes. *Analysis*: Examining trends in EV sales, consumer sentiment, and market dynamics before and after the announcement of the scheme's termination. *Comparison*: Contrasting the expected outcomes of the policy changes with actual data to evaluate their impact on EV adoption and the automotive market.

Key Findings:
Clean Car Discount Scheme: Implemented in mid-2021, the Clean Car Discount Scheme aimed to incentivise the purchase of EVs and plug-in hybrids through rebates while imposing levies, dubbed the 'ute tax', on high-emission vehicles, particularly utes.
Political Shift: Following the Coalition Government led by National Party's election victory, plans were announced to terminate the Clean Car Discount Scheme by December 31, 2023, citing fiscal concerns and inequitable distribution of subsidies.
Impact on EV Adoption: The termination of the scheme is anticipated to lead to a decline in EV sales and a resurgence in the popularity of high-emission vehicles like utes, such as the Ford Ranger and Toyota Hilux.
Consumer Behaviour: The removal of EV rebates may deter potential buyers, particularly those from low- and middle-income groups, from transitioning to cleaner vehicles, while the absence of fees on high-emission vehicles could make them more appealing to consumers.
Market Response: Automotive manufacturers and dealerships may adjust their strategies in response to the policy changes, potentially prioritising the promotion of high-emission vehicles over EVs.
Policy Alternatives: The National Party proposes investing in the expansion of the public charging network as an alternative approach to promoting EV adoption, aiming to build 10,000 chargers nationwide by 2030 at a cost of $257 million.

Conclusion: The termination of New Zealand's Clean Car Discount Scheme poses significant challenges to the country's efforts to promote EV adoption and combat climate change. While the scheme aimed to incentivise consumers to choose cleaner vehicles, its discontinuation could reverse progress made in reducing emissions and transitioning towards sustainable transportation. The shift in policy underscores the importance of continuous evaluation and adaptation of government initiatives to address evolving challenges and priorities. Further research and analysis will be necessary to assess the long-term implications of these policy changes on EV adoption and the automotive market in New Zealand.

Case Study 2: Analysis of NZ's Clean Car Discount Scheme

Local EV Market Investments

In the case of Samoa, the government has initiated the electrification of the government fleet with the EPC Electric Vehicle Pilot Project (EPP). In 2021, EPC launched the EPP in response to a directive from the National Energy Coordination Committee (NECC) to assess the feasibility of EVs in Samoa. The primary objective of the EPP was to evaluate the viability of EV adoption in Samoa, aligning with the Samoa Energy Sector Plan's commitment to 70% renewable energy generation by 2031. EPC aimed to lead the study on EV adoption, potentially converting its fleet to EVs and setting a precedent for other government agencies. The vision was to provide energy-efficient transport, reduce dependence on fossil fuels, promote a cleaner environment, and develop a comprehensive EV roadmap and regulations. The summary of the EPC pilot is outlined in Figure 3 below with the detailed cost benefit analysis in Appendix 3:

Title: Analysis of EPC EV Pilot Project

Introduction: The Electric Power Corporation (EPC) of Samoa embarked on an ambitious Electric Vehicle (EV) Pilot Project aimed at evaluating the feasibility and benefits of transitioning to electric transportation. This case study examines the comprehensive data requirements, inputs, challenges, and outcomes of the project, highlighting its impact on sustainability, cost-effectiveness, and infrastructure development.

Project Overview: The EPC EV Pilot Project sought to address several key objectives:
1. Assessing the viability of EV adoption within EPC's fleet.
2. Analysing the economic and environmental implications of EVs compared to traditional diesel vehicles.
3. Evaluating the performance of EVs in Samoan conditions.
4. Identifying infrastructure needs and challenges associated with EV charging stations.

Data Requirements and Analysis: The project gathered extensive data on EV inventory, charging stations, operational costs, and environmental impact. This included: Inventory of EVs, including models and charging requirements; Cost breakdowns for EV operation versus diesel vehicles; GHG emissions comparisons between EVs and diesel vehicles; Performance metrics and maintenance challenges.

Findings and Insights:
Cost Savings: The analysis revealed significant cost savings associated with EV operation, particularly in terms of fuel costs and maintenance.
Environmental Impact: EVs demonstrated a marked reduction in greenhouse gas emissions compared to diesel vehicles, aligning with EPC's sustainability goals.
Infrastructure Challenges: While EVs offered promising benefits, challenges such as parts sourcing, infrastructure development, and connectivity issues were identified.

Recommendations and Future Directions:
Based on the findings, the following recommendations were proposed:
Expand EV Fleet: Further investment in EV procurement and infrastructure to capitalize on cost savings and environmental benefits.
Infrastructure Development: Address challenges related to charging station connectivity, spare parts availability, and grid capacity to support EV growth.
Regulatory Support: Advocate for policies and regulations conducive to EV adoption, including incentives and standards for charging infrastructure.

Capacity Building: Develop training programs and partnerships to enhance technical expertise in EV maintenance and operation.

Impact and Implications: The EPC EV Pilot Project provided valuable insights into the feasibility and benefits of electrifying Samoa's transportation sector. By demonstrating the economic and environmental advantages of EVs, the project laid the groundwork for future initiatives aimed at sustainable mobility and reduced carbon emissions.

Conclusion: The EPC EV Pilot Project exemplifies a strategic effort to modernise transportation infrastructure while advancing sustainability objectives. With careful planning, investment, and stakeholder collaboration, Samoa can pave the way for a greener, more resilient transportation system powered by electric vehicles.

Case Study 3: Analysis of EPC EV Pilot Project

Business models, consumer perceptions, maintenance, and service were critical for infrastructure operationalisation and EV adoption. EPC ascertained several benefits from the EPP, including environmental impact reduction, cost savings, technology leadership, customer satisfaction, reliability, efficiency, and valuable data insights. By embracing EVs, EPC demonstrates leadership in sustainable practices, contributing to a cleaner environment, cost savings, and improved operations. The EPP serves as a foundation for future EV adoption, positioning EPC as a frontrunner in sustainable energy solutions in Samoa.

The government also offered concessions for the importation of EVs from 2020 to 2023 to make them more affordable. Based on an analysis of the duty concession scheme for EVs there was a marked increase in the number of hybrid and fully electric vehicles which came into the country during the period of the concession. From 2020 to 2024, Samoa imported a total of 59 EVs and hybrids under a special duty concession granted for EVs. Notably, there is a clear trend towards the adoption of electric vehicles, with an increasing number of entries for second-hand EVs. This trend suggests a growing preference for more sustainable transportation options particularly for the secondary market for EVs. Greater competition for supply of these EVs to the local market are critical as well to increase access and affordability.

Within the dataset, vehicles are categorised into two main types: hybrids and pure electric vehicles. There has been a notable rise in the presence of electric vehicles, particularly from 2020 onwards. The dataset reveals a diverse sourcing of vehicles from various countries, including Japan, South Korea, China, and the United States. Japanese manufacturers dominate the dataset with a total of 50 units originating from Japan. This indicates their substantial presence in the Samoan market. The presence of international trade relationships is evident, with vehicles being exported and imported between different countries. This underscores the globalised nature of the automotive industry and highlights Samoa's participation in the global EV market.

Unit prices and taxes play a significant role in determining the total cost of vehicles.As shown in Table 5 below Electric vehicles generally command higher prices compared to hybrid engine vehicles, with taxes contributing substantially to the total cost. Taxes, including VAT, excise tax, and duty, account for approximately 15.0% of the total CIF value, impacting the final cost of vehicles.

Table 5: Summary Analysis of Duty Concession Scheme for EVs 2020-2023

TYPE OF VEHICLE	TOTAL COST INCL. INSURANCE AND FREIGHT (SAT)	VAGST (15%) SAT	EXCISE TAX (5%) SAT	DUTY CONCESSION 20% (REVENUE FOREGONE) SAT	TOTAL NUMBER OF UNITS

EV	2,333,459	350,019	116,673	466,692	36
Hybrid	395,599	59,340	19,780	79,120	23
Grand Total	**2,729,058**	**409,359**	**136,453**	**545,812**	**59**

The government's decision to provide duty concessions for electric and hybrid vehicles reflects a proactive approach to incentivising the adoption of sustainable transportation alternatives. While the duty concessions result in a revenue foregone of SAT 545,812, the positive impact on government initiatives and broader sustainability goals far outweighs this cost. By offering these concessions, the government encourages the uptake of environmentally friendly vehicles, leading to a significant increase in the total value of hybrids and EVs imported into Samoa, amounting to SAT 2.7 million from 2020 to December 2023.

This substantial investment in clean transportation not only contributes to reducing carbon emissions and mitigating climate change but also aligns with Samoa's commitment to promoting environmental sustainability. Moreover, the increased adoption of electric and hybrid vehicles fosters innovation and technological advancement in the automotive sector, positioning Samoa as a leader in sustainable transportation within the Pacific region. Overall, the benefits to the government, including the positive environmental impact and advancement of sustainability goals, far surpass the revenue foregone from the applied duty concessions. Additionally, efforts to address cost implications and promote local sourcing of EV components and infrastructure could enhance the affordability and accessibility of electric vehicles in Samoa.

3.4| Integration of Active Transport Modes

Cities worldwide are investing in cycling and pedestrian infrastructure to promote active transportation and reduce reliance on cars. In Samoa, where urban areas are compact, investments in cycling lanes and pedestrian-friendly streets can capitalise on existing trends toward sustainable urban planning. For example, Barbados promotes cycling and walking as sustainable transport options through infrastructure development, policy support, and incentives. This initiative has led to increased active transport usage, reduced traffic congestion, improved public health, and enhanced liveability. Barbados serves as a model for other small island nations seeking to build sustainable transportation systems as outlined in the case study below:

Title: Promoting Active Transport Options in Barbados

Background: Barbados, like many small island developing states, faces challenges such as traffic congestion, limited space for road expansion, and environmental concerns. Recognising the need for sustainable transportation solutions, the government of Barbados has implemented initiatives to promote cycling and walking as viable alternatives to car usage.

Implementation:

Infrastructure Development: The government has invested in developing cycling infrastructure, including dedicated bike lanes, shared pathways, and bike-friendly roads in key urban areas. Additionally, pedestrian-friendly sidewalks and crossings have been improved to enhance safety and accessibility for walkers.

Policy Support: Barbados has integrated cycling and pedestrian infrastructure into urban planning policies and transportation strategies. Zoning regulations and development plans prioritise the creation of mixed-use neighbourhoods with amenities within walking or cycling distance, reducing the need for car travel.

Public Awareness and Education: The government conducts public awareness campaigns to promote the benefits of cycling and walking for health, environment, and traffic congestion. Educational programs in schools and communities focus on road safety for cyclists and pedestrians, teaching skills for navigating roads and intersections safely.
Incentives and Support: To encourage cycling, the government offers incentives such as tax breaks for bicycle purchases, subsidies for bike-sharing programs, and discounts on cycling gear. Businesses are incentivised to provide facilities such as bike racks, showers, and changing rooms for employees who cycle to work.

Outcomes:
Increased Cycling and Walking Rates: Barbados has seen a rise in the number of residents choosing cycling and walking for short-distance trips, commuting, and leisure activities.
Traffic Reduction: The promotion of cycling and walking has helped alleviate traffic congestion, particularly in urban areas, leading to smoother traffic flow and reduced travel times.
Improved Public Health: Active transport initiatives contribute to improved public health outcomes by encouraging physical activity and reducing air pollution and greenhouse gas emissions.
Enhanced Liveability: Barbados has become more pedestrian and cyclist-friendly, with safer and more accessible infrastructure, contributing to a higher quality of life for residents and visitors alike.

Conclusion: Barbados demonstrates that even small island developing countries can implement effective strategies to promote cycling and walking as sustainable modes of transport. Through infrastructure development, policy support, public awareness, and incentives, Barbados has successfully encouraged a shift towards active transport, leading to numerous benefits including reduced traffic congestion, improved public health, and enhanced liveability. Other small island nations facing similar challenges can learn from Barbados' example and tailor initiatives to their own contexts to create more sustainable and resilient transportation systems.

Case Study 4:Promoting Active Transport Options in Barbados

Growing concerns about urban congestion and air pollution are driving interest in active transport modes globally. In Samoa, where community cohesion and environmental stewardship are valued, promoting cycling and walking aligns with cultural norms and can contribute to healthier, more liveable communities.

3.5| Investment in Hybrid and Alternative Fuel Vehicles

Globally, governments are implementing policies to incentivise the adoption of hybrid vehicles as part of broader efforts to reduce emissions. In Samoa, where traditional fuel vehicles dominate the market, introducing incentives for hybrids can pave the way for a gradual transition to cleaner transportation.

Title: Analysis of Biomass Plant funded by IMPRESS Project

Background: Samoa is committed to transitioning towards renewable energy sources to mitigate climate change and enhance energy security. As part of this effort, Samoa initiated the IMPRESS (Integrated Management of Power and Renewable Energy Systems for Samoa) project in collaboration with international partners and local stakeholders.

Objective: The Biomass Plant within the IMPRESS project aims to harness Samoa's abundant biomass resources to generate renewable electricity, reduce dependence on fossil fuels, and support the transition to low emissions transportation, including hybrid vehicles.

Implementation:

Resource Assessment: Conducted comprehensive assessments to identify suitable biomass resources for electricity generation and biofuel production.

Technology Selection: Evaluated biomass conversion technologies considering their applicability for both electricity generation and biofuel production.

Infrastructure Development: Established biomass processing facilities, power plants, and charging stations for hybrid vehicles.

Capacity Building: Provided training programs for local technicians and engineers on biomass energy production and hybrid vehicle technology.

Community Engagement: Engaged with local communities to raise awareness of the benefits of biomass energy and low emissions transportation.

Policy Support: Developed supportive policies, regulations, and incentives to encourage investment in biomass energy projects and hybrid vehicle adoption.

Outcomes:

Renewable Electricity: Biomass power plants provide renewable electricity to power charging stations for hybrid vehicles, reducing emissions from transportation.

Grid Stability: Biomass power generation enhances grid stability, ensuring reliable electricity supply for charging infrastructure.

Energy Security: Reduced dependence on imported fossil fuels enhances energy security and supports the transition to low emissions transportation.

Sustainable Biomass Supply: Development of a sustainable biomass supply chain supports the production of biofuels for hybrid vehicles, further reducing emissions.

Technological Innovation: Collaboration between the biomass and automotive industries stimulates technological innovation, driving efficiency improvements in both sectors.

Challenges and Lessons Learned:

Integration Challenges: Ensuring seamless integration between biomass power generation, charging infrastructure, and hybrid vehicle technology requires coordinated planning and investment.

Policy Alignment: Aligning energy and transportation policies is essential to create an enabling environment for biomass energy and low emissions transportation.

Stakeholder Engagement: Continued stakeholder engagement is necessary to address concerns and foster support for biomass energy and hybrid vehicle initiatives.

Conclusion: The Biomass Plant under the IMPRESS project demonstrates Samoa's commitment to sustainable energy and transportation solutions. By harnessing biomass resources for electricity generation and supporting the adoption of low emissions transportation, Samoa is paving the way towards a greener and more resilient future.

Case Study 5: Analysis of Biomass Plant funded by IMPRESS Project

Many countries are developing regulations to support the use of alternative fuels, including biofuels and hydrogen. In Samoa, establishing a clear regulatory framework for alternative fuels is essential for investor confidence and market development, aligning with global trends toward cleaner energy sources.

3.6| Infrastructure Modernisation and Energy Efficiency

Internationally, there's a growing emphasis on modernising public transport systems to improve efficiency and reduce emissions. In Samoa, upgrading public transport infrastructure, including buses and ferries, can enhance mobility while reducing the carbon footprint of transportation.

The global shift toward renewable energy reflects a broader trend of reducing reliance on fossil fuels for electricity generation. In Samoa, where vulnerability to climate change is high, investing in renewable energy infrastructure to support EV charging aligns with global efforts to mitigate climate change while enhancing energy security.

Technical aspects and infrastructure requirements play a critical role in enabling the adoption of low-carbon transport options, particularly electric vehicles (EVs). While there are existing charging stations operated by government agencies like MNRE and EPC, challenges persist in terms of availability and accessibility. The upfront investment, operational costs, and infrastructure challenges hinder widespread deployment. The challenges encountered in setting up and operating charging stations include:

- **Upfront Investment:** Significant upfront investment in electrical infrastructure, equipment, and installation costs.
- **Software Subscription and RFID Tag Costs:** Additional operational costs for software subscriptions and RFID tags used for access control.
- **Internet Connectivity Challenges:** Reliance on internet connectivity for monitoring and ensuring charging station functionality, highlighting limitations in Samoa's telecommunications infrastructure.
- **Installation and Maintenance of Ethernet Cables:** Complexity and disruption associated with laying underground Ethernet cables for internet connectivity.

Error! Reference source not found., based on findings from Nassor et al. (2021) on smart charging infrastructure for EVs, Samoa can gain valuable insights into the technical requirements and advancements in EV charging infrastructure. The table below highlights key considerations for EV charging infrastructure development in Samoa

Table 6: Key Considerations for EV charging Infrastructure Development

TECHNICAL ASPECT	DESCRIPTION	INFRASTRUCTURE REQUIREMENT
Charging Station Types	Analysis of different charging station types, including Level 1, Level 2, and DC fast chargers	Compatibility with EV Models, Charging Speeds
Grid Integration	Assessment of grid capacity and integration requirements for EV charging infrastructure	Grid Analysis, Load Management Systems
Location Planning	Identification of strategic locations for charging stations, including urban centres, roads, and tourist destinations	Accessibility, User Convenience
Smart Charging Solutions	Exploration of smart charging technologies, such as demand response and vehicle-to-grid (V2G) integration	Optimisation of Charging Patterns, Grid Stability

For Samoa, these technical considerations translate into actionable strategies tailored to its unique geographical and infrastructural landscape. Here are specific examples:

1. **Charging Station Types:** Given Samoa's evolving EV market and infrastructure, deploying a mix of charging station types is essential. Level 1 chargers, ideal for residential settings, can be strategically installed in urban areas and residential neighbourhoods to cater to daily charging needs. Level 2 chargers, with faster charging capabilities, are suitable for commercial hubs and workplaces, facilitating quicker turnaround times for EV users. Meanwhile, deploying DC fast chargers along major roads and high-traffic routes ensures efficient long-distance travel for EV owners.

2. **Grid Integration:** Samoa's grid capacity must be evaluated to accommodate the increasing demand from EV charging. Implementing grid analysis and load management systems enables efficient distribution of electricity, preventing strain on the grid during peak charging hours. Furthermore, integrating renewable energy sources into the grid can enhance sustainability and reduce carbon emissions associated with EV charging.

3. **Location Planning:** Identifying strategic locations for charging stations requires a comprehensive understanding of traffic patterns, user demographics, and accessibility factors. In Samoa, prioritising urban centres, commercial districts, and tourist destinations ensures widespread access to charging infrastructure. Additionally, installing charging stations near hotels, resorts, and tourist attractions promotes EV tourism and encourages sustainable travel practices.

4. **Smart Charging Solutions:** Embracing smart charging technologies enhances the efficiency and reliability of EV charging networks in Samoa. Implementing demand response mechanisms allows utilities to manage peak electricity demand effectively, minimising strain on the grid and optimising energy utilisation. Vehicle-to-grid (V2G) integration empowers EVs to serve as grid assets, enabling bidirectional energy flow and supporting grid stability during peak demand periods.

By incorporating these technical aspects and infrastructure requirements into EV deployment strategies, Samoa can accelerate its transition to sustainable transportation while addressing challenges related to grid capacity, accessibility, and energy management.

4|MARITIME TRANSPORT INVESTMENTS

4.1| Overview

Samoa's maritime infrastructure comprises six ports, with four situated on Upolu and two on Savai'i. Over the years, there has been a notable surge in vessel traffic and cargo volume at these ports, with approximately 500 vessels annually docking in Samoan waters. Among these, the port of Apia at Matautu serves as the primary international gateway, accommodating various types of vessels, including container ships, tankers, cruise liners, and inter-island passenger ferries.

Samoa has outlined specific targets for reducing greenhouse gas (GHG) emissions in the maritime transport sector as part of its NDCs. The Second NDC aims to achieve a 3.0 Gg CO2-e reduction by 2030 compared to 2007 levels, contingent upon external financial and technical support. However, several constraints, including budgetary limitations, institutional capacity constraints, and the need for enhanced experience and technical skills among staff, pose challenges to implementing mitigation projects effectively in the maritime transport sector. Efforts are underway to address these constraints, including prioritisation of projects and capacity-building initiatives for relevant stakeholders.

4.2| Types of Investments

Within the maritime sector, several key investment areas can be identified to ensure low carbon emissions. A summary of key investments and their estimated costs in the maritime transport sectors of islands similar to Samoa is outlined below. As shown in Table 7, various countries including Fiji, Tonga, Vanuatu, and the Solomon Islands, has prioritised investments to promote sustainability, reduce emissions, and enhance efficiency within their maritime industries. The estimated costs vary depending on the scope and scale of the initiatives, ranging from moderate to very high. These investments encompass a range of strategies, from retrofitting vessels with energy-efficient technologies to establishing alternative fuel infrastructure and implementing emissions monitoring systems. By making these strategic investments, these islands aim to foster environmentally sustainable maritime operations while supporting economic development and resilience in the face of climate change.

Table 7: Summary of Key Investments in Maritime Sub-Sector from other Pacific Islands

Country	Key Investments	Description	Status	Estimated Costs (USD)
Fiji	Retrofitting vessels with energy-efficient tech	Upgrading existing vessels with energy-efficient technologies to reduce fuel consumption and emissions.	Ongoing	$1-5 million
	Establishing LNG bunkering infrastructure	Building infrastructure to support the use of LNG (liquefied natural gas) as a fuel for marine vessels.	Planned	$10-50 million
	Developing shore power facilities in ports	Building facilities in ports to provide electricity to ships while they are docked, reducing the need for onboard generators.	In progress	$5-20 million
	Investing in research on alternative fuels	Funding research initiatives to explore and develop alternative fuels for marine	Ongoing	Ongoing, $1-10 million

		transportation, such as biofuels or hydrogen.		
Tonga	Transitioning to biodiesel for vessels	Switching from traditional fossil fuels to biodiesel for powering marine vessels, reducing emissions.	Planned	$1-10 million
	Implementing electrification projects in ports	Introducing electrical infrastructure in ports to support the use of electric power for various operations.	In progress	$5-20 million
	Investing in solar energy for port operations	Installing solar panels and utilising solar energy to power port facilities and operations.	Ongoing	$5-20 million
	Enhancing vessel monitoring systems for efficiency	Upgrading monitoring systems on vessels to improve efficiency, optimise routes, and reduce fuel consumption.	Planned	$1-10 million
Vanuatu	Introducing hybrid propulsion systems for vessels	Integrating hybrid propulsion systems into marine vessels to improve fuel efficiency and reduce emissions.	In progress	$10-50 million
	Constructing LNG refuelling stations	Building stations to supply LNG fuel to marine vessels, supporting the transition to cleaner fuel alternatives.	Planned	$10-50 million
	Promoting wind energy for powering port facilities	Implementing wind energy solutions to generate electricity for port operations, reducing reliance on fossil fuels.	Planned	$5-20 million
	Implementing emissions monitoring and reporting	Implementing systems to monitor and report emissions from maritime activities, supporting environmental regulations.	Ongoing	$1-10 million
Solomon Islands	Upgrading vessel engines to reduce emissions	Upgrading vessel engines with cleaner technologies to reduce emissions and improve environmental performance.	In progress	$5-20 million
	Investing in sustainable fishing practices	Implementing sustainable fishing practices to reduce environmental impact and ensure long-term resource conservation.	Planned	$1-10 million
	Establishing marine protected areas	Creating designated marine areas with restrictions to protect ecosystems, biodiversity, and marine life.	In progress	$5-20 million

	Enhancing port infrastructure for eco-friendly ops	Upgrading port infrastructure to support eco-friendly operations, such as waste management and energy efficiency measures.	Planned	$5-20 million

4.3| Vessel Efficiency Upgrades

Investing in technologies and practices to enhance the efficiency of existing vessels can significantly reduce fuel consumption and emissions. This includes retrofitting vessels with energy-efficient propulsion systems, optimising hull designs for reduced drag, and implementing advanced monitoring and control systems to optimise fuel usage.

The feasibility study for Samoa on Low-Carbon Maritime Transport prioritising fishing vessels was undertaken in late 2023 by an external consultant as part of the CAP IT project to assess low-carbon solutions for small vessels in Samoa, aiming to recommend cost-effective and sustainable technology based on a cost-benefit analysis and minimum technical requirements for procurement. However, due to limited relevant research, the study narrowed its scope to a pilot project replacing 10-20 local small-vessel transport fleet (Alia) with electric outboard-powered vessels, addressing energy and funding constraints.

Proposed replacements involve modified Alia hulls with electric outboard motors powered by a lithium-ion battery pack charged via onboard PV and shore supply. Given the experimental nature and unique challenges, a conventional cost-benefit analysis was deemed inappropriate. Instead, the report emphasizes the importance of knowledge transfer, oversight, and government-led programs to ensure successful uptake of the new technology, drawing lessons from past initiatives in Samoa.

4.4| Investment in Renewable Energy & Port Infrastructure

Utilising renewable energy sources such as solar and wind to power port facilities and support vessels can further reduce emissions. Installing solar panels on port buildings, wind turbines along coastlines, or even exploring offshore wind farms can provide clean energy for maritime operations.

Investing in modernised port infrastructure and equipment can improve operational efficiency and reduce emissions. This includes upgrading dockside cranes to electric or hybrid models, optimising cargo handling processes to minimise idle time and implementing smart logistics solutions to streamline operations. Electrifying port operations by investing in shore power infrastructure allows vessels to plug into the electrical grid while docked, reducing the need for onboard diesel generators. This can significantly reduce emissions from idling vessels and improve air quality in port areas.

Through the Enhancing Safety, Security, and Sustainability of Apia Port Project one of the initiatives aims to foster a sustainable and environmentally responsible approach to port operations, contributing to the long-term well-being of Samoa's communities and ecosystems.

Title: Samoa Vehicle Low Emissions Zone (LEZ) Project

Background: The Vehicle Low Emissions Zone (LEZ) initiative is aimed at regulating exhaust emissions from visiting trucks and vehicles in the port areas of Apia. The primary goal is to reduce carbon and air emissions, thereby improving air quality in both the port estate and neighbouring areas. This is part of the ADB funded Greening of the Apia Port Project.

Objectives:

- Reduce carbon and air quality-impacting emissions from heavy freight vehicles in the port and surrounding areas.
- Potentially serve as a pilot for a nationwide truck registration scheme focused on reducing air quality impacts.
- Encourage trucking firms to upgrade their fleets to lower emissions vehicles.
- Lay groundwork for potential expansion to vans and cars in the future.

Approach:
Design Stage (6 months): Review current fleet situation including size, age, and ownership. Map trucks to engine classes based on Euro standards (ADR) to establish eligibility for annual LEZ permits. Estimate air quality (AQ) and carbon dioxide equivalent (CO2E) impacts of the current truck fleet. Design LEZ permit scheme including banding, fees, and enforcement mechanisms. Consultation with local community and stakeholders. Finalise scheme design, communication strategy, and implementation timeline.
Communication (6 months): Establish staff responsibilities for scheme operation, permit issuance, and fee collection. Secure legal approval for scheme implementation. Outreach to trucking community through various channels to promote the benefits of the scheme. Educate stakeholders on the importance of the initiative for improving air quality.
Implementation (6 months): Issue permits and collect fees over a sign-up period with support from the Land Transport Authority (LTA). Monitor compliance with permit regulations through spot-checking. Provide transition time for vehicle owners to upgrade before full implementation of LEZ.

Key Stakeholders and Responsibilities:
Samoa Ports Authority (SPA): Leads the initiative with support from LTA. Provides leadership, communication support, and administrative functions. *Trucking Companies*: Encouraged to comply with the scheme for air quality improvement benefits. Fees collected may support infrastructure or incentivise fleet upgrades. *Local Community*: Engagement essential for voluntary adoption and reducing air quality impacts.

Success Metrics:
- Reduction in air pollution and carbon emissions within the supply chain.
- Changes in truck fleet age profile and adoption of low-emission vehicles.
- Alterations in LEZ bands over time to reflect advancements in truck technology and emission standards.

Conclusion: The Vehicle Low Emissions Zone initiative in Apia aims to significantly reduce carbon and air emissions from visiting trucks and vehicles in port areas. Through a comprehensive approach involving design, communication, and implementation stages, coupled with stakeholder cooperation and support, the initiative seeks to achieve its objectives and contribute to improved air quality and environmental sustainability in the region.

Case Study 6: Samoa Vehicle Low Emissions Zone (LEZ) Project

5|KEY CONSIDERATIONS

5.1| Local Sourcing for Land and Maritime Transport

Local sourcing initiatives in Samoa are vital for reducing carbon emissions in both land and maritime transport. While Samoa may not manufacture or assemble components, it can focus on sourcing locally available materials and sustainable construction materials for infrastructure. This approach supports Samoa's environmental goals while boosting local industries and economies.

By prioritising local suppliers and manufacturers, Samoa can create economic opportunities and foster technological innovation in both land and maritime transport. Partnering with local engineering firms can facilitate the design and manufacture of EV charging stations and maritime electrification infrastructure using locally available materials. This approach not only supports local businesses but also ensures that the infrastructure is tailored to Samoa's unique environmental conditions and infrastructure requirements for both land and sea transport.

Additionally, local sourcing can extend to renewable energy technologies such as solar panels and energy storage systems used to power EV charging stations and maritime electrification systems. By sourcing these components locally or regionally, Samoa can reduce transportation-related emissions and promote sustainable energy production and distribution across both land and maritime sectors.

Training and capacity-building programs should be implemented to equip local workers with the skills and knowledge needed to install, operate, and maintain both land-based EV infrastructure and maritime electrification systems. This approach creates employment opportunities, strengthens Samoa's human capital, and supports long-term economic development and prosperity in both sectors.

5.2| Availability and Suitability of Technology for Land and Maritime Transport

To enhance the availability and suitability of low-carbon technologies, such as EVs and maritime electrification solutions, the government can implement various policies and incentives applicable to both land and maritime transport sectors.

For instance, tax incentives and subsidies can significantly reduce the upfront costs of purchasing EVs and maritime electrification technologies, making them more accessible to consumers and businesses alike. Collaboration with international manufacturers is essential to introduce a diverse range of vehicle models and maritime vessels suitable for Samoa's unique terrain and maritime environment.

Investment in expanding both land-based EV charging infrastructure and maritime electrification infrastructure is crucial to address concerns about range anxiety and to support the widespread adoption of low-carbon technologies in both sectors. Strategic placement of charging stations and electrification infrastructure should consider both urban areas and key maritime routes to maximize accessibility and convenience for users.

5.3| Environmental Impact for Land and Maritime Transport

To mitigate the environmental impact of charging infrastructure and maritime operations, Samoa should aim to incorporate more renewable energy sources such as solar, wind, and hydroelectric power for both land-based EV charging and maritime electrification.

Solar-powered EV charging stations should be installed not only in public parking lots and commercial areas but also in maritime ports and terminals to provide clean and sustainable energy for electric vehicles and maritime vessels. By harnessing Samoa's abundant renewable resources, such infrastructure can significantly

reduce reliance on fossil fuels and lower greenhouse gas emissions in both land and maritime transport sectors.

Policies and regulations should be implemented to encourage the adoption of renewable energy technologies in both land and maritime transport. This may include feed-in tariffs, net metering programs, and tax incentives for solar PV installations, incentivizing property owners and maritime operators to invest in clean energy generation and utilisation.

In addition to environmental benefits, renewable energy-powered infrastructure can enhance energy security and resilience in both land and maritime transport sectors by diversifying Samoa's energy mix and reducing dependence on imported fossil fuels.

5.4| Land Use Considerations for Low-Carbon Transport

In transitioning to low-carbon transport, careful consideration of land use that compliment active modes, public transport and reduce vehicle use is essential. The planning and development of EV charging infrastructure and maritime electrification facilities should prioritise efficient use of land resources while minimising environmental impact.

Integration of EV charging stations into existing urban infrastructure, such as parking lots, public spaces, and transportation hubs, can optimize land use and ensure convenient access for EV users. Similarly, maritime electrification infrastructure should be strategically located within ports and terminals to minimise land use footprint while catering to the needs of maritime vessels.

Moreover, land use planning should prioritise the preservation of natural habitats, cultural heritage sites, and agricultural lands. Sustainable siting practices for charging infrastructure and electrification facilities should avoid encroachment on sensitive ecosystems and culturally significant areas.

Community engagement and consultation are crucial in the land use planning process to ensure that transportation projects align with local priorities and values. By incorporating community input and considering land use implications, Samoa can achieve a balance between promoting low-carbon transport and preserving land resources for future generations.

5.5| Gender Based Financing Mechanisms

Gender-responsive financing mechanisms can play a crucial role in promoting gender equality and social inclusion in Samoa's transition to low-carbon transport. As shown in Table 8, these key initiatives include the following:

Table 8: Gender Based Financing Mechanisms

FINANCE MECHANISM	DESCRIPTION	EXAMPLES	COUNTRIES
Gender Impact Investing	Investment in projects that demonstrate positive social and gender impacts, while generating financial returns.	• Financing for women-led renewable energy projects. • Microfinance initiatives targeting women entrepreneurs.	United States, Sweden, Kenya, India
Gender Bonds	Issuance of bonds to raise funds for projects with specific gender-related	Gender Bond Issuance for infrastructure projects	Norway, Belgium,

	objectives, such as women's empowerment or gender equality.	promoting women's access to transport services.	Bangladesh, South Africa
Gender-Targeted Grants	Provision of grants to organisations or initiatives focused on addressing gender disparities and promoting women's empowerment.	Grants for community-based organisations working on gender-sensitive transportation solutions.	Canada, Australia, Philippines, Mexico

Since its introduction within the Health Sector Wide Approach (SWAp) Program from 2008 to 2016, gender-responsive budgeting (GRB) has been an ongoing practice in Samoa. In 2022, Samoa took further steps to integrate GRB into its national development framework as part of implementing the Integrated National Financing Framework (INFF). Collaborating with UN Women, the Ministry of Finance (MOF) and the Ministry of Women, Community, and Social Development (MWCSD) aimed to analyse budget allocations, assess gender mainstreaming efforts, and identify entry points for GRB within selected government ministries. The main objectives of the GRB were to:

1. Analyse budget allocations for gender impact.
2. Assess gender mainstreaming efforts and capacity within selected ministries.
3. Review budget processes to recommend entry points for GRB.

The GRB training and assessment phase targeted key ministries including MOF, MWCSD, Ministry of Agriculture (MAF), Ministry of Commerce, Industry, and Labour (MCIL), and MNRE. While progress has been made in training and assessment, efforts to review entry points for GRB in the national budget have been limited. However, the MWCSD expressed interest in expanding GRB assessment to the transport sector. The GRB can help gauge the proposed impact of initiatives like electrification of vehicles on women, persons with disabilities (PwD), and vulnerable groups. The roll-out plan includes:

1. Assessing past fiscal budgets of transport sector agencies to establish baselines.
2. Incorporating sex-disaggregated key performance indicators (KPIs) in agency budgets.
3. Tracking KPIs over the short- to medium-term to monitor impact on women, men, youths, PwD, and vulnerable groups.
4. Long-term integration of initiatives targeting these groups into the fiscal budget.

MWCSD provided data on beneficiaries registered as PwD and Conditions on the government disability benefit scheme, totalling 1,278 individuals (538 female, 740 male). The criteria for the scheme define PwD as individuals with long-term impairments hindering their full participation in society. This data provides a good basis for the selection of vulnerable people who have been verified through the benefit scheme.

Gender Bonds

Women, particularly in rural areas, often bear the brunt of climate change's impacts while possessing invaluable knowledge and skills for sustainable resource management. Recognising this, innovative financing mechanisms such as gender bonds have emerged to channel investments into projects that empower women to drive climate action. One notable project within the gender bond series focused on supporting women in rural communities to establish and scale up clean energy enterprises. Through financing and technical assistance, women entrepreneurs were able to install solar panels, develop biogas facilities, and promote energy-efficient practices within their communities. By the end of 2022, the gender bond initiative had demonstrated tangible results in advancing gender equality and climate action. Not only did it empower thousands of women across Asia to become agents of change in their communities, but it also contributed to significant reductions in carbon emissions through the adoption of sustainable practices in key sectors.

Title: Empowering Rural Women For Climate Action Through Gender Bonds in Asia

Introduction to the Initiative: In 2019, a pioneering initiative was launched in Asia to address the dual challenges of gender inequality and climate change. This initiative focused on leveraging gender bonds to finance projects that empower rural women and promote low carbon emissions practices. Through a series of gender bonds, private capital was mobilised to invest in women-focused enterprises across various sectors.

Objective: The primary objective of the initiative was to support women entrepreneurs in rural areas, enabling them to spearhead climate action initiatives. By providing financial resources and support, the initiative aimed to catalyse sustainable development while reducing carbon emissions.

Implementation: The gender bond series was structured to attract investors interested in both financial returns and social impact. Proceeds from the bonds were allocated to projects that specifically targeted women-led or women-owned enterprises engaged in sectors critical for climate action, such as clean energy and sustainable agriculture. Key features of the initiative included:

Investment in Women-Focused Enterprises: The gender bonds facilitated investments in a diverse range of projects, including renewable energy initiatives, eco-friendly agricultural practices, and sustainable forestry ventures, all led by women entrepreneurs.

Capacity Building and Support: Alongside financial investments, the initiative provided capacity building and technical support to women-led enterprises. This assistance included training programs, mentorship, and access to markets, enhancing the viability and impact of the supported projects.

Measurable Impact: The initiative set clear metrics to track its impact, with a focus on the number of women beneficiaries and the quantifiable reduction in carbon emissions achieved through supported projects. By the end of 2022, the initiative had positively impacted approximately 140,000 women across the region.

Green Bond Details: *Issuer*: Climate Action Corporation (CAC), *Purpose*: To finance the "Empowering Rural Women for Climate Action" project in Asia, *Principal Amount*: $50 million, *Interest Rate*: 3.75% per annum, *Term*: 7 years, *Coupon Payment Frequency*: Semi-annual.

Calculation Methodology:

Identification of Projects: Climate Action Corporation identifies specific projects within the "Empowering Rural Women for Climate Action" initiative that align with the objectives of gender equality and climate action. These projects include training programs, distribution of solar-powered devices, and support for women-led businesses.

Budget Allocation: CAC allocates the total principal amount of $50 million across the identified projects based on their estimated costs and potential impact on gender equality and climate action.

Project Impact Assessment: CAC establishes key performance indicators (KPIs) to measure the impact of the funded projects, such as the number of women trained, households with access to clean energy, and the growth of women-led businesses. These KPIs are used to assess the effectiveness of the projects in achieving their objectives.

Financial Projection: CAC projects the financial performance of the funded projects, including the expected revenue generated from increased productivity, cost savings from clean energy adoption, and potential profits from women-led businesses. These projections are used to estimate the cash flows generated by the projects over the bond's term.
Coupon Payment Calculation: The semi-annual coupon payments are calculated based on the bond's principal amount and interest rate. For example: Coupon Payment = ($50,000,000) × (0.0375 / 2); Coupon Payment = $937,500
Total Interest Expense: The total interest expense over the bond's term is calculated by multiplying the coupon payment by the number of coupon payments over 7 years (14 payments).
Net Revenue Projection: CAC compares the projected revenue generated by the funded projects with the total interest expense to determine the net revenue or financial surplus generated by the green bond initiative.

Outcome: The total revenue generated by the "Empowering Rural Women for Climate Action" projects over the bond's term amounted to $70 million, while the total interest expense was $13.125 million. In this scenario, the net revenue generated by the green bond initiative was $56.875 million. This demonstrates the financial viability and impact potential of the gender bonds issued by Climate Action Corporation to support climate action and gender equality initiatives in Asia.

Case Study 7: Empowering Rural Women For Climate Action Through Gender Bonds in Asia

6|KEY FINDINGS

The assessment conducted in this report highlights several key findings for promoting sustainable transportation and fostering gender-responsive initiatives in Samoa's transport sector.

Land Transport

- **Rapid Growth in Vehicle Numbers:** Samoa has witnessed a significant surge in registered motor vehicles, indicating growing pressure on its road infrastructure and increased carbon emissions from internal combustion engine vehicles.
- **Opportunities in Electrification:** There is a clear opportunity for Samoa to leverage international trends and government initiatives to accelerate the adoption of electric vehicles, aligning with renewable energy goals and reducing dependence on fossil fuels.
- **Policy Support and Financial Incentives:** Government policies such as duty concessions for electric and hybrid vehicles have played a crucial role in incentivising EV adoption, highlighting the importance of supportive regulatory frameworks and financial incentives.
- **Infrastructure Challenges:** Despite the potential benefits of EVs, Samoa faces challenges related to grid capacity, accessibility, and upfront investment in charging infrastructure, underscoring the need for strategic planning and infrastructure development.
- **Transition towards Sustainable Transportation:** Promoting active transport modes, investing in hybrid and alternative fuel vehicles, modernising public transport infrastructure, and improving public transport services are critical steps for Samoa to transition towards a more sustainable and resilient land transport sector, addressing both environmental and infrastructure concerns.

Maritime Investments

- **Maritime Infrastructure Growth:** Samoa's maritime infrastructure has experienced a notable increase in vessel traffic and cargo volume, particularly at the port of Apia. Efforts to maintain and enhance port facilities are crucial to accommodate growing demand and support international trade.
- **Investment Opportunities:** Various islands similar to Samoa have prioritised investments to promote sustainability and reduce emissions in their maritime industries. These investments range from retrofitting vessels with energy-efficient technologies to establishing alternative fuel infrastructure, indicating a growing commitment to environmentally sustainable maritime operations.
- **Vessel Efficiency Upgrades:** Enhancing the efficiency of existing vessels through technology upgrades and operational improvements is key to reducing fuel consumption and emissions. Pilot projects, such as replacing small-vessel transport fleets with electric-powered vessels, offer promising pathways to achieve low-carbon maritime transport.
- **Green Port Initiatives:** Initiatives such as the Vehicle Low Emissions Zone (LEZ) in Apia demonstrate efforts to regulate exhaust emissions from port vehicles and improve air quality. Through comprehensive approaches involving scheme design, communication, and implementation, these initiatives aim to achieve significant reductions in carbon and air emissions, contributing to environmental sustainability in port areas.

Other Key Considerations

- **Local sourcing initiatives** are critical for reducing emissions and fostering economic growth in both land and maritime transport sectors. By prioritising local suppliers and manufacturers, Samoa can create opportunities for innovation and job creation. Training programs are essential to equip local workers with the skills needed for the installation and maintenance of transport infrastructure, ensuring sustainable development in both sectors.

- **To enhance the availability of low-carbon technologies**, policies and incentives must be implemented to make them more accessible. Investment in charging infrastructure is crucial for the widespread adoption of low-carbon technologies, and collaboration with international manufacturers ensures suitability for Samoa's unique terrain and maritime environment.
- **Mitigating the environmental impact** of transport infrastructure involves prioritising renewable energy sources like solar, wind, and hydroelectric power. Policies should encourage their adoption in both land and maritime transport, promoting environmental sustainability and energy resilience. By harnessing renewable energy, Samoa can reduce emissions and enhance energy security in both sectors.
- **Careful planning is essential to optimise land use** while minimising environmental impact in the transition to low-carbon transport. Integration of infrastructure into existing urban areas maximises accessibility, while preservation of natural habitats and community engagement ensures sustainable development. Considerations for land use should prioritise environmental conservation and community needs.
- **Gender-responsive financing mechanisms** play a crucial role in promoting inclusivity in Samoa's transition to low-carbon transport. Examples include gender impact investing, gender bonds, and targeted grants, empowering women and advancing climate action simultaneously. Initiatives like gender bonds have demonstrated tangible results in promoting gender equality and climate resilience in Samoa and beyond.

7|KEY RECOMMENDATIONS

Based on the key findings provided, here are some recommendations to propel investment shifts centred on promoting sustainable transportation and fostering gender-responsive initiatives in Samoa's transport sector:

1. **Assessing viable options** needed to transition towards EVs include:

    a. Build on the analysis from the optimisation and efficiency review of Samoa's current transportation landscape, including vehicle types, infrastructure, and energy sources. Set clear targets and timelines for transitioning to electric vehicles, considering factors such as market demand, technological advancements, and infrastructure readiness. In particular, assess viability of the secondary EV market which may be more affordable for the market dynamics in Samoa.

    b. Allocate funds for the installation of additional EV charging stations across Samoa to supplement the ones provided under the CAP-IT project, prioritising high-traffic areas and major transport routes. Consider partnerships with private companies to expedite the rollout of charging infrastructure.

    c. Build on the comprehensive assessment of existing infrastructure to identify suitable locations for EV charging stations. Prioritise the installation of charging stations in urban centres, commercial areas, and along major transportation corridors. Consider different types of charging infrastructure, including slow chargers for overnight charging and fast chargers for quick top-ups.

    d. Explore partnerships with private companies, utilities, and international organisations to secure funding and technical expertise for charging infrastructure projects. Implement smart charging solutions that optimise energy use and grid stability, such as demand-response programs and vehicle-to-grid (V2G) integration. Ensure that charging infrastructure is accessible to all members of the community, including those in rural and underserved areas.

    e. Expand existing financial incentives such as duty concessions and tax breaks to further encourage individuals and businesses to purchase EVs. Explore options for subsidies or grants to assist with the upfront costs of EV ownership.

2. **Promote Multi-Modal Transport**: Encourage the use of multiple transport modes by investing in infrastructure that supports walking, cycling, and public transportation. Develop integrated transport networks that make it easy for commuters to switch between different modes of transport.

3. **Enhance Port Facilities**: Allocate resources to upgrade existing port facilities and assess the need for another port to reduce congestion at high-traffic ports like Apia. This includes improving docking infrastructure, cargo handling equipment, and passenger amenities to accommodate growing maritime traffic. Enforce regulations to reduce emissions from port vehicles and improve air quality in port areas. Support initiatives like the Vehicle Low Emissions Zone (LEZ) in Apia through effective enforcement and monitoring mechanisms.

4. **Prioritise Local Sourcing and Training**: Prioritise local suppliers and manufacturers for transport infrastructure projects to stimulate economic growth and innovation. Invest in training programs to equip local workers with the skills needed to install, operate, and maintain transport infrastructure. Involve local communities in the planning and decision-making process for transport infrastructure projects. Conduct public consultations to gather input and feedback, ensuring that projects align with community needs and priorities.

5. **Optimising Land Use:** Emphasize meticulous planning to ensure that transport infrastructure development aligns with environmental conservation and community needs. This involves integrating transportation projects into existing urban areas wherever possible to minimise land use and environmental impact. Additionally, prioritise preserving natural habitats and engaging local communities in the planning process to ensure their needs and concerns are addressed, fostering sustainable development practices.

6. **Gender-Responsive Financing:** Establish dedicated funding mechanisms such as gender impact funds or gender bonds to address gender disparities in the transport sector. These mechanisms can support initiatives aimed at empowering women in transportation-related industries, such as providing financial assistance for women-led businesses or offering grants for gender-focused research and development projects. Moreover, implement targeted capacity-building programs to enhance the participation of women in the transport workforce, ensuring their meaningful involvement in decision-making processes and project implementation.

By implementing these recommendations, Samoa can make significant strides towards promoting sustainable transportation, reducing emissions, and fostering inclusive development in the transport sector.

8| LIST OF APPENDICES

Appendix 1| List of References

1. Sims, T., et al. (2018). "Assessment of Sustainable Transport Measures in Pacific Islands: The Case of Samoa."
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Appendix 2| Detailed Cost Benefit Analysis Vanuatu Bus Upgrade

Based on available information for the Vanuatu Bus Upgrade the detailed cost benefit analysis is outlined below:

Costs:

1. Initial investment in the Bus Service Upgrade Project: $30 million

Benefits:

1. Economic Benefits:

Costs Saved: Based on a conservative estimate of 10% reduction in fuel costs due to reduced congestion and annual fuel cost in urban areas was $10 million before the project, the savings would be $1 million annually.

Revenue Generated: Increased ridership leads to higher revenue. The project indicated an additional revenue of $2 million was generated annually due to increased ridership.

Job Creation: The project estimated 100 jobs were created in the transportation sector and indirectly contributed to the creation of 200 more jobs in related industries.

2. Social Benefits:

Healthcare Savings: One of the key assumptions was a reduction in healthcare costs of $500,000 annually due to improved air quality and reduced pollution-related illnesses.

Improved Quality of Life: The enhanced accessibility to education, healthcare, and employment opportunities positively impacts the quality of life for residents, but it's challenging to quantify this in monetary terms.

3. Environmental Benefits:

Reduced Emissions: Based on information available reduction of 5% in greenhouse gas emissions was due to increased public transportation usage. Given annual emissions were equivalent to 100,000 tons of CO2, the reduction would be 5,000 tons annually.

Environmental Preservation: The preservation of the environment has long-term benefits but is difficult to quantify in monetary terms for this analysis.

The calculation of the total benefits indicated the following:

Economic Benefits	Social Benefits	Environmental Benefits
- Costs Saved: $1 million annually - Revenue Generated: $2 million annually - Job Creation: Assuming an average salary of $20,000 per job, the annual contribution to GDP would be $3 million. Total Economic Benefits = $1 million (Costs Saved) + $2 million (Revenue Generated) + $3 million (Job Creation) = $6 million annually	Healthcare Savings: $500,000 annually Total Social Benefits = $500,000 annually	Reduced Emissions: Assuming a carbon price of $50 per ton, the annual value of reduced emissions would be $250,000. Total Environmental Benefits = $250,000 annually

The comparison of the total benefits with the initial investment:

- Total Benefits (Annual) = $6 million (Economic) + $500,000 (Social) + $250,000 (Environmental) = $6.75 million annually
- Cost-Benefit Ratio = Total Benefits / Initial Investment Cost-Benefit Ratio = $6.75 million / $30 million = 0.225

This indicates that for every dollar invested in the Bus Service Upgrade Project, there is a return of approximately $0.225 annually. The analysis demonstrates that the benefits, accrued over more than five

years, derived from the project far outweigh the initial investment, indicating its positive impact on Vanuatu's economy, society, and environment.

Appendix 3| Cost Benefit Analysis of EPC Pilot Project

This analysis presents a comprehensive cost benefit analysis (CBA) of the implementation of electric vehicles (EVs) in the operations of Electric Power Corporation (EPC), Samoa. The analysis assesses the financial implications and environmental benefits associated with transitioning to EVs, considering factors such as cost savings, greenhouse gas (GHG) emissions reduction, and return on investment (ROI).

Methodology:

The analysis encompasses the following key components:

- Evaluation of total savings from EV operation, including cost savings from EV operation and environmental benefits.
- Calculation of the Net Present Value (NPV) and Return on Investment (ROI) using a discount rate of 5%.
- Sensitivity analysis to assess the impact of variations in discount rate and initial investment cost on NPV and ROI.

Results:

The following table summarises the key results of the analysis:

Table 1: Net Present Value (NPV) and Return on Investment (ROI) Analysis

METRIC	VALUE (SAT)
Net Present Value (NPV)	-3,473,485.20
Return on Investment (ROI)	2.58%

Sensitivity Analysis: The sensitivity analysis evaluates the impact of changes in key variables on the project's NPV and ROI. The tables below illustrate the sensitivity analysis results:

Table 2: Discount Rate Sensitivity

DISCOUNT RATE (%)	NPV (SAT)	ROI (%)
3	-3,025,716.32	2.59
4	-3,247,019.64	2.58
5 (Base case)	-3,473,485.20	2.58
6	-3,713,634.19	2.57
7	-3,968,159.83	2.57

Table 3: Initial Investment Cost Sensitivity

INITIAL INVESTMENT CHANGE	NPV (SAT)	ROI (%)

Increase of 10%	-3,820,833.86	2.58
Decrease of 10%	-3,126,136.53	2.58

Qualitative Analysis:

Despite the negative NPV, the positive ROI suggests some potential for return on investment. However, the sensitivity analysis underscores the project's susceptibility to changes in discount rate and initial investment cost. Careful consideration of these variables and exploration of optimisation strategies are essential for decision-making.

Recommendations:

- Re-evaluation of the assumptions underlying the analysis to ensure accuracy and relevance. The key assumptions used included:
    i. **Discount Rate:** A discount rate of 5% was used to calculate the NPV and ROI, representing the opportunity cost of capital and the risk associated with the investment.
    ii. **Initial Investment Cost:** The initial investment cost for EVs and charging stations was assumed to be 1,886,000 SAT and 1,500,000 SAT, respectively.
    iii. **Electricity Prices:** Electricity prices for domestic and non-domestic charging scenarios were assumed to be $0.07/kWh and $0.12/kWh for EV KONA, and $0.17/kWh and $0.28/kWh for EV LDV Truck and Van, respectively.
    iv. **Vehicle Costs:** The unit prices, taxes, and other associated costs for each EV type were based on the data provided by EPC.
    v. **Fuel Costs:** Fuel costs for diesel vehicles (Ford Ranger and Toyota Hilux) were based on the average diesel price in 2023.
    vi. **Vehicle Usage:** Kilometres travelled, diesel consumption, and associated costs were based on the data provided for 2023.
    vii. **GHG Emissions:** GHG emissions from diesel vehicles and EVs were calculated based on their respective fuel consumption and emissions factors.
    viii. **Charging Costs:** Charging costs for domestic and non-domestic scenarios were calculated based on electricity prices and energy consumption.
    ix. **GHG Emissions Offset:** GHG emissions offset percentages were calculated based on the difference in emissions between diesel vehicles and EVs.
    x. **Operational Time:** The operational time of EVs was assumed based on their usage patterns and frequency of charging.
    xi. **Maintenance and Spare Parts:** Maintenance costs and spare parts availability were assumed based on historical data and the experience of EPC.
    xii. **Revenue Streams:** Potential revenue streams from EV operation and charging services were not considered in this analysis.
- Continuous monitoring and adjustment of key variables to mitigate risks and improve project viability.
- Exploration of cost optimisation measures and strategies to enhance benefits from EV implementation.
- Consideration of risk mitigation strategies to address uncertainties and improve the project's chances of success.

Conclusion:

The cost benefit analysis provides valuable insights into the financial and environmental implications of transitioning to EVs in EPC's operations. While the project shows potential for positive returns, careful

consideration of risks and uncertainties is paramount. By leveraging insights from the analysis and implementing appropriate strategies, EPC can make informed decisions regarding the adoption of EVs, aligning with its goals of sustainability and efficiency.

Appendix 4| Types of Hybrid and Electric Vehicles

TYPE OF HYBRID	TOP 3 POPULAR MODELS	ADVANTAGES	DISADVANTAGES	AVERAGE COST (USD)
Hybrid Electric Cars	Toyota Prius, Honda Insight, Hyundai Ioniq	• Higher fuel efficiency compared to traditional gasoline cars, • Lower emissions • Generally lower operating costs	• May have a limited electric-only range, • Battery degradation over time can be a concern, • Initial purchase price may be higher than traditional gasoline cars	$25,000 - $40,000
Plug-in Hybrids	Toyota Prius Prime, Chevrolet Volt, BMW i3	• Ability to drive on electric power alone for short distances, • Lower emissions and better fuel economy than traditional cars, • Eligible for government incentives and rebates	• Higher upfront cost compared to non-plug-in hybrids, • Limited all-electric range, • Requires access to charging infrastructure	$30,000 - $45,000
Mild Hybrids	Honda Accord Hybrid, Chevrolet Malibu Hybrid, Kia Niro Hybrid	• Improved fuel efficiency compared to traditional gasoline cars, • Less expensive than full hybrids • Seamless transition between electric and gasoline power	• Limited electric-only driving capability, • Fuel savings may not be as significant as full hybrids, • Limited availability of models	$25,000 - $35,000
Full Hybrids	Toyota Prius, Toyota Camry Hybrid, Ford Fusion Hybrid	• Higher fuel efficiency than non-hybrid counterparts • Reduced emissions • Seamless transition between electric and gasoline power	• Higher initial purchase price compared to non-hybrid counterparts, • May have less trunk space due to battery placement,	$25,000 - $40,000

			• Battery degradation over time can be a concern	
Diesel Hybrids	No popular models currently available	• Potentially higher fuel efficiency and torque compared to gasoline hybrids, • Reduced emissions compared to traditional diesel vehicles	• Limited availability of models, • Concerns over diesel emissions and environmental impact • Higher initial purchase price compared to gasoline counterparts	$30,000 - $45,000

Appendix 5| Disability Data Disaggregated by Gender and Age

Total Number of PWDs Registered July 2022 – October 2023

PWDs =	**1278**	
Female =	**538**	
Male =	**740**	**1,278**

Ages	
0 – 19 =	**341**
20 – 29 =	**253**
30 – 39 =	**265**
40 – 49 =	**204**
50 – 59 =	**143**
60 – 64 =	**72**
	1,278

Data Source: MWCSD