



STRENGTHENING THE PACIFIC BLUE SHIPPING PARTNERSHIP

Blended finance roadmap

For official use only

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Preamble

This analytical work aiming at “Strengthening the Pacific Blue Shipping Partnership (PBSP)” was undertaken as part of the World Bank’s wider regional advisory services and analytics (ASA) “A Blue Transformation for Pacific Maritime Transport.

For transparency, it is important to note that this analytical work faced significant challenges in the research process. These included, for instance, the Covid-19 pandemic with the impossibility of in-person consultations and site visits, the unavailability or limited availability of governmental officials due to shifts in priorities, or the reassignment of consultants and related analytical responsibilities as the work evolved.

This analytical work aims to make a significant contribution to decarbonizing regional maritime transport in the Pacific. It strengthens the analytical foundation of the PBSP, it outlines potential key options (e.g., governance, technical, operational, or financial) to consider moving forward, and it provides a basis for discussion. However, given the challenges mentioned, it should not be considered as fully conclusive or exhaustive, and can benefit from existing complementary analytics by other experts as well as further research.

Acknowledgments

The preparation of this Blended Finance Roadmap working paper was led by the World Bank, with the expert support of GHD Group.

The World Bank task team responsible for this paper was led by Dominik Englert and comprised Jennifer Brown, Yoomin Lee, Isabelle Rojon, and Michael Wilson. Peter Nuttall provided strategic expert guidance and advice. The GHD team was led by Guy Reynolds.

The World Bank team would like to express its great appreciation to Fei Deng for her managerial guidance and constructive suggestions during the planning, development, and finalization of this research work. Her willingness to give her time and support was highly valued.

Support from the NDC Support Facility is gratefully acknowledged.

Acronyms and abbreviations

The following acronyms and abbreviations have been used in the Report.

Acronym / abbreviation	Meaning
ADB	Asian Development Bank
AIFFP	Australian Infrastructure Financing Facility for the Pacific
B100	Biofuel
BAU	Business As Usual
BDS	Business Development Services
CAPEX	Capital Expenditure
CO ₂	Carbon Dioxide
CO ₂ e	Carbon Dioxide Equivalent
DFAT	Department of Foreign Affairs and Trade
ESG	Environment, Social and Governance
FJD	Fiji Dollars
GCF	Green Climate Fund
GDP	Gross Domestic Product
GGGI	Global Green Growth Institute
GHD	GHD Pty Ltd
GHG	Greenhouse Gas
IMO	International Maritime Organization
MFAT	New Zealand Ministry of Foreign Affairs and Trade
MSME	Micro, Small & Medium Enterprises
NDC	National Determined Contribution
OECD	Organisation for Economic Co-operation and Development
OPEX	Operational Expenditure
PBSP	Pacific Blue Shipping Partnership
PV	Present Value
RMI	Republic of Marshall Islands
SDG	Sustainable Development Goals
SME	Small to Medium Enterprises
SIDS	Small Island Developing State
UNDP	United Nations Development Programme
UNSW	University of New South Wales
USD	United States Dollars
WASP	Wind-Assist Ship Propulsion

Executive Summary

GHD Pty Ltd (GHD) has been commissioned by UNSW as part of their engagement with the World Bank on the Pacific Blue Shipping Partnership (PBSP) project. GHD's scope included the preparation of a Zero-Carbon Transition Plan and a Blended Finance Roadmap for the Transition Plan. This report is the Blended Finance Roadmap which should be read in conjunction with the accompanying Zero-Carbon Transition Plan.

Approach

The preliminary capital expenditures (CAPEX) and operational expenditures (OPEX) estimates¹ set out in this report are based on assumptions and judgments detailed in the World Bank's complementary working paper "Blended Finance Roadmap (working title)". The analysis focuses on the known domestic vessel fleets of the PBSP member countries along with immediately associated maritime infrastructure and provides estimates for more detailed work to be based on. It utilizes publicly available information on the energy resources or the technological upstream components required at the country level. This short review allows for input into a rapid assessment of the financial needs related to the identified GHG abatement measures in the PBSP member countries. Details of the methodology and additional data used can be found in the complimentary report titled 'Blended Finance Roadmap'.

All cost-related information is presented in United States Dollars (USD) (per 2022) based on information retrieved from a range of sources and countries as best applicable to the PBSP member countries. No allowance for price escalation, inflation, or price reduction due to technological and market maturity has been made. Present values are discounted at an annual rate of seven percent to an assumed PBSP GHG abatement project start year of 2023.

Key findings

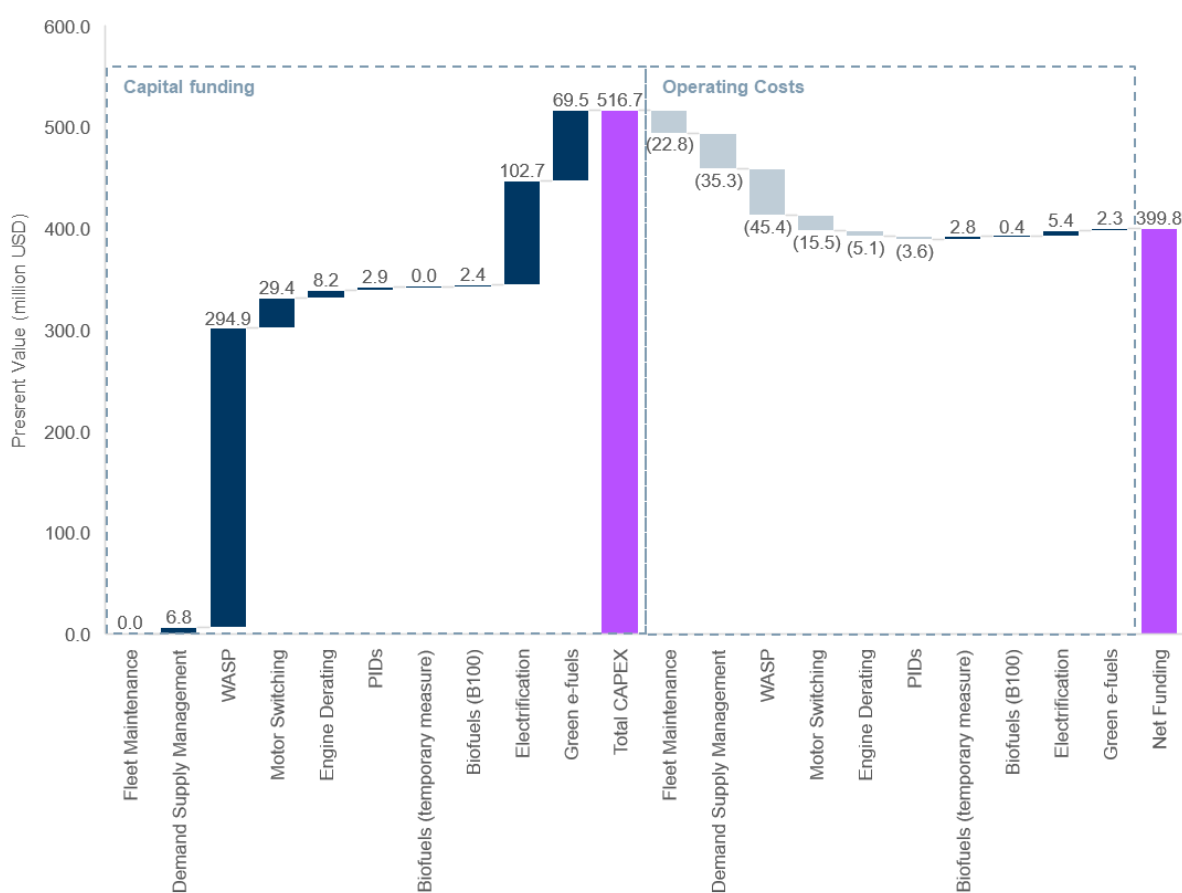
Funding requirements

The analysis finds that the total CAPEX for all GHG abatement measures from 2023 to 2027 is approximately USD 214 million, delivering a net OPEX saving of USD 42 million. The total CAPEX for all GHG abatement measures in 2028–2032 amounts to USD 302 million, delivering a net OPEX saving of USD 75 million.

Most of the CAPEX required between 2023 and 2032 is for wind-assisted ship propulsion (WASP) (USD 294.9 million), followed by electrification (USD 102.7 million) and green e-fuels (USD 69.5 million). The modelling forecasts that this level of investment would correspond to a reduction in operating costs of USD 116.8 million over the same period. Here, the biggest cost savings come from WASP technologies (USD 45.4 million) and demand-supply management (USD 35.3 million), whereas the largest operating costs come from electrification (USD 5.4 million) and biofuels (USD 3.2 million). Considering both capital and operating expenditures as well as savings, the net costs for the presented PBSP technical pathway over a 10-year horizon amount to a minimum of USD 399.8 million. Figure 1 below provides a waterfall analysis of the CAPEX investments and OPEX cost-saving by abatement measure.

¹ The estimates are strategic level Class 5 Order of Magnitude estimates defined in the International Cost Estimate Classification System of the American Association of Cost Engineers with an expected accuracy range of -20 percent to -50 percent (Low) and +30 percent to +100 percent (High). They are intended to screen abatement options and identify potential funding sources as part of the Blended Finance Roadmap. They are not suitable for budgetary purposes.

Figure 1: Capital and operating cost requirements from 2023 to 2032



Source: Based on data from the Zero-Carbon Transition Plan (working title).

The following abbreviations were used: WASP: wind-assisted ship propulsion; PIDs: propulsion improving devices; Biofuels (B100): 100 percent biofuels, i.e., non-blended.

The role of blended finance

Blended finance is the strategic use of development finance to lower the cost of capital and mobilize additional finance support to realize projects that could otherwise not be delivered through traditional financing. This is typically applied to first-mover projects to demonstrate the viability of new projects and reduce the perceived market risk, thereby incentivizing and growing the number of public and private market participants through a more favorable and sustainable investment landscape.

While the PBSP member countries would clearly benefit from mobilizing commercial finance, it is rather likely that public grants and public concessional finance will be the main source for funding the decarbonization of the Pacific shipping sector in the immediate and near term because:

- Today, subsidies are already at times provided to ensure vessels service the routes that are uneconomical.
- Although the Zero-Carbon Transition Plan indicates savings in operating costs, the scale of the sector is such that the commercial sustainability of these projects will be limited and subject to external factors, which will determine if commercial financing can be accessed.
- The nascent stage of low- and zero-carbon shipping requires market development before any pipeline investment can be developed.
- The fast-evolving technology in this space presents a risk of short investment lives, adversely impacting the return on investments from those projects.

Key actors and funding instruments

A mapping exercise identified the following actors as potential key funders: national governments, donor governments, development partners, philanthropic funds, national and regional development banks, commercial banks, institutional investors, and retail investors.

A review of the relevant funding instruments and their applicability to the PBSP is shown in Table 1.

Table 1: Application of funding instruments to PBSP investment projects

Funding instrument	Potential application in PBSP
Grants	Grants will play a critical role in the deployment of the PBSP technical pathways and are likely to be among the main funding instruments over the next ten years.
First loss, guarantees	Could be used to mitigate off-taker risk in the deployment of a fleet of new vessels, if they were centrally owned and chartered, or for vessel maintenance contracts. First loss capital or guarantees will be critical in the longer term for the maritime shipping sector as opportunities start to become commercially viable with institutional investors starting to consider them for their portfolios.
Outcome funding, impact linked finance, impact bonds	Limited to transactions where the impact can be clearly specified. This could be the financing of vessels or facilities that have clear GHG emissions reduction targets.
Concessional financing and subordinated debt	This will be best suited to initiate the deployment of measures that have a clear impact but are lower than market returns. It is well suited to early movers who have more technical knowledge and insight into how the maritime shipping market will develop. For example, this may include upgrading, repairs, and maintenance of vessels, the deployment of wind-assisted ship propulsion technologies, or electrification infrastructure.
Market rate debt and equity	Maritime transport in the Pacific presents some significant commercial barriers to mainstream finance participation and is most likely to flow into projects that either already present commercial sustainability, or where other instruments have already funded the proof of concept and financed the research and development, pilot testing, and market development supporting the business concept. The scope for this form of funding is therefore limited, and only potentially viable in the later stages of deployment.
Revenue-raising market-based measure	The International Maritime Organization (IMO) is currently considering the implementation of a revenue-raising market-based measure as part of its plan to reduce GHG emissions from international shipping. A small share of the potential carbon revenues raised—the World Bank refers to potential USD 40-60 billion annually ² —could be sufficient to meet the funding needs of PBSP member countries. However, currently, it is still unclear whether such a measure will be implemented and how potential carbon revenues raised would be used.

It is especially the last-named funding instrument, carbon revenues from a revenue-raising market-based measure applied by the IMO to international shipping, which could become a true game changer given the orders of magnitude of financing potentially becoming available. However, in light of the political uncertainties related to the adoption of such a policy measure, it is not yet specifically listed as a recommended funding instrument in the following (although it would obviously apply to all GHG abatement measures under consideration).

Based on alignment of characteristics around risk, timing and return, the most appropriate funding instruments were identified for each of the GHG abatement measures included in the Zero-Carbon Transition Plan. This is summarized in [Table 2](#).

² World Bank. 2022. Carbon Revenues from International Shipping: Enabling an Effective and Equitable Energy Transition

Table 2: GHG abatement measure funding

GHG abatement measure	Regional funding need, 2023–2032 (Present value USD million):		Recommended funding instruments	Potential funding actors	Potential implementing entities
	CAPEX	OPEX			
Fleet maintenance	0.0	(22.8)	<ul style="list-style-type: none"> – Fiscal incentives – Grants – Owner investment (maybe gradual and not incomplete) 	<ul style="list-style-type: none"> – National and donor governments – development partners – Later ship owners with fiscal incentives 	<ul style="list-style-type: none"> – Ship owners – infrastructure owners
Demand / supply management and infrastructure	6.8	(35.3)	<ul style="list-style-type: none"> – Grants – Potential to transition to owner funded once benefits are evident 	<ul style="list-style-type: none"> – National and donor governments – development partners – Later commercial banks 	<ul style="list-style-type: none"> – Governments
Wind-assisted ship propulsion retrofit	294.9	(45.4)	<ul style="list-style-type: none"> – Grants for pilot testing – Grants or other direct financial incentives (concessional interest rates, loans, or lease schemes) – Outcome funds with guarantees 	<ul style="list-style-type: none"> – National and donor governments – development partners – Philanthropic funders – Later development, commercial and/or institutional banks 	<ul style="list-style-type: none"> – Governments – Small and medium-sized enterprises (SMEs)
Motor switching	29.4	(15.5)	<ul style="list-style-type: none"> – Grants – Potential for private sector participation by way of subsidized motor replacements 	<ul style="list-style-type: none"> – National and donor governments – Development partners – Later also SMEs 	<ul style="list-style-type: none"> – Ship owners with fiscal incentives
Engine derating	8.2	(5.1)	<ul style="list-style-type: none"> – Grants – Impact funding – Fiscal measures 	<ul style="list-style-type: none"> – National and donor governments – development partners – Later also SMEs 	<ul style="list-style-type: none"> – SMEs – Ship owners with fiscal incentives
Propulsion improvement devices	2.9	(3.6)	<ul style="list-style-type: none"> – Grants – Potential to transition to owner funded once benefits are evident – Loans and grants to provide the infrastructure needed to effect the change 	<ul style="list-style-type: none"> – National and donor governments – development partners – Later also SMEs 	<ul style="list-style-type: none"> – SMEs – Ship owners with fiscal incentives
Biofuels (blended)	0.0	2.8	<ul style="list-style-type: none"> – Production and fuel subsidies – Accelerator programs for CAPEX investments 	<ul style="list-style-type: none"> – National and donor governments – Development partners – Philanthropic funding – Later also SMEs 	<ul style="list-style-type: none"> – Governments – Ship owners with fiscal incentives
Biofuel (B100, non-blended)	2.4	0.4	<ul style="list-style-type: none"> – Production and fuel subsidies – Accelerator programs for CAPEX investments – Debt financing or concessional loans for vessel retrofitting and purchase. 	<ul style="list-style-type: none"> – Donor governments – Development partners – Later also commercial banks and national governments 	<ul style="list-style-type: none"> – Governments – Ship owners with fiscal incentives
Electrification	102.7	5.4	<ul style="list-style-type: none"> – Commercial asset impact schemes – Credit guarantee schemes 	<ul style="list-style-type: none"> – Donor governments – Development partners – Philanthropic funds 	<ul style="list-style-type: none"> – Governments – SMEs – Infrastructure owners

GHG abatement measure	Regional funding need, 2023–2032 (Present value USD million):		Recommended funding instruments	Potential funding actors	Potential implementing entities
	CAPEX	OPEX			
				– Later also commercial banks	– Ship owners with fiscal incentives
Green e-fuels	69.5	2.3	<ul style="list-style-type: none"> – Development partners grants and technical assistance for trials – Possible commercial funding for fuel production as production costs decline – Concessional capital and guarantees to encourage private sector involvement 	<ul style="list-style-type: none"> – Donor governments – Philanthropic funds – Later also commercial banks, national governments, and development partners 	<ul style="list-style-type: none"> – Governments – SMEs – Infrastructure owners – Ship owners with fiscal incentives

Source: The information on CAPEX and OPEX for the abatement measures is based on the Zero-Carbon Transition Plan (working title).

Recommendations

Several action areas have been identified to enable the effective implementation and financing of the Zero-Carbon Transition Plan. These include continued policy advocacy, focused discussions with funding partners, a detailed review of the infrastructure requirements, and specifying the technical requirements for vessels (particularly donor vessels) and retrofit technologies, summarized as follows:

- **Discussions with funding partners:** A coordinated approach to communicating with funders to capitalize on available funding and ensure that funding is pooled and targeted at achieving PBSP climate targets.
- **Vessel procurement:** Develop standardized specifications for vessel procurement to ensure that minimum standards are met that support the achievement of the PBSP climate targets as well as coordinated vessel deployment and disposal across all PBSP member countries.
- **Vessel maintenance scheduling:** Schedule maintenance across all PBSP member countries' fleets to promote efficient use of infrastructure and consider centralizing maintenance hubs.
- **Performance monitoring assessment:** The PBSP will need to promote transparency, data availability, and knowledge sharing to continue the active collaboration between governments, multilateral development banks, development finance institutions and the private sector. To track funding impact, key performance indicators need to be integrated into funding agreements and projects will need to allocate sufficient resources for monitoring and evaluation.
- **Policy advocacy:** National policies need to be aligned with the long-term enablers of maritime transport featuring prominently in national transport, environment, and climate policies. This may include appropriate legislative changes to implement the necessary financial and fiscal incentives that foster the achievement of the PBSP's GHG emissions reduction targets.

Additional areas for further work have been identified to support the zero-carbon transition of the maritime transport sector in PBSP member countries in the long term:

- **Carbon revenues:** PBSP countries should continue supporting the implementation of revenue-raising market-based measures to reduce GHG emissions from international shipping. The scale of potential carbon revenues would be a true game changer for financing the PBSP's transition towards zero-carbon shipping. Yet, since it remains unclear whether IMO member states will adopt such a revenue-raising market-based measure or how potential carbon revenues would eventually be used, alternative funding opportunities discussed in this report need to be pursued in parallel.

- **Alignment with national plans:** National governments in PBSP countries have made sustainable maritime transport a priority. There should now be a focus on capturing maritime-related targets within PBSP member countries' Nationally Determined Contributions (NDCs) and strategic plans to ensure an economy-wide approach is taken.
- **Extended role of commercial finance:** The initial funding is designed to focus on early-stage proof of concept and trials. This will identify any potentially bankable projects, whilst financing the market formation and an enabling environment to promote sector innovation and growth. For long-term success, it is critical that the measures are locally led. There should be a focus on encouraging investment by local institutional investors and financial institutions over the long term. The financial components ideally need a mix of concessional and commercial funding at different stages of the project. Quantified studies of the costs and returns over time will be required to understand revenue streams and the long-term evolution of any commercial investment.
- **Facilitation of involvement of small and medium-sized enterprises (SMEs):** SMEs could play a critical role in achieving the technical transition pathway whilst enabling PBSP member countries' economies to prosper. Fewer commercial finance options exist for SMEs but participation in commercial operations is likely to increase in the longer term as opportunities spin-off from the maritime sector transition. There should be a focus on understanding how green or blue funding strategies are being adopted in other sectors and how these can be used to promote SME involvement in the PBSP.
- **Capacity development:** For maritime transport to deliver investable opportunities, it will require market formation, capacity development and training, and the development of supporting infrastructure as well as specific capacity development in the operation and maintenance of the new vessel propulsion systems.

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1 Introduction

GHD has been engaged by the University of New South Wales (UNSW), as part of UNSW's work for the World Bank on the Pacific Blue Shipping Partnership (PBSP), to provide advice on two components of UNSW's service to the World Bank:

1. Technical Solutions and Decarbonization Pathways for domestic and regional shipping to transition from a current baseline to a 40% reduction in CO₂ emissions by 2030 and zero CO₂ emissions by 2050.
2. A Blended Finance Roadmap, which outlines, at a high-level, the scale, scope and needs of financing the proposed Decarbonization Pathways for the PBSP.

This Report covers the **Blended Finance Roadmap** work component and is the **Final** version issued by GHD on 31 October 2022. This report should be read in conjunction with GHD Advisory's Technical Solutions and Decarbonization Pathways Report.

GHD has been instructed by the World Bank to use a specific revised dataset (spreadsheet dated 17 October 2022). As per this baseline, the six PBSP island countries covered in this Report are **Fiji, Kiribati, Marshall Islands, Solomon Islands, Tonga, and Tuvalu**. As inventory baseline data for other PBSP nations are currently unavailable, country-specific decarbonization transition pathways for **Samoa** and **Vanuatu** are not provided. Discussions around the work have been presented at three online PBSP Open Forums (25 May 2022, 22 June 2022 and 29 July 2022).

1.1 Scope and limitations

This report: has been prepared by GHD for University of New South Wales and may only be used by University of New South Wales for the purpose agreed between GHD and University of New South Wales.

GHD otherwise disclaims responsibility to any person other than University of New South Wales arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described in this report. GHD disclaims liability arising from any of the assumptions being incorrect.

The Scope of the proposed Decarbonization is primarily the domestically operating maritime fleets (including small/artisanal craft with 2-stroke outboard engines), but also includes those vessels and maritime trades between the six PBSP island countries (i.e., Inter PBSP island country maritime trade). For national accounting consistency, and the avoidance of double counting, the importing PBSP island country involved in the Inter PSBP island country maritime trade has been allocated the resulting CO₂ emissions in the Baseline determinations.

The identification of the various current domestic maritime fleets, their likely CO₂ emissions, and the inter PBSP island country trades have been researched and estimated by University College London (engaged by UNSW). This Baseline work was then integrated into GHD's Technical Decarbonization Pathways modelling.

The Report (this Report) has been prepared for UNSW for the purpose of facilitating discussion of the PBSP and to provide focus on matters that may require further investigation or consideration.

GHD has not been involved in the preparation of the associated UNSW reports for the Task A (Baseline Assessment) and Task D (Advisory and Capacity Support for Multi-Country NDC Enhancement and Governance) and has had no contribution to, or review of the associated reports other than in this report. GHD shall not be liable to any person for any error in, omission from, or false or misleading statement in, any other part of the Governance of the PBSP report.

GHD has prepared the preliminary CAPEX and OPEX estimates set out in this report (“Cost Estimate”) using information reasonably available to the GHD employee(s) who prepared this report; and based on assumptions and judgments made by GHD.

The Cost Estimate has been prepared for the purpose of this project and must not be used for any other purpose.

The Cost Estimate is a preliminary estimate only. Actual prices, costs and other variables may be different to those used to prepare the Cost Estimate and may change. Unless as otherwise specified in this report, no detailed quotation has been obtained for actions identified in this report. GHD does not represent, warrant or guarantee that the zero carbon emissions pathways can or will be undertaken at a cost which is the same or less than the Cost Estimate.

Where estimates of potential costs are provided with an indicated level of confidence, notwithstanding the conservatism of the level of confidence selected as the planning level, there remains a chance that the cost will be greater than the planning estimate, and any funding would not be adequate. The confidence level considered to be most appropriate for planning purposes will vary depending on the conservatism of the user and the nature of the project. The user should therefore select appropriate confidence levels to suit their particular risk profile.

GHD has prepared this report on the basis of information provided by *University of New South Wales* and others who provided information to GHD (including Government authorities)], which GHD has not independently verified or checked beyond the agreed scope of work. GHD does not accept liability in connection with such unverified information, including errors and omissions in the report which were caused by errors or omissions in that information.

Informed by consultation with Pacific Blue Shipping Partnership Member Countries and given ongoing high-level discussions between countries and the Asian Development Bank (ADB), ADB officials were not consulted directly for the purposes of developing this report. Types / categories of instruments available from ADB and other multilateral development banks are however considered a core component of the analysis, based on publicly available information and feedback from the PBSP Secretariat.

1.2 General assumptions

GHD has based our analysis on the following countries: Fiji, Solomon Islands, Kiribati, Republic of Marshall Islands, Tuvalu, and Tonga. These are the countries which had baseline data provided by University College London.

GHD has based our analysis on current “commercially available” and/or “in proof of concept” technologies. GHD cannot predict developments in alternative technologies and energy supplies that can and will occur in the future.

A zero-carbon emissions pathway has been assumed without the use of carbon offsets. The use of carbon offsets may be used to help fund individual carbon abatement measures.

Extent of the study – GHD’s analyses are focused on the known domestic vessel fleets of the PBSP countries along with immediately associated maritime infrastructure. GHD is only providing a short review (screening), based on publicly available information, of the energy resource or the upstream components that will be required to be in place for the transition pathways at the country-level. This

short review allows for input into a rapid assessment of the appropriateness of the identified abatement measures for the PBSP.

Consultation with stakeholders has been undertaken in the time available to complete the study. Direct consultation with partner countries has been through two open forum meetings completed over the course of this study.

Assessment of vessel revenue and financial modelling is not within the scope of this engagement.

1.3 Emissions reductions assumptions

The emissions reductions model is based on the maritime fleet in the inventory data, including vessel count, type, size, operation type, fuel type, engine power, fuel consumption, and total annual greenhouse gas emissions. Where data is incomplete or missing, assumptions have been made based on similar vessels within the inventory. In some cases, information on government vessels have been updated based on government ship listing websites.

This model is based on the carbon dioxide equivalent (CO_{2e}) emissions of the inventory. Percentage reductions in CO_{2e} emissions are applied per applicable vessel. Some abatement measures will be more effective in reducing emissions for some vessel types than others based on a range of factors, including how the vessels are currently maintained, operated, and designed. Therefore, this model takes a simplified averaging approach of emissions abatement across the applicable vessels.

Each abatement initiative has a start and end year (unless the initiative is considered ongoing past 2050). Abatement initiative start and end years are based on GHD's understanding of the requirements to action these abatement measures and the readiness for roll-out. Each initiative is also coordinated with the timing of other abatement measures to meet the short-term or long-term targets, with consideration of the compatibility of each initiative.

For this assessment, abatement measures are modelled to phase-in and phase-out linearly over the nominated respective periods and does not consider potential acceleration of roll-out that may occur. Where it is expected that an initiative is unlikely to reach all applicable vessels, the total reduction in emissions is reduced by a factor based on GHD's understanding which is informed by stakeholder feedback.

A number of abatement measures assumes 100% coverage across the applicable vessels. This is based on the underlying target for the PBSP fleet to achieve zero emissions by 2050. This means that each vessel (including small craft) has a target of zero emissions by 2050.

Actual wind resource energy used across the countries will inevitably be different to those used as a basis to estimate the efficiency gains for wind-assisted ship propulsion (WASP) technology. The effectiveness of this technology varies based on a range of variables including, local available wind resource; vessel type, specific WASP technology, and vessel loading. Accordingly, the outputs of the model cannot be relied upon to represent actual conditions without due considerations of the inherent inaccuracies.

For battery charging requirements of electrified vessels, battery capacity is presented in terms of kilowatt-hours (kWh), with cost estimates made based on this. Energy generation, including renewable energy supply such as solar irradiance (for photovoltaic energy supply), wind, wave, and hydro resource energy, has only been shortly reviewed at a high-level in terms of its general availability at a PBSP country level and consequential impact on the applicability of a particular identified abatement measure.

It is acknowledged that area requirements for energy generation, including biofuel feedstock production represents a significant challenge for the PBSP nations and are reflected in the applicability of the respective abatement initiative in the model and discussed for each abatement initiative.

Specific assumptions made for each abatement initiative is discussed in more detail in Appendix C of the Technical report – Model Assumptions.

1.4 Cost model assumptions

CAPEX and OPEX estimates (Cost Estimate), are based on the inventory parameters indicated in this report, using information reasonably available to the GHD employee(s) who prepared the Report; and based on assumptions and judgments made by GHD and documented in the Report.

The Cost Estimate is a strategic level Class 5 Order of Magnitude estimate as defined in the International, Cost Estimate Classification System of the American Association of Cost Engineers with an expected accuracy range of -20% to -50% (Low) and +30% to +100% (High). It is intended for the purpose of screening of abatement options and the identification of potential sources of funding as part of the Blended Finance Roadmap. These costs are not suitable for budgetary purposes.

All cost related information is presented in USD (per 2022) based on information from a range of sources and countries as best applicable to the PBSP nations. No allowance for price escalation, inflation, or price reduction due to technological and market maturity has been made. Present Values (PVs) are discounted at an annual rate of 7%³ to an assumed PBSP abatement projects start year of 2023.

The Cost Estimate is high-level and informs the blended finance modelling but is not suitable for budgeting purposes. The sources of the costing information are specified in Appendix B but are obtained from a mix of publicly available information (studies, PBSP government agencies, international agencies) and GHD industry-knowledge acquired through industry consultations and the use of a GHD subscription to a third-party (Clarkson's SIN) maritime database.

The Cost Estimate is a preliminary estimate only. Actual prices, costs and other variables may be different to those used to prepare the Cost Estimate and may change. Unless as otherwise specified in the Report, no detailed quotation has been obtained.

1.5 Qualifications

The Report was prepared subject to your acknowledgement that GHD is not qualified and/or accredited to give advice in relation to legal issues, contractual issues, accounting issues, currency issues, human resources, industrial relations, native title, land tenure, climate change, or taxation issues or to make financial forecasts that would require any of these areas of expertise.

1.6 Material received after the date of the Report

The opinions, conclusions and any recommendations in the Report are based on conditions encountered and information reviewed at the date of preparation of the Report.

UNSW acknowledge that GHD has not, and GHD accepts no obligation to, update the Report for events subsequent to the date that the Report was signed.

1.7 GHD's quality systems

This engagement has been conducted under GHD's Quality Management System, which has been certified by Lloyds as complying with AS/NZS ISO 9001.

GHD's quality system procedures are applied to all GHD projects and include a requirement to prepare quality plans to verify compliance with the technical and commercial requirements of the project.

A key component of the GHD's quality system is the requirement to have each report independently reviewed by experienced personnel in that area before it is delivered to UNSW.

³ See Technical Pathway report for further details.

2 The development of blended finance roadmaps

2.1 Application of blended finance principles to the PBSP

Blended Finance is a relatively new and innovative concept designed to mobilize commercial finance to enable sustainable developments in developing countries. Projects that attract blended finance typically contribute to clearly defined SDGs and utilize catalytic concessional capital from philanthropic or public sources through instruments that accept a lower than market return and/or absorb a higher level of risk. This catalytic funding is designed to increase private sector investment over the longer term. Consequently, blended finance transactions **MUST** have a revenue line and some form of commercial sustainability. This can be a particular challenge in developing countries.

The Organisation for Economic Co-operation and Development (OECD) set out five broad principles for the development of blended finance initiatives. The application of these principles to the PBSP is discussed as follows. This illustrates that the PBSP has good alignment with Principle 1 and Principle 3. There is potential for the PBSP to align with Principles 4 and 5 if appropriate measures are integrated into the development and deployment of the PBSP. The small scale of the sector is likely to compromise the alignment with Principle 2 (Design Blended Finance to increase the mobilization of commercial finance). This presents the most significant barrier to securing significant commercial investment in the PBSP.

In practice, public funding and concessional capital will be the main source of financing the decarbonization of the Pacific shipping sector in the immediate and near term because:

- maritime transport in the Pacific is already subsidized in many economies to ensure vessels service the routes that are not economical;
- although the Technical Transition Pathway indicates savings in operating costs, the scale of the sector is such that the commercial sustainability of these projects will be limited and subject to external factors, which will determine if commercial financing can be accessed;
- the nascent stage of this sector requires market development before any pipeline investment can be developed;
- the fast-evolving technology in this space presents a risk of short investment lives, adversely impacting the return on investments from those projects.

The blended commercial investment in PBSP is therefore more likely to come from smaller scale domestic investors. In demonstration of this Project Cerulean aims to develop a new class of low-carbon, low-cost sail-assisted inter-island cargo vessel⁴. In November 2018, The University of the South Pacific (USP) in Fiji and Republic of Marshall Islands and Swire Shipping signed a Memorandum of Understanding (MOU) to conduct feasibility studies for the design and costs, building of a pilot vessel, and then operation of the pilot vessel for up to two years to prove its viability. Working with the private sector can therefore raise economic capacity in the South Pacific.

A more detailed discussion on actions needed for success is presented in the key actions for implementation discussion in Section 9.

Principle 1 Anchor Blended Finance use to a development rationale

Alignment with PBSP

The PBSP has set clear temporal goals for the reduction of carbon emissions from the maritime sector. These goals can be integrated into the funding initiatives.



⁴ <https://www.swireshipping.com/information/info-pages/sustainability/project-cerulean/>

The technical assessment has indicated the scale of the impact that the proposed measures should have on carbon emissions with clearly defined results for each proposed abatement measure. These clear goals need to be embedded within the finance agreements and funders selected that align with these SDGs and broader operating principles.

Mostly aligned

Built into the proposed measures is the need for adopting the latest technologies and defining minimum requirements for donor vessels for example, to progressively improve the baseline of the infrastructure that supporting the transition to zero carbon.

Principle 2 Design Blended Finance to increase the mobilization of commercial finance

Implementation of the PBSP will require significant capital investment. This includes investment in vessels and the infrastructure needed for vessel maintenance and the production and distribution of energy (fuel).



Not aligned

In the wake of the COVID pandemic spending in countries has fallen short of that required to achieve the development goals pre-pandemic⁵. The pandemic has also tightened fiscal budgets of the national governments in the Pacific, most of them with already high levels of national debt, further constraining their ability to provide solutions to the rising development issues.

The relatively small scale of the Pacific maritime sector means that commercial returns are likely to be low (or non-existent), particularly in the initial stages of deployment of abatement measures. Commercial sustainability is likely to be poor, making it challenging to attract investment.

Principle 3 Tailor blended finance to the local context

The abatement measures are targeting technologies and techniques that can be deployed locally and will develop local capability.



Mostly aligned

The proposed operational measures and the improvement in efficiencies of existing propulsion systems (e.g., engine derating or retrofitting of alternative propulsion systems) will all promote the development of in-country capability.

The focus of the finance map is to utilize in-country sources where possible or increase investment from in-country institutional investors so that domestic capital flows into the maritime sector in the longer term where opportunities present themselves. This could also support the development of local financial markets and reduce currency risk for local economies.

Principle 4 Focus on effective partnering for blended finance

To be effective, both development and finance objectives need to be achieved. This requires careful allocation of risk between parties.



Potential for alignment

This means selecting funding partners with clear mandates, objectives and risk/reward profiles that align with the likely outcomes of the PBSP. This includes assessment of country specific risks because political and credit risks will differ between countries.

Given the level of risk and expected low (or nil) returns in the early stages, particularly during trials and proof of concept work, participation of private funding is unlikely. These initiatives are likely to be grant funded.

⁵ OECD (2020), "The impact of the coronavirus (COVID-19) crisis on development finance", OECD Policy Responses to Coronavirus (COVID19),

The objective would be to inject sufficient funding to enable the creation of a pipeline of projects so that over time, commercial partners could be attracted to specific initiatives. This may include vessel and engine maintenance, charging infrastructure, fuel distribution etc. In practice the small scale of the maritime sector in the Pacific is such that even over the long term, non-commercial investment partners are likely to dominate.

Principle 5 Monitor blended finance for transparency of results

The performance of initiatives needs to be regularly reviewed to make sure that development and commercial goals are being achieved.



Potential for alignment

The clearly defined goals (Principle 1) will need to be integrated into the developments and funding instruments, and performance against these goals tracked.

Financing and monitoring regimes need to be designed to promote collaboration and may include reporting by individuals on their actions to secure concessional funding (e.g., evidence of implementing an engine upgrade or switch). These monitoring requirements should be consistent across countries.

The sharing of data and knowledge between PBSP governments, multilateral development banks and development finance institutions will be essential. Public transparency is also critical to the perceived success of any finance initiative.

This commitment to ongoing monitoring is likely to be challenging and costly to implement in practice and may have contributed to the low level of commercial investment in the sector to date.

This will require allocation of resources and costs to monitoring, which can be in the order of 5% of the budget.⁶

⁶ Blended Finance Guidance, The OECD Development Assistance Committee, 2021, p38.

2.2 Approach to finance mapping

Figure 2 shows our approach to developing country specific Finance Roadmaps in accordance with the above principles.

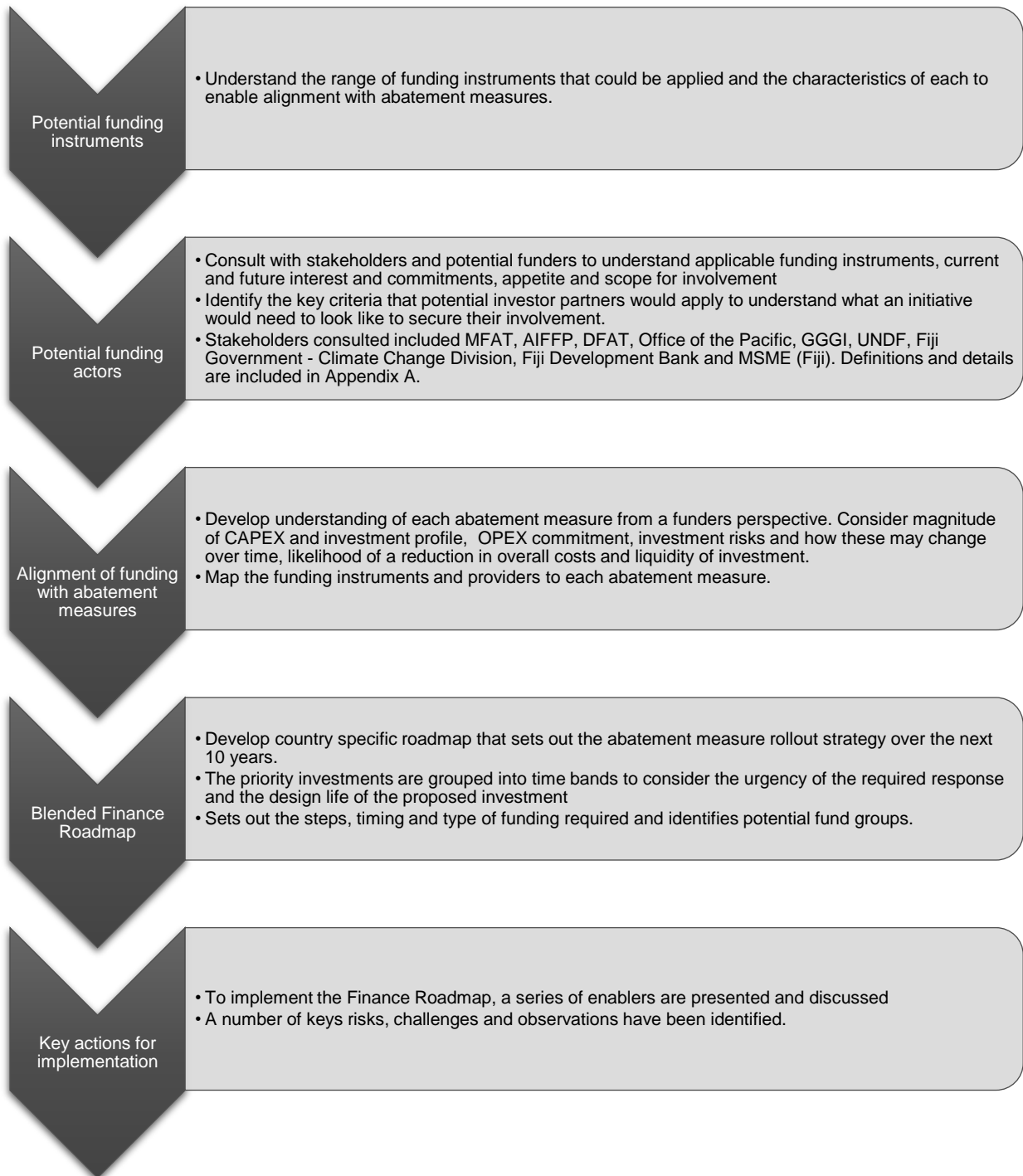


Figure 2: Blended Finance mapping process

3 Potential funding instruments and actors

Building a finance roadmap requires alignment of the timing, commercial risk and liquidity characteristics of the abatement measures with the funding instruments. Table 3 summarizes the funding instruments, the typical actors and the typical investment characteristics.

Each of these funding instrument clusters are discussed in more detail in the following sections through discussion of the:

- Typical application: where this type of instrument is typically used
- PSBP application: how this instrument could be applied to the PBSP
- Current initiatives: a review of current levels of funding that this instrument provides
- Potential Actors: the type of entity that may utilize this funding instrument for the PBSP

Table 3: Categories of partners / funders and their investment characteristics

Financial Instruments provided	Type of Funder	Examples	Objective	Role in Finance	Horizon	Return Expectations	Liquidity requirement	Asset Allocation
Grants, loans, equity, insurance, guarantees	National government	National Governments of partner countries	High development impact	Facilitator, technical assistance to make project bankable, concessional funds	Suited to project financing needs	Low	Low	Mixed
Grants, loans, equity	Donor Government program	Australian Department of Foreign Affairs and Trade (DFAT) funded programs, New Zealand Ministry of Foreign Affairs and Trade (MFAT) funded programs	High development impact, financial sustainability Concessional returns	Project developer, investor in blended finance solutions through wholesale investing, regional or bilateral programs	Suited to project financing needs	Low	Low	Growth
Loans, Equity, Guarantees, Grants	Development Partners	World Bank, Asian Development Bank, Green Climate Fund, Global Green Growth Institute, Global Fund for Coral Reefs	High development impact, Financial sustainability Concessional or commercial returns	Facilitator, technical assistance to make project bankable, concessional funds	Suited to project financing needs	Low-mid (dependent on context)	Low	Mixed
Grants, loans, equity	Philanthropic Funds	Leonardo DiCaprio Foundation Althelia Sustainable Oceans Fund Okeanos Foundation	High development impact, financial sustainability, concessional or commercial returns	Providing high risk capital in development finance	Suited to project financing needs	Low - mid	Low	Mixed
Loans, equity, guarantees, grants	National and development banks	Fiji Development Bank	High development impact financial viability Concessional returns	Investor/ guarantor/ provider of local currency finance/manager of concessional lending	Short- medium	Low - mid	High	Income
Loans	Commercial banks	Bank of the South Pacific	Financial viability, Commercial returns	Lender	Short- medium	Low - mid	High	Income
Loans, equity	Institutional investors	Solomon Islands National Provident Fund	Commercial returns	Investor	Long	Mid - high	Low	Growth with some income
Loans, equity, guarantees, grants	Retail Investors	Private impact-conscious Investors/diaspora communities	Impact and commercial returns	Invest through thematic bonds (green/blue)	Medium to long-term	Mid - high	High	Income and growth

3.1 Cluster 1 – Grants and technical assistance

Typical application Used where there is no expected commercial return. Often applied to catalyze other forms of capital over time.

These instruments tend to be common at market research and market formation stages, as well as for pilot or proof of concept programs or capacity building initiatives.

PBSP Application It is crucial that grants and technical assistance fund vital capacity building and policy reform alongside the development of the right enabling conditions for the Technical Transition Pathway.

Technical assistance support will be required for:

- Review of national policies and regulations to align them with the decarbonization strategies through various ministerial portfolios
- Staff capacity building to drive implementation
- Private sector and other stakeholder training on new technology rollouts
- Monitoring and reporting of results

Grants will play a critical role in the deployment of the PBSP technical pathways and will be almost the sole funding instrument in the immediate and near term (next 10 years).

Grant funding is likely to be required for:

- Proof of concept and pilot testing for technology where the unique circumstances of the Pacific will stop global research and technology being directly adopted.
- Pilot-testing for technology relating to WASP and electrification transition to shape the roll out of particular technologies

Any grant or technical assistance in the maritime sector will require a stringent due diligence process as well as ongoing monitoring and evaluation to ensure the development targets are met.

Current initiatives The Pacific region has seen an aid commitment of \$3.88 billion in 2019 with \$2.44 billion being spent during the year. Australia, New Zealand, Japan, and US governments along with development agencies such as European Bank and World Bank have ranked in the top grantors for the region over the last 5 years⁷.

ADB has mobilized \$602.8 million in sovereign co-financing and \$8.6 million for technical assistance over the 2016-2020 period⁸. Its commitment for 2021 to the six countries under review totals to \$228.8 million⁹.

World Bank through its Country Partnership Framework with various countries in the Pacific has also stated an indicative lending program for these countries over 2021-2024 through the International Development Association and the International Bank for Reconstruction and Development of FJD \$1B (\$452million USD)¹⁰.

⁷ <https://pacificaidmap.lowyinstitute.org/>

⁸ <https://www.adb.org/sites/default/files/institutional-document/712796/pacific-approach-2021-2025.pdf>

⁹ ADB Fact Sheets

¹⁰ <https://www.worldbank.org/en/country/pacificislands/brief/world-bank-groups-new-country-partnership-framework-for-fiji-2021-2024>

Apart from allocation to carbon reduction programs and clean energy, these commitments do not include any clear maritime shipping focus.

Organizations such as the Secretariat of the Pacific Regional Environmental Programme and the Pacific Community have also been very active in developing prototypes, pilot testing and providing feasibility support in the green and blue economy projects. The Global Green Growth Institute (GGGI) also provides assistance at government level to incorporate green strategies into the country's national development plans and financing while also helping them to access financing from larger global partners such as Global Climate Fund (GCF).

- Potential actors**
- National governments
 - Donor governments
 - Development partners
 - Philanthropic funds

3.2 Cluster 2 – First loss, guarantees

Typical application The instruments are not sources of funding but make investments more attractive by mitigating transaction risks. This eases the access to capital and mitigates the risks of low early stage returns which enable institutional investor involvement.

They are more suitable for transactions that have reached the later stage investment and for larger assets. For first loss and guarantees to become effective it is crucial that the provider and recipient believe in the commercial viability of the business or project.

PBSP Application These could be used as performance or loan guarantees to cover technical risk of the performance of services.

They could be used to mitigate off-taker risk in the deployment of a fleet of new vessels, if they were centrally owned and chartered, or for vessel maintenance contracts. First loss capital or guarantees will be critical in the longer term for the maritime shipping sector as opportunities start to become commercially viable with institutional investors starting to consider them for their portfolios.

Current initiatives Current initiatives in the maritime sector do not present opportunities yet.

Guarantee schemes are used as credit enhancement mechanisms to improve access to capital for SMEs and other specific sectors across the region. Solomon Islands and Fiji have government-backed guarantee schemes that enable banks to lend to SMEs that traditionally would not be considered (due to insufficient collateral or equity threshold). This access to finance shows that government guarantees part of the loan and therefore shares part of the default risk with the banks.

- Potential actors**
- National Governments
 - Donor Governments
 - Development partners
 - Philanthropic funds

3.3 Cluster 3 – Outcome funding, impact linked finance, impact bonds

Typical application These instruments tend to drive results-based financing by linking the creation of impact or change to the financial rewards.

PBSP Application This type of funding is limited to transactions where the impact can be clearly specified.

This could be the financing of vessels or facilities that have clear emissions reduction targets. The targets can be aligned with the term of the investment which enables direct monitoring of performance over the life of the investment.

As the shipping sector seeks to decarbonize, there will be a need to design explicit technical criteria for ship owners and operators to meet before they can access any such impact-linked financial instruments.

Current initiatives The United Nations Environment Programme Financial Initiative, the International Capital Markets Association, the International Finance Corporation, ADB and United Nations Global Compact are partnering to develop a global guidance for bonds to finance the sustainable blue economy.¹¹

The Climate Bonds Shipping Initiative is a scheme to ensure that certified bonds and loans are consistent with the two degrees Celsius limit in the Paris Agreement. It forms part of the Climate Bonds Standard and provides a set of decision rules for determining if shipping projects and assets are compatible with a low carbon, climate resilient economy, and are therefore eligible for certification under the Climate Bonds Standard. It also imposes reporting requirements on issuers or borrowers to confirm compliance.¹²

The Fijian Government, with technical support from the United Nations Development Programme (UNDP) and the UK Government, will be issuing Fiji's first sovereign blue bond in its 2022-2023 financial year. The issuance will focus on raising capital market finance to support projects in four priority sectors, including blue shipping. Technical assistance may be required to roll out similar bond issues in other jurisdictions.

Given the lack of properly developed capital markets in the Pacific, these instruments are likely to be managed through the governments' treasury managed platform. An example of this would be that the National Provident Fund in Fiji being has over USD 5 billion in assets, compared with the Pacific Stock Exchange market cap of less than USD 2 billion¹³.

Potential actors

- National governments
- Donor Government programs
- Development partners
- Philanthropic funds
- National and development banks
- Retail investors (who are willing to sacrifice financial return for impact)

¹¹ <https://www.unepfi.org/news/themes/ecosystems/global-guidance-for-bonds-to-finance-a-sustainable-blue-economy/>

¹² [Shipping | Climate Bonds Initiative \(https://www.climatebonds.net/standard/shipping\)](https://www.climatebonds.net/standard/shipping)

¹³ <https://documents1.worldbank.org/curated/en/312101562602785621/pdf/Practical-Guide-on-the-Potential-of-Capital-Markets-Development-in-Small-Economies.pdf>

3.4 Cluster 4 – Concessional financing and subordinated debt

Typical application These would include instruments such as subordinated capital and concessional capital in the form of debt or equity but where returns of less than market rates are expected.

Specific applications depend on the scale of the concession and alignment of risk between funder and initiative.

PBSP Application This will be best suited to initiating the deployment of measures that have a clear impact, but lower than market returns. It is well suited to the early movers who have more technical knowledge and insight on how the maritime shipping market will develop.

Concessional financing options are likely to encourage private actors to participate in or transition to sustainable options where the initial CAPEX required is large, but where there are long term operating cost reductions. This may include upgrading, repairs and maintenance of vessels, the deployment of WASP technologies or electrification infrastructure operating of charging stations for example.

These instruments will need to work with the grants and technical assistance to ensure the dynamic shift to prepare the sector for private funding in the future.

Current initiatives State-owned development banks are looking at increasing their roles in financing the green and blue economies. Fiji Development Bank is one of the first to be granted the direct access entity status with GCF to directly channel funds for related projects.

Concessional finance through junior equity has been adopted by GCF recently to help set up a blended finance platform in India to facilitate the financing and leasing of electric vehicles.¹⁴

Potential actors

- National Governments
- Donor Governments
- Development partners

3.5 Cluster 5 – Market rate debt and equity

Typical application These are mainstream finances where investors are looking for market returns and are agnostic to impact. This means to secure this capital, projects will be competing for funding with other projects, which may have different (potentially more attractive) risk and reward programs.

The funders will consider bankable or investment ready projects and adjust their return expectation in line with the risks associated with the projects.

PBSP Application Maritime shipping in the Pacific presents some significant commercial barriers to mainstream finance participation. There are likely to be perceived credit risk, currency risk, country risk, capital exposure and risk of return given the level of subsidies that already exist in the shipping sector.

Realistically, any form of commercial financing in the maritime shipping sector in the Pacific is likely to flow into projects that either already present a commercial sustainability, or where other instruments have already funded the proof of concept

¹⁴ <https://www.macquarie.com/au/en/impact/case-studies/financing-indias-e-mobility-transition.html>

and financed the research and development, pilot testing and market development supporting the business concept.

This is most likely suited to short term initiatives where there is a revenue stream. This could be the construction and operation of vessel maintenance facilities or the roll-out of alternative fueled outboards or potentially the supply of alternative fuels, but it may need to be partnered with some form of guarantee (see section 3.2).

Early movers and other instruments may also be able to encourage commercial financing through offtake agreements, particularly if supported by incentives and policy reforms that encourage tax savings or other benefits.

In practice, we anticipate the role of this instrument directly in the deployment of PBSP abatement measures to be very limited, and only potentially in the later stages of deployment.

Current initiatives While there are no examples of market rate debt and equity in the maritime sector, examples of market return expectations from other sectors such as clean energy, which are more developed, should be noted.

For example, Sunergise Group in New Zealand is a leading solar power services company in the Pacific Island region. It was started by entrepreneurs and veteran investors. The International Finance Corporation took a stake into the business in 2014 and this was followed by private investor Todd Incorporation taking a major stake in the group by 2019 ¹⁵.

Potential actors

- National and development banks
- Institutional investors
- Retail investors

3.6 Cluster 6 – Revenue-raising market-based measures and carbon credits

Typical application Carbon pricing can help funding GHG emissions reductions in two main ways. A first option is through the implementation of revenue-raising market-based measures. The second, is through carbon credits. These two options are further discussed below.

The primary aim of market-based measures is to put a price on GHG emissions and thereby incentivize GHG abatements. Besides incentivizing GHG mitigation, some types of market-based measures can also raise revenues. Two market-based measures that can raise revenues are carbon levies and some types of cap-and-trade.

Carbon levies are charges that target the carbon content of fossil fuels or the GHG emitted in producing and consuming these fuels. These levies are therefore different — and more cost-effective in inducing GHG abatements — from levies on fossil fuels which merely increase the cost of fossil fuels without targeting GHG emissions or carbon content.¹⁶

Under cap-and-trade, regulators establish a cap on GHG emissions and distribute GHG emission allowances among the entities under the mechanism. Regulated entities can exchange emission allowances on the secondary market and are

¹⁵ <https://www.sunergisegroup.com/studio-info>

¹⁶ Dominioni, Goran. Pricing carbon effectively: a pathway for higher climate change ambition. *Climate Policy* (2022): 1-9.

requested to surrender these allowances for the GHG emissions released during each compliance period, which is often one year. Emission allowances can be distributed to regulated entities for free or sold — at a fixed price or, most often, via an auction. When emission allowances are sold, they generate revenues.¹⁷

Besides regulatory forms of market-based measures, carbon credits can also help in generating funding for reducing GHG emissions. Carbon credits are voluntary certified GHG emissions reductions (or removals) achieved in a sector which can be sold to third parties. Third parties may be interested in buying these certified GHG emissions reductions to use them for compliance with domestic or regional regulations or to meet internal targets (e.g., a net-zero pledge).

PBSP Application If a revenue-raising market-based measure is implemented to decarbonize international maritime transport, a share of the revenues could be used to finance GHG emissions reductions from the maritime shipping sector in the Pacific.

Research indicates that pricing GHG emissions from international shipping could raise significant carbon revenues. Implementing a carbon price compatible with meeting the minimum GHG mitigation targets of the Initial IMO GHG Strategy could raise between \$1.3 trillion and \$2.6 trillion in total.¹⁸ Carbon revenues would be lower, but still significant, under a carbon price that fully decarbonizes the sector by 2050: between \$1 trillion and \$2 trillion.¹⁹ Another study finds that implementing a carbon levy of \$250/ton of GHG raises \$3.7 trillion by 2050.²⁰ Depending on analytical assumptions made, implementing carbon revenues from shipping could raise on average between \$40 and \$60 billion annually until 2050.²¹

Using a small share of carbon revenues from shipping would be sufficient to meet the financial needs to decarbonize the marine shipping sector in PBSP countries. For instance, imagine that carbon revenues raised are on the lower end of the figures discussed above, i.e., \$40 billion annually. In this context, using 5%, 2% or 0.5% of these revenues to support the decarbonization of international maritime transport in PBSP countries would result in \$2 billion, \$800 million, or \$200 million spent on this cause every year. This is a significantly *larger* amount of funding compared to the financing needs of PBSP countries to decarbonize their maritime transport sector — especially if these revenues are used to catalyse private sector investments.

In practice, the amount of carbon revenues raised will depend on the scope of GHGs covered by the instrument, the level of the carbon price applied, and whether carbon pricing is implemented together with other GHG mitigation policies. Furthermore, the availability of carbon revenues from shipping to support the decarbonization of maritime transport in the Pacific will depend on political decisions by IMO Member States on how carbon revenues will be used.²²

¹⁷ Dominiononi, Goran; Englert, Dominik. 2022. Carbon Revenues From International Shipping: Enabling an Effective and Equitable Energy Transition - Technical Paper. Washington, DC: World Bank.

¹⁸ Baresic, Domagoj, Isabelle Rojon, Alison Shaw, and Nishatabbas Rehmatulla. 2022. Closing the Gap: An Overview of the Policy Options to Close the Competitiveness Gap and Enable an Equitable Zero-Emission Fuel Transition in Shipping. Prepared by UMAS, London.

¹⁹ Baresic, Domagoj, Isabelle Rojon, Alison Shaw, and Nishatabbas Rehmatulla. 2022. Closing the Gap: An Overview of the Policy Options to Close the Competitiveness Gap and Enable an Equitable Zero-Emission Fuel Transition in Shipping. Prepared by UMAS, London.

²⁰ Mærsk Mc-Kinney Møller Center for Zero Carbon Shipping. 2021. Options Paper on Market-Based Measures. Copenhagen: Mærsk Mc-Kinney Møller Center for Zero Carbon Shipping.

²¹ Dominiononi, Goran; Englert, Dominik. 2022. Carbon Revenues From International Shipping: Enabling an Effective and Equitable Energy Transition - Technical Paper. Washington, DC: World Bank.

²² Dominiononi, Goran; Englert, Dominik. 2022. Carbon Revenues From International Shipping: Enabling an Effective and Equitable Energy Transition - Technical Paper. Washington, DC: World Bank.

With regards to carbon credits, as mentioned above, in principle, they could help stimulating GHG emission reductions in the shipping sector of PBSP countries.

Current initiatives The IMO is considering the implementation of a suit of measures to decarbonize international maritime transport. Among the measures that could be finalized and agreed in the mid-term — i.e., between 2023 and 2030, but ideally closer to 2025 — there are also market-based measures.²³

Various submissions to MEPC and ISWG-GHG have proposed to implement a revenue-raising market-based measure in international shipping and recent discussions in these fora suggest that if such a measure is implemented, a share of the carbon revenues could be used to support the decarbonization of the shipping sector, including in the Pacific region.

However, despite ongoing efforts from PBSP countries, the World Bank, and other stakeholders, it is unclear whether a revenue-raising market-based measure will be implemented and how potential carbon revenues would be used. For this reason, alternative funding opportunities as outlined in the report need to be pursued in parallel.

Carbon credits are unlikely to play a major role in financing the decarbonization of the shipping sector in PBSP countries in the short-medium term. On the one hand, while voluntary carbon markets have grown in recent years, they tend to be small.²⁴ At the same time, the international crediting mechanism under the Paris Agreement is not operational yet.²⁵

Potential actors

- IMO
- IMO Member States
- Other IMO stakeholders

²³ Dominioni, Goran; Englert, Dominik. 2022. Carbon Revenues From International Shipping: Enabling an Effective and Equitable Energy Transition - Technical Paper. Washington, DC: World Bank.

²⁴ In November 2021, for the first time the total value of voluntary carbon markets has exceeded \$1 billion, see World Bank. 2022. State and Trends of Carbon Pricing 2022. State and Trends of Carbon Pricing;. Washington, DC: World Bank.

²⁵ On Article 6.4 of the Paris Agreement, see <https://unfccc.int/process-and-meetings/the-paris-agreement/article-64-mechanism>

4 Potential funding actors

4.1 National governments

PBSP application While the Pacific governments make investment commitments in decarbonization, the rising national debt levels may be restricting their ability to provide direct funding. This is likely to be particularly challenging in the near future as these economies emerge from the COVID19 pandemic.

Existing policies may incentivize practices that have negative environmental impacts. These might include tax credits or exemptions in some industry sectors, fuel duty concessions, direct subsidies (particularly for transportation), and inadequate funding for waste management services.

It is beyond the scope of this engagement to undertake a review of fiscal policies, but National governments can set up policy frameworks that support the transition to sustainable shipping by creating incentive policies and by removing disincentives.

Obvious tools include carbon taxes or feebates, where polluters are charged a fee, but then receive a rebate against practices which reduce emissions (it is understood that both the Marshall Islands and the Solomon Islands are advocating for a \$100/tonne tax on ships CO₂ emissions).²⁶ Tools like these can be attractive to governments because they do not require direct granting of funds.

Alternative policy instruments that drive positive environmental impacts are already in place in some of the partner countries such as Fiji²⁷, RMI²⁸ and Kiribati²⁹. Typical instruments include:³⁰

- Taxes or charges linked to resource use (15% VAT in Fiji, super yacht charter taxes ranging from 5-12.5% in the Pacific Island Countries)³¹
- Tax incentives to promote lower emissions fuel choices (tax exemptions and energy subsidies to support cleaner vehicles and replacement of fossil fuel energy)³²
- Direct support for lower emissions fuel alternatives, or reduced import taxes on lower emissions propulsion systems.

This includes targeting and incentivizing clean energy and technology driven efficiencies to create an enabling environment for the private sector to innovate. This means collaborating within the public sector departments and line ministries such as environment, transport, commerce, and finance to align and prioritize strategies and implement them in a coordinated way. This enables the benefits or revenues to be transparently re-invested to help the PBSP countries meet climate mitigation and adaptation needs.

²⁶ Pacific islands propose levy on ships' GHG emissions | Insurance Marine News <https://insurancemarinenews.com/insurance-marine-news/pacific-islands-propose-levy-on-ships-ghg-emissions/>

²⁷ <https://www.fiji.gov.fj/getattachment/15b0ba03-825e-47f7-bf69-094ad33004dd/5-Year-20-Year-NATIONAL-DEVELOPMENT-PLAN.aspx>

²⁸ <https://www.theprif.org/sites/default/files/2020-08/Marshall%20Islands%20National%20Strategic%20Plan%202020%20to%202030.pdf>

²⁹ https://www4.unfccc.int/sites/ndcstaging/PublishedDocuments/Kiribati%20First/INDC_KIRIBATI.pdf

³⁰ Greener taxes and subsidies in PICTs final.pdf (ieep.eu) <https://ieep.eu/uploads/articles/attachments/bd2711c8-b5e5-40ea-b2c4-a2e6b0705db6/Greener%20taxes%20and%20subsidies%20in%20PICTs%20final.pdf?v=63690680677>

³¹ Greener taxes and subsidies in PICTs final.pdf (ieep.eu) <https://ieep.eu/uploads/articles/attachments/bd2711c8-b5e5-40ea-b2c4-a2e6b0705db6/Greener%20taxes%20and%20subsidies%20in%20PICTs%20final.pdf?v=63690680677>

³² Greener taxes and subsidies in PICTs final.pdf (ieep.eu) <https://ieep.eu/uploads/articles/attachments/bd2711c8-b5e5-40ea-b2c4-a2e6b0705db6/Greener%20taxes%20and%20subsidies%20in%20PICTs%20final.pdf?v=63690680677>

Stakeholder Consultation GHD consulted with the Ministry of the Economy and the team members of Climate Change and International Cooperation Division for Fiji. The key observations were:

- There are other incentives that the Fiji government is working on relating to clean energy – examples being electric buses that test engagement of the private sector.
- Discussion of Fiji’s Climate Finance strategy, which laid out Fiji’s main investment priorities from 2022 to 2029, essentially being the ‘blueprint’ for Fijian government and its development partners.
- Analysis of tax incentives, discovering which tax rebates and incentives currently exist for clean energy – however highlighting that there are no specific ones for maritime shipping at this stage

Current initiatives Some governments are already targeting the removal of tariffs and disincentives as well as the creation of tax and other incentives to drive innovation and emissions reductions.

Some national governments are more advanced with proof of concept and allocating funds for mitigation priority projects, such as Fiji’s National Climate Finance Strategy.³³

4.2 Donor governments and development partners

PBSP application Donor governments and development partners are grouped together due to the similarities in the role they play in providing region-wide support to address common issues faced by the island economies.

Donor governments and development partners work through regional, bilateral and domestic arrangements to provide grants and other forms of concessional financing for development. This includes capital injection to their existing development programs.

The institutions that are able to offer grants or concessional loans (e.g., development finance institutions, governments) are likely to be more open to funding higher risk investments.

This is likely to be best suited to early-stage proof of concept, pilot trials and capacity building.

This type of funding is also typically used to underpin infrastructure upgrades, such as improvement to slipways and maintenance facilities which will support the vessel upgrades required to implement the Technical Transition Pathway.

Donor governments also make contributions in the form of gifted vessels. For this to form part of regional fleet renewal under the PBSP, there will need to be a proactive approach to procurement of gifted vessels and second-hand vessels such that any replacement or additional vessels are equipped with emissions reducing capability before they can start operating domestically.

Stakeholder Consultation GHD consulted several development partners including UNDP, Office of the Pacific, Global Green Growth Institute (GGGI), Department of Foreign Affairs and Trade (DFAT), Australian Infrastructure Financing Facility for the Pacific (AIFFP) and New Zealand Ministry of Foreign Affairs and Trade (MFAT).

³³ https://www.economy.gov.fj/images/CCIC/uploads/ClimateFinance/21WRI_FijiClimFinStrategy_Final.pdf

Overall, all stakeholders consulted are focusing on climate adaptation and resilience to future climate change and natural disasters. They are also focused on decarbonization – especially in the renewable energy sector.

While most stakeholders agreed that concessional finance is valuable, they noted that technical assistance tends to be the preferred investment for the maritime sector due to the lack of pilot studies and data available in decarbonization of the maritime sector.

MFAT, DFAT and AIFFP expressed that they are focusing on the maritime and ports industry.

Current initiatives Funding for the maritime sector in the Pacific through donor governments and development partners has been focused on safety and security improvements to date.

They are also heavily intertwined through programs in the Pacific. For example:

- Australian Government Department of Foreign Affairs (DFAT) partly funds Asian Development Bank (ADB) initiatives that are carried out through the Pacific Private Sector Development Initiative, Pacific Region Infrastructure Facility and Australian Climate Finance Partnership and other programs.
- ADB is in the process of accessing Green Climate Fund directly for projects it assesses and finances.
- Given the impact driven nature of the sustainable maritime shipping in the Pacific, there are a few impacts focused programs that are noteworthy:
 - The Emerging Markets Impact Investment Facility is a funder of funds in the Asia-Pacific region for impact investment opportunities.
 - InvestPacific - an impact fund being considered by New Zealand government for impact investments specifically in the Pacific region.
 - Australian Infrastructure Financing Facility for the Pacific (AIFFP), noting its remit is limited to the fixed infrastructure components.
 - Business Partnership Platform - a DFAT funded program that supports inclusive and sustainable businesses through partnership with the Australian Government.

The UNDP's Blue Accelerator Grant Scheme supports promising blue economy projects through tailored technical assistance and micro and small grants ranging from \$50,000 to \$150,000. The Fiji Drua Incubator (a product of the United Nations Framework Convention on Climate Change - 23rd Conference of Parties) works with UNDP to assess and qualify these projects that may receive the grant with the aim to build a pipeline of blue projects for the Fiji Government Blue Bond issue.

In establishing the investors for the Infrastructure Development Fund, it is critical to first assess the role of these existing programs and their applicability to the maritime sector in the region. There is significant scope to enhance support by directly funding sustainable investments, de-risking and crowding in additional sources of funding. This includes through capacity development and credit enhancement for innovative financial products and supporting the integration of sustainability criteria and standards in traditional financial products.

4.3 Philanthropic funds

PBSP application Philanthropic funds play an important role in creating effective enabling conditions and providing early stage and growth financing for the long term. They generally

adopt the attitude, processes and methods of professional investors. They identify and invest in businesses and projects on the path of economic and commercial sustainability but are driven by non-commercial outcomes. These can successfully blend non-profit, venture capital and impact investing into projects, making them ready for the next stage of financing or co-investment.

Philanthropic funds could play a critical role in the early-stage funding required as the region's maritime shipping develops and adopts greener strategies to decarbonize the sector.

Current initiatives Such funds have already been working in the Pacific:

- Altheia Sustainable Oceans Fund: a fund that creates investor value and social impact by providing growth capital to companies that use the oceans natural capital.
- The Fiji Rural Electrification Fund where the seed funding has been provided by Leonardo DiCaprio Foundation.³⁴
- Okeanos Foundation providing sustainable sea transportation in the Pacific.³⁵

4.4 National and development banks

PBSP application Driven by financial sustainability rather than profitability, development banks will play a key role in financing components of the Technical Transition Pathway that other lenders consider to be an unacceptable risk. Development banks also notably work closely with development partners to expand their development role through capacity development and policy reforms. For example, Fiji Development Bank is an accredited Direct Access Entity with the Green Climate Fund (GCF). This would enable GCF funds to be channeled into domestic projects and could be blended with other sources to support deployment of the abatement measures.

Development banks in the Pacific economies typically have a strong development mandate that differentiates them from commercial banks. They specifically target sectors that contribute towards the national development goals, national budgets, and SDGs. They aim to deliver financial solutions and fill the financing gap in the credit supply where commercial banks and other financiers may not operate.

Sustainable maritime shipping could also become one of the focus sectors for the development banks in these economies where the governments are already subsidizing interest rates for loans to specific sectors such as SMEs, and agriculture to promote more innovation and growth.

Development banks and other financial institutions may be able to provide guarantee or first loss capital to improve access to capital where borrowers have insufficient collateral or equity.

Current initiatives The Fiji Development Bank has provided a \$1M loan blended with \$4M of technical assistance for the Fiji Agrophotovoltaic Project in Ovalau.³⁶

Fiji Development Banks SME Sustainability Package offers an interest rate of 3.99% with loans from USD \$2,000 to USD \$50,000.³⁷

³⁴<https://www.pcreee.org/sites/default/files/event/files/presentations/2%29%20Strategies%20for%20Energy%20Access%20%E2%94%82%20Vineil%20Narayan.pdf>

³⁵ [About us - Okeanos \(okeanos-foundation.org\)](https://www.okeanos-foundation.org/en/about-us/) (<https://okeanos-foundation.org/en/about-us/>)

³⁶ <https://www.greenclimate.fund/ae/fdb>

³⁷ <https://www.rbf.gov.fj/economic-review-december-2021/>

4.5 Commercial banks, institutional and retail investors

PBSP application Commercial banks, institutional investors and retail investors have varying levels of risk appetite and return expectations. For the purposes of this discussion, they have been grouped together as they offer traditional debt or equity financing.

This group form a large part of the domestic capital in the Pacific economies. While Environment, Social and Governance (ESG) strategies are clearly missing from most of their investment mandates, these institutions could play a role in financing the maritime sector as some of the financial components within the maritime sector develop further.

In theory, life insurance and pension funds could be a good fit for the procurement of maritime vessels because the investment would be tied to a capital-intensive asset with an economic life of 30-40 years. However, the pension funds in the Pacific are constrained by their liquidity requirement and risk appetite and have a more prudent investment mandate.

Institutional investors will only consider projects that are investment ready - similar to commercial banks who will finance businesses that are bankable.

Accessing retail investment could prove difficult given the non-existence of capital markets in most of the countries under review (with the exception of Fiji).

Lending in the Pacific is heavily collateralized, making it very difficult for commercial debt financing to play any vital role in financing retrofitting or upgrading of vessels that are already under lien from other financiers. Any lending made available to early-stage businesses may also come at relatively high interest rates to reflect the risk.

In practice, these investors would only contribute to the maritime sector where other actors have first supported projects to a level of investment-readiness or through innovative incentives for first movers, guarantees, first loss capital and other ways of mitigating risks.

The appetite for private sector funders will depend on the magnitude of any operational savings that could be realized by the abatement measures, particularly in the initial years following deployment. As discussed in section 3.5, we anticipate the role of these funders in the deployment of PBSP abatement measures to be very limited, and only potentially in the later stages of deployment. It is expected that the National Governments may have to fund any differential costs or implement other forms of incentives to promote private sector involvement.

Current initiatives None identified.

4.6 International Maritime Organization and potential partner institutions

PBSP application As discussed above (section 3.6), the IMO is considering the implementation of revenue-raising market-based measures to decarbonize international maritime transport. At the moment, it is not clear whether a measure of this type will be implemented, nor what the governance of potential carbon revenues raised would look like. For instance, potential carbon revenues could be distributed by a new entity (e.g., a new fund — perhaps under the auspices of the IMO) or an existing entity, such as an existing climate fund. Both these options have been advanced in existing proposals submitted to the IMO. For this reason, this section includes “potential partner institutions” together with the IMO among the potential funding institutions.

Similarly to development banks (section 4.4), climate funds can support decarbonization efforts by providing concessional finance. This concessional finance can take various forms, including grants or below market rate loans. According to the OECD, there are currently 99 public funds that focus on providing climate finance.³⁸ Major climate funds that focus also on climate change mitigation include, the Climate Investment Funds (CIFs), the Green Climate Fund (GCF), and the Global Environmental Facility (GEF).

Other partner organizations for the distribution of carbon revenues from shipping could include multilateral development banks. Besides acting as potential direct funders, multilateral development banks often serve as trustees of climate funds, meaning that they support these institutions in holding, investing, and distributing funding. Currently, the World Bank act as trustee for CIFs, GCF, and GEF. Furthermore, multilateral development banks can help PBSP to access climate finance by acting as intermediaries. This role could be key to obtain carbon revenues from shipping if accessing funding directly presents transaction costs that are too high for countries with limited capacity to present competitive proposals independently.

Current initiatives Currently, the IMO has not implemented a revenue-raising market-based measure in international shipping. Thus, there is no current initiative identified besides the IMO negotiations mentioned above.

³⁸ <https://qdd.oecd.org/subject.aspx?subject=climatefundinventory>

5 The role of small and medium enterprises (SMEs) in the PBSP

PBSP application It is generally recognized that the health of the SME community is very important for the health of an economy, at a national and regional level. SMEs typically make up the vast majority of company registrations. They are the primary source of job creation in the Pacific. They drive entrepreneurship, spur innovation, attract private sector investment, drive growth and development and improve livelihoods. SMEs are likely to be a key component of economic growth and the alleviation of poverty.

Many of the abatement measures that form part of the Technical Transition Pathway will also create other investable components well suited to SMEs. This may include vessel maintenance, motor switching, engine derating and installation of propulsion improvement devices, where the scale of investment is relatively modest and could be managed or implemented through SMEs. There is also likely to be scope for SMEs in data gathering and analysis technology, as well as capacity development, education and training and awareness programs.

There are some challenges with securing funding for SMEs in the Pacific. These include:

- Despite high liquidity, credit to SMEs has remained tight as banks perceive more risk with these businesses. Debt serviceability and non-performing loans have been major concerns around SME lending especially since the pandemic
- Insufficient historical information to enable loan assessments
- Lack of access to affordable financial and advisory expertise to prepare business plans and forecasts
- Cost of borrowing
- Inability to meet the equity threshold required by the financial institutions
- Lack of collateral

The absence of credit bureaus and the unregistered businesses that still operate informally in the region present additional challenges for SMEs. Entrepreneurs are also reluctant to take loans where their revenue streams are volatile, and they are unsure of the ability to make timely repayments.

In considering a SME financing facility specifically for the Pacific maritime sector, it is important to consider what financing already exists in these countries.

In most economies, the state-owned development banks or national banks are tasked with focusing on the SME lending. This could be through development, national or commercial banks via concessional capital placed with the financial institution. Alternatively, in times of high bank liquidity where capital placement is not required, other support initiatives such as interest rate subsidies or guarantees can be introduced for debt loans. For example, Fiji Development Banks SME Sustainability Package that offers an interest rate of 3.99% with loans from USD \$2,000 to USD \$50,000.³⁹ Similarly, the Tongan Development Fund has a Fisheries Development Fund that offers loans at 1% that has the potential to finance retrofitting of smaller vessels in the country.⁴⁰

³⁹ <https://www.rbf.gov.fj/economic-review-december-2021/>

⁴⁰ <https://asset.tdb.to/files/PDF/GOVTDEVLOANS-GUIDELINES.pdf>

For SMEs in the Pacific maritime sector to successfully access finance through these banks, there is a need for more specific product design and capacity building within them to enable smoother and more timely loan assessment criteria, due diligence and approval processes.

International funds looking at impact investment opportunities such as Invest Pacific (a fund being set up through New Zealand Ministry of Foreign Affairs and Trade to focus on impact investment opportunities in the Pacific) may also be able to channel funds through to some of the SME projects in the maritime sector.

Asset-backed financing for assets such as vessels are also available with licensed credit institutions in some of the countries under review. However, such financing could be at much higher interest rates given the level of risk.

Business development service (BDS) providers play a critical role in making SMEs investment ready by working with SMEs through various incubator and accelerator programs to help build pipeline investments.

There are also several locally anchored entrepreneurial support organizations. While some of these groups target early-stage businesses or those with smaller funding requirements, it is an important area to monitor as the entrepreneurship ecosystem in the region develops. It is also important to note that while many programs offer accelerator programs, actual investment readiness support for businesses in their growth stage is not very common.

Notwithstanding the potentially critical role for SMEs in the deployment of the transition pathways, there are a number of barriers to setting up SMEs in practice:

- Lending in the Pacific is heavily collateralized, and SMEs often fail to meet the credit assessment criteria of the financial institutions. The state-owned development banks could design specific products for this sector and through existing guarantee schemes or new ones, enable SMEs from the maritime sector to access finance. These product offerings could be further enhanced by a government interest rate subsidy to lower the cost of borrowing for these SMEs.
- Financing facilities and the entrepreneurial support networks that already exist in these countries should be assessed to see if any existing financing platforms could be used to channel finance into the maritime sector. This will avoid duplication of efforts where programs are already supporting SMEs in all sectors to become bankable.
- Working closely with BDS providers will also be crucial as the SMEs in the maritime sector are well positioned to access these services. It will be important to choose the right BDS partners to ensure incubator and accelerator programs are streamlined and targeted at sector specific needs and challenges.

The numerous SME initiatives that already exist should be reviewed in detail to identify scope to collaborate and complement those programs to support and channel the funding for the SMEs in the maritime sector.

Current initiatives Since the pandemic a number of stimulus packages have been rolled out by national governments and development partners targeting SMEs. The ADB rolled out a \$4 million COVID-19 Business Recovery Program, MFAT and DFAT-funded program Business Link Pacific gave adaptation grants for SMEs for amounts up to NZ\$20,000, followed by the placing of wholesale capital with financial institutions for concessional lending. There were sovereign loans and grants given to national governments by development partners where the recovery of SMEs was targeted

in their economic response packages through concessional loans, grants and non-financial support such as advisory services.

Pacific Green Entrepreneurs Network is a 3-year project funded by Qatar Fund for Development and implemented by GGGI. This project supports green and inclusive job growth through their incubator, accelerator and mentorship programs.

Chamber of commerce and other business associations in these countries also focus on the SME sector, providing capacity building, advisory services and accelerator programs such as the Fiji Enterprise Engine, Solomon Islands Business Enterprise Centre and Tonga Business Enterprise Centre.

Credit enhancement mechanisms such as government guarantee schemes already exists in Solomon Islands and Fiji enabling SMEs to access finance without appropriate collateral. Secured transactions regimes have also been rolled out by ADB in a number of Pacific economies to help close the financing gap for SMEs.

An assessment of the entrepreneurial ecosystem in the Pacific carried out by UNCDF indicates a number of support programs funded by donor agencies while also highlighting that these programs are sporadic and overlapping.⁴¹

⁴¹ https://unctad.org/system/files/information-document/UNCDF_Entrepreneurship-Ecosystem-Pacific-Report.pdf

6 Alignment of funding sources with abatement measures

6.1 General principles

This section of the report overlays the characteristics of the funding instruments (and funding actors) onto the abatement measures. Based on alignment of characteristics around risk, timing and return, the most appropriate sources of funding and the potential funding actors are identified.

The Technical Transition Pathway identifies nine abatement measures:

- Fleet maintenance
- Demand / supply management and infrastructure
- WASP retrofit
- Motor switching from 2-stroke to 4-stroke
- Engine derating
- Propulsion Improving Devices (PIDs)
- Biofuel (blended) – temporary measure
- Biofuel (B100)
- Electrification
- Green e-fuels

The deployment is mapped out in two time bands across the 10 year period captured in the Finance Roadmap:

- 2023 - 2027 Immediate: the deployment to technology ready initiatives that can deliver immediate benefits
- 2028 - 2032 Near term: the deployment of technologies that are subject to proof of concept and pilot testing

The Finance Roadmap (in section 7) builds on the rollout of abatement measures over the 10 years to 2032 presented in the Technical Transition Pathway. It identifies the scale of funding required, the most applicable funding instrument and potential funding actors.

During the initial 10-year period covered by the Finance Roadmap, the larger financial components will require seed funding and technical assistance. It's assumed that most abatement measures will undergo some level of pilot-testing and feasibility prior to deployment. This will build a pipeline of projects and maximize the opportunity to attract private funding in the longer term (noting the reservations relating to long-term commercial viability made earlier). The Fiji National Climate Finance Strategy is following a similar strategy which indicates the need for investment of FJD \$12M (USD five million) annually in "proof of concept" for low-carbon marine vessels.⁴²

In working towards net zero by 2050, the technology and abatement measures may require different financing instruments at feasibility stage, product development stage (including pilot-testing), commercial stage and expansion stage as the market matures. Each stage will entail varying mix of capital and operating expenditure. This choice of financing instruments will depend on the level of concession or incentives needed to encourage the transition.

To identify the most appropriate source of funding for each abatement measure, we have considered:

- The nature of funding – whether it will be used for capital expenditure or operational costs
- The timing for the capital requirement

⁴² .Fiji National Climate Finance Strategy document

- The level of risk associated with the project
- The ability of the asset or business owner to generate revenue streams and potential savings from the abatement measure to meet the differential cost of adopting the new technology.

Most of the abatement measures will require education, training and awareness programs for the technology or device being rolled out. For the financing organizations, it will be important to understand the nature of investment and assess each financial component based on the business case, their debt serviceability for loans and due diligence as well as ongoing monitoring on the contribution towards the net zero target being made.

Each abatement measure is discussed in the following sections where the capital and operating costs shown are the total over the given time period. Operating costs savings do not include the financial value of carbon abatement, i.e., there is no carbon price avoided due to reductions in emissions. See Section 3.6 for further discussion on carbon price and indications of the potential revenue.

6.2 Fleet maintenance

Regional funding 2023-2032 Capital investment: 0.0
(PV USD Million): 2023-2032 Operating Cost: (22.8)

Outline of Maintenance measure: Relates to the realization of efficiency improvements through improved and more regular vessel maintenance. Might include regular replacement of consumables (e.g., filters) and more thorough ongoing repairs and maintenance (such as engine servicing).

Applies to all vessels and can be rolled out immediately with supporting infrastructure improvements (slipways and maintenance facility capability) implemented over time.

Funding Strategy: Entails no major CAPEX (other than that required for vessel maintenance infrastructure) and is likely to start delivering operational cost savings immediately following vessel upgrades. However, in some countries the cost relating to this abatement measure is relatively high. In Solomon Islands for example, due to the age and make of the current vessels, our assessment indicates that adopting this measure results in an increment of operating costs of \$28.4 million in the immediate to near term.

With the savings delivering a business case in itself, this abatement measure could be financed internally by the existing vessel owners, particularly for owner operated vessels (where the same party pays for vessel costs and fuel costs). It has been shown that there are a number of barriers to this in commercial shipping and in practice, implementation rates for owner funded improvements like this are low, despite the apparent efficiency savings.⁴³

The research indicates no particular correlation between barriers and efficiency measures, but a set of common barriers across all initiatives. Significant amongst these, and applicable to the PBSP is the lack of reliable information on the cost savings that could be realized, even for mature technologies. This has been attributed to a perception of biased data leading to mistrust and an unwillingness to invest.

It may be that national governments could use tax incentives and adaptation grants for the differential in operating costs to help with the transition. Once the transition

⁴³ Barriers to energy efficiency in shipping: A triangulated approach to investigate the principal agent problem, N Rehmattulla, T Smith, Energy Policy 84, (2015) 44-57

is underway the savings and benefits are likely to become more widely known, but an information barrier may still remain.⁴⁴

- Funding Instruments:**
- Fiscal incentives
 - Adaptation grants
 - Owner investment (maybe gradual and not incomplete)

6.3 Demand / supply management and infrastructure

Regional funding (PV USD Million): 2023-2032 Capital investment: 6.8
2023-2032 Operating Cost: (35.3)

Outline of Maintenance measure: Demand and supply management, data systems, and improvements to supporting infrastructure can provide efficiencies through optimized routing, vessel specialization, passenger/cargo separation and improved information systems.

Funding Strategy: The operational efficiency through demand/supply management and infrastructure involves freight route improvements, vessel specialization and improved information systems. This will have a slightly slower adoption rate because of the training and systems change required, rendering it a near term priority.

This has relatively low initial CAPEX but with substantial long term operating cost savings, meaning that it should be a viable for operator or owners to fund.

Similar to fleet maintenance, research indicates implementation rates for owner funded improvements like this are low, despite the apparent efficiency savings.⁴⁵ This may be because the benefits realized by these measures are not immediately tangible.

Adaptation grants are likely to be required to support the training and operations shift required to realize these savings.

- Funding Instruments:**
- Adaptation grants
 - Potential to transition to owner funded once benefits are evident

6.4 WASP retrofit

Regional funding (PV USD Million): 2023-2032 Capital investment: 294.9
2023-2032 Operating Cost: (45.4)

Outline of Maintenance measure: Retrofitting or procuring new build vessels with WASP capability. This includes all vessels from small local vessels to large cargo vessels.

In practice, WASP will need to be accompanied by back-up propulsion systems, possibly electric propulsion supported by onboard solar and battery. WASP vessels are likely to deliver significant reduction in operational costs through energy costs savings compared to conventional vessels which could help offset the initial CAPEX.

Funding Strategy: For the purpose of the finance roadmap, we have distinguished between privately owned and government owned vessels, regardless of size. That's because in the

⁴⁴ Implementation Barriers to Low Carbon Shipping, N Rehmatulla, T Smith, 2012., 11–12 September, University of Newcastle, Newcastle

⁴⁵ Barriers to energy efficiency in shipping: A triangulated approach to investigate the principal agent problem, N Rehmatulla, T Smith, Energy Policy 84, (2015) 44-57

immediate term, the financing of pilot testing and conversion of government fleets have been prioritized. This pilot testing would confirm commerciality and scalability before rolling out to the privately owned vessels.

Pilot testing of large WASP vessels is already being carried out in Fiji through the Sustainable Sea Transport Initiative (SSTI) and in Marshall Islands. The need to carry out pilot testing in other member countries (to account for country-specific circumstances) and testing the commerciality of this technology in the short term will be vital before it can be rolled out.

Access to capital for energy efficient investments has typically been considered a barrier because of the high hurdle rate adopted.⁴⁶

For purchases of new WASP vessels or substantial retrofit costs, grants or other financial incentives could be used to support the additional cost.⁴⁷ This could also be funded by concessional loans but will ultimately depend on the debt serviceability of the vessel owner. Retrofitting WASP for larger vessels through concessional loans could prove challenging if the vessels are already collateralized for existing loans.

National governments could also consider buying or leasing the vessel fleet, then subleasing to the private sector to operate. This option to buy and lease vessels is likely to weigh heavily on the national governments' fiscal budgets, existing level of debt and aid dependency which makes this approach less feasible.

Concessional interest rates could be offered to encourage the private sector to lease new WASP vessels. Such leasing and financing options could be driven by the state-owned development banks through direct funding or wholesale capital channeled by development agencies such as Green Climate Fund. Similar mechanisms are being used successfully to fund similar blended finance structures for electric vehicles in other jurisdictions.⁴⁸

Partnership with international banks who are actively expanding their mandate into sustainability projects could also be considered as a means to channel commercial debt financing into the sector through credit enhancement mechanisms such as credit guarantee schemes to mitigate collateral and default risks of borrowers. Any grant, guarantees or concessional funding provided to the sector operators will require a stringent due diligence process as well as monitoring and evaluation systems in place to ensure the development targets are met.

- Funding Instruments:**
- Grants for pilot testing.
 - Grants or other direct financial incentives (concessional interest rates, loans or lease schemes).
 - Outcome funds with guarantees.

6.5 Motor switching

Regional funding (PV USD Million): 2023-2032 Capital investment: 29.4
2023-2032 Operating Cost: (15.5)

⁴⁶ Implementation Barriers to Low Carbon Shipping, N Rehmatulla, T Smith, 2012., 11–12 September, University of Newcastle, Newcastle

⁴⁷ Practical Playbook for Maritime Decarbonization – Value Chain-based pathways towards zero-emission shipping, Nordic West Office, 2022

⁴⁸ <https://www.livemint.com/companies/news/macquarie-seeks-funds-to-set-up-ev-leasing-co-11657471875130.html>

Outline of Maintenance measure: Replacement of 2-stroke engines for more efficient and lower emissions 4-stroke.

Funding Strategy: The data indicates the scope to exchange 5,719 outboard motors in the countries under review.

Savings generated from reduction in operating costs for the same period has been estimated to be lower than the capital investment required. The cost of upgrading will therefore need to be subsidized.

As discussed above, owners are likely to perceive barriers to switching because of lack of certainty over the benefits.

It is therefore likely that some form of grant funding would be necessary, but this could take the form of a buy-back scheme to encourage uptake.

It may be possible to supplement the grants by securing some level of private sector involvement from the engine producers to provide subsidized replacement motors, incentivized by ongoing maintenance revenue.

Funding Instruments:

- Adaptation grants
- Potential for private sector participation by way of subsidized motor replacements.

6.6 Engine derating

Regional funding (PV USD Million): 2023-2032 Capital investment: 8.2
2023-2032 Operating Cost: (5.1)

Outline of Maintenance measure: Engine derating involves optimizing the vessel's engine to suit typical operating speed, which results in reduced fuel consumption.

Funding Strategy: Engine derating will ultimately deliver savings through operational efficiency. If left to vessel owners, low uptake levels are likely due to lack of certainty over the benefits (as discussed for other operational improvements above).

It is therefore likely that some form of grant or impact funding will be necessary to initiate uptake. Given the higher initial outlay, tax incentives such as accelerated depreciation and tax deductions may also provide the necessary financial incentives.

Funding Instruments:

- Grants, impact funding
- Fiscal measures

Engine derating will ultimately deliver savings through operational efficiency hence the transition would be a business improvement strategy and not need much enticing. However, given the higher initial outlay, governments could look at tax incentives such as accelerated depreciation and tax deductions to encourage private vessel owners to adopt this measure.

6.7 Propulsion improvement devices

Regional funding (PV USD Million): 2023-2032 Capital investment: 2.9

2023-2032 Operating Cost: (3.6)

Outline of Maintenance measure:

Retrofitting of Propulsion Improving Devices (PIDs) to larger existing vessels (>10m length) with significant life remaining. These devices improve the efficiency of vessel propulsion and are a proven technology.

Propulsion improvement devices will be suitable for those vessels with significant economic life remaining.

Funding Strategy:

Propulsion improvement devices will be suitable for only larger vessels (>10m length) and those with significant economic life remaining.

Total CAPEX is likely to be more than offset by the reduction in operating cost over the longer term. Theoretically, this provides incentives for the vessel owners to implement these improvements, but as discussed above for other similar measures, this is unlikely to be observed in practice.

As for other similar measures, it may be that national governments could use tax incentives and adaptation grants for the differential costs to help with the transition. Once the transition is underway the savings and benefits are likely to become more widely known, but an information barrier may still remain, meaning that uptake may not be fleet wide.⁴⁹

The implementation of this measure will require appropriate infrastructure (slipways and maintenance capability) to implement. These aspects would typically be implemented by government with grants or concessional loans. These costs of these upgrades are subject to a review of infrastructure condition and capability and are not included in the CAPEX figures here.

Funding Instruments:

- Adaptation grants
- Potential to transition to owner funded once benefits are evident
- Loans and grants to provide the infrastructure needed to effect the change

6.8 Biofuels (temporary measure)

Regional funding (PV USD Million): 2023-2032 Capital investment: 0.0
2023-2032 Operating Cost: 2.8

Outline of Maintenance measure:

The straight substitution of fossil fuels with biofuel blends offering a reduction in emissions with no need to significantly change engines.

Funding Strategy:

Blended biofuels are aimed to be replacement 'drop in' fuels for existing vessels. These do not require any CAPEX and a relatively small increase in operating cost, making it easier for vessel owners to switch. However, the cost of biofuel is estimated to be higher than the fossil fuels currently being used.

There is also likely to be limited capacity for locally produced biofuels which will limit the reach of this abatement measure.

For vessel owners targeted for this transition, it may require the national governments to provide incentives to produce biofuels and subsidize cost of blended biofuels to make it indifferent to purchase of initial fuels (cost increment from biofuels is estimated at \$1.3 million for the region).

⁴⁹ Implementation Barriers to Low Carbon Shipping, N Rehmatulla, T Smith, 2012., 11–12 September, University of Newcastle, Newcastle

A contract for difference may enable governments to secure some price certainty for a period but does not change the conclusion that a subsidy will be required.

If CAPEX investment is required to make adjustments to engines, it is likely to be relatively modest and could be funded via accelerator programs which could encourage vessel owners to participate.

- Funding Instruments:**
- Production and fuel subsidies
 - Accelerator programs for CAPEX investments

6.9 Biofuel (B100)

Regional funding (PV USD Million): 2023-2032 Capital investment: 2.4
2023-2032 Operating Cost: 0.4

Outline of Maintenance measure: Provision for engines to run of 100% biofuel. Some vessels will require engine upgrades to run 100% biofuel. Some vessels are likely to remain on 100% biofuel instead of transitioning further into electrification

Funding Strategy: Securing a reliable supply of biofuel is critical to the success of this measure. It is likely that biofuel in these quantities would need to be sourced internationally, which presents a supply chain risk.

The strategy is similar to the biofuel blends, except that the CAPEX required will be significantly greater.

Similar measures for blended biofuels are likely to be appropriate where national governments provide incentives to produce biofuels and subsidize cost of biofuels to make it indifferent to the purchase of fossil fuels.

For new build or costly retrofitting of vessels, there is likely to be a need to fund the CAPEX through adaptation grants. Any debt financing options will be difficult if the vessel is already used as security for other loans.

- Funding Instruments:**
- Production and fuel subsidies
 - Accelerator programs for CAPEX investments
 - Debt financing or concessional loans for vessel retrofitting and purchase.

6.10 Electrification

Regional funding (PV USD Million): 2023-2032 Capital investment: 102.7
2023-2032 Operating Cost: 5.4

Outline of Maintenance measure: This includes the retrofitting of electric outboards and battery storage to existing vessels and the purchase of newbuild electric powered vessels.

This would need supporting with shoreside storage and shoreside charging infrastructure.

This abatement option requires proof of concept, pilot testing and feasibility on the commerciality of electric vessels before it can be successfully rolled out. The expectation is that government sector vessels would be pilot tested while the private/commercial sector vessels start transitioning from 2030 onwards.

It would require detailed analysis of generation, transmission and charging infrastructure to make sure there was sufficient generating capacity to support

the long-term deployment of this measure (which is beyond the scope of this study).

Funding Strategy: The pilot testing phase is likely to be carried out through technical assistance and funding through development partners.

Financing of commercial electric vessels could be achieved through various commercial asset financing schemes targeted at the maritime sector. State-owned development banks should be aligned with the government priorities and be able to design loan products specifically targeting such vessels. Commercial banks and other financiers may also consider involvement if credit guarantee schemes were put in place to mitigate the risk.

Electrification is aimed for the longer term due to the production and supply of sufficient renewable energy. However, it will also be important to learn from other clean energy trials in the member countries with private sector involvement, such as Fiji's pilot testing of e-bus shuttles⁵⁰.

Funding Instruments:

- Technical assistance for pilot testing
- Commercial asset impact schemes
- Credit guarantee schemes
- Tax and other incentives to offset high cost of electric energy

6.11 Green e-fuels

Regional funding (PV USD Million):

2023-2032 Capital investment:	69.5
2023-2032 Operating Cost:	2.3

Outline of Maintenance measure: The replacement of fossil fuels with green e-fuels (liquid hydrogen, ammonia, and methanol) produced from renewable energy.

We anticipate that e-methanol and ammonia are the most likely e-fuels for the PBSP because they are likely to present the lower vessel CAPEX requirements.

Whilst some of these fuels can be used on existing engines with significant modifications, it is probable that these technologies would only be deployed on new vessels.

Detailed analysis of e-fuels supply chain and local infrastructure to assist in the long-term planning of the transition will be required. This would need to be supported by identification of the appropriate vessels and discussions with vessel suppliers.

Fuel production, storage and distribution infrastructure needs to be in place for the successful rollout and operation of this abatement measure which requires significant CAPEX investment.

Given the level of commitment and expenditure required this is only a long-term solution.

Funding Strategy: The financing of the feasibility and pre-commercial testing is likely to be funded through development partners with relevant technical assistance support.

As technology improves and production costs of e-fuels reduces, it is possible the commercial funding may be attracted, particularly if supported with concessional capital and guarantees.

⁵⁰ Stakeholder discussions

- Funding Instruments:**
- Development partners grants and technical assistance for trials
 - Possible commercial funding for fuel production as production costs decline.
 - Concessional capital and guarantees to encourage private sector involvement.

6.12 Summary 2023-2032 funding requirements

The CAPEX funding required across all six PBSP countries considered in the transition plan over this period is USD516.7 million. The modelling suggests this investment would lead to a reduction in operating costs of USD116.8 million over this period.

The implementation of many of the proposed abatement measures is conditional upon sufficient capability in vessel maintenance infrastructure (slipways and maintenance facilities) to implement the measures in the proposed timeframes. The capital investment requirements presented Figure 3 do not include capital provision for the construction or upgrade of vessel maintenance facilities. Review of the condition of these assets was outside GHD Advisory’s scope of work. A detailed assessment of vessel maintenance capability and asset condition should be undertaken, and additional capital investment needs identified accordingly.

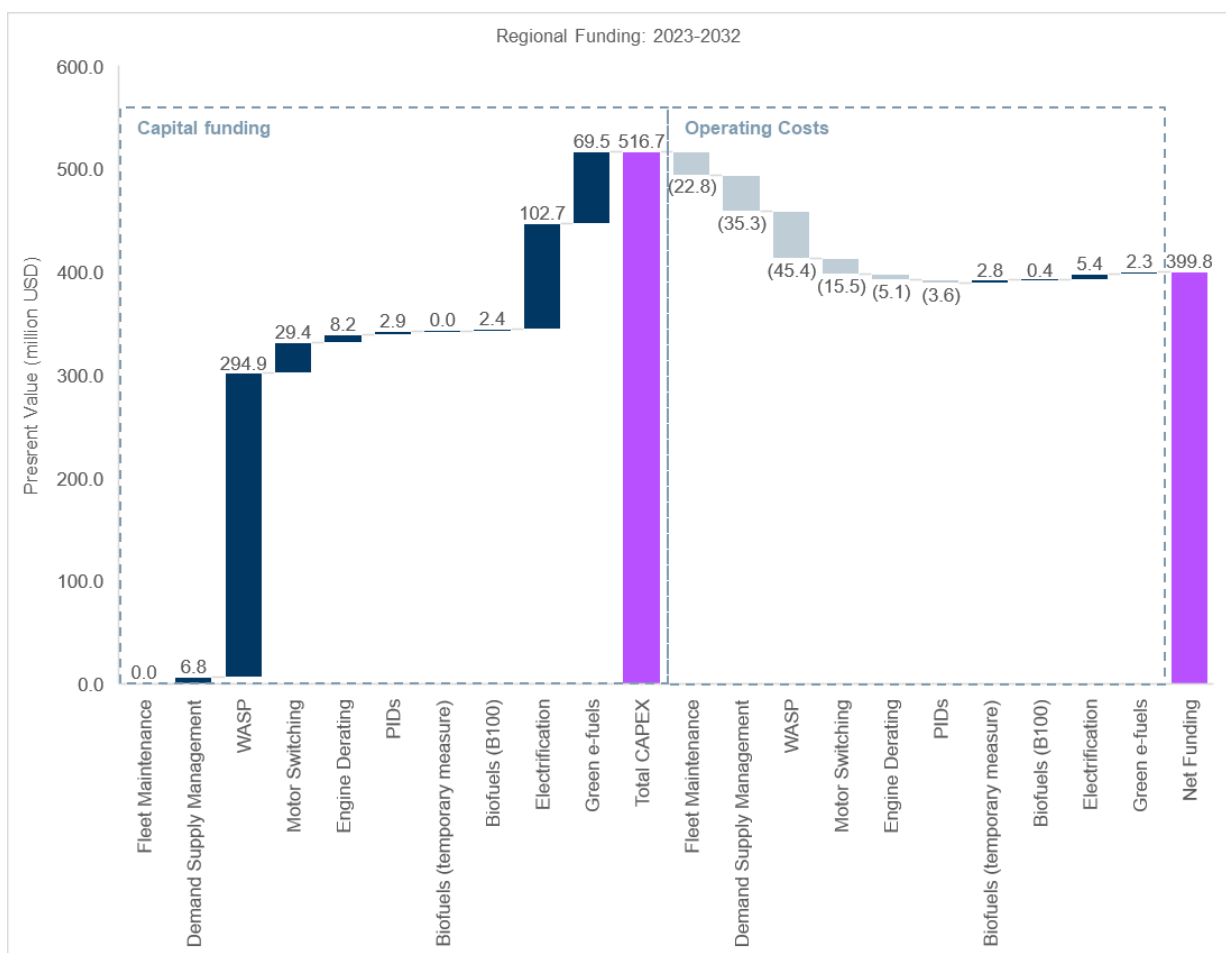


Figure 3: Capital and operating costs 2023-2032

7 Finance roadmaps

The combined capital and operating costs over the 10-year period shown in Figure 3, are broken down into the funding for 2023 to 2027 in Figure 4, and for the remainder of the 10-year period to 2032 in Figure 5.

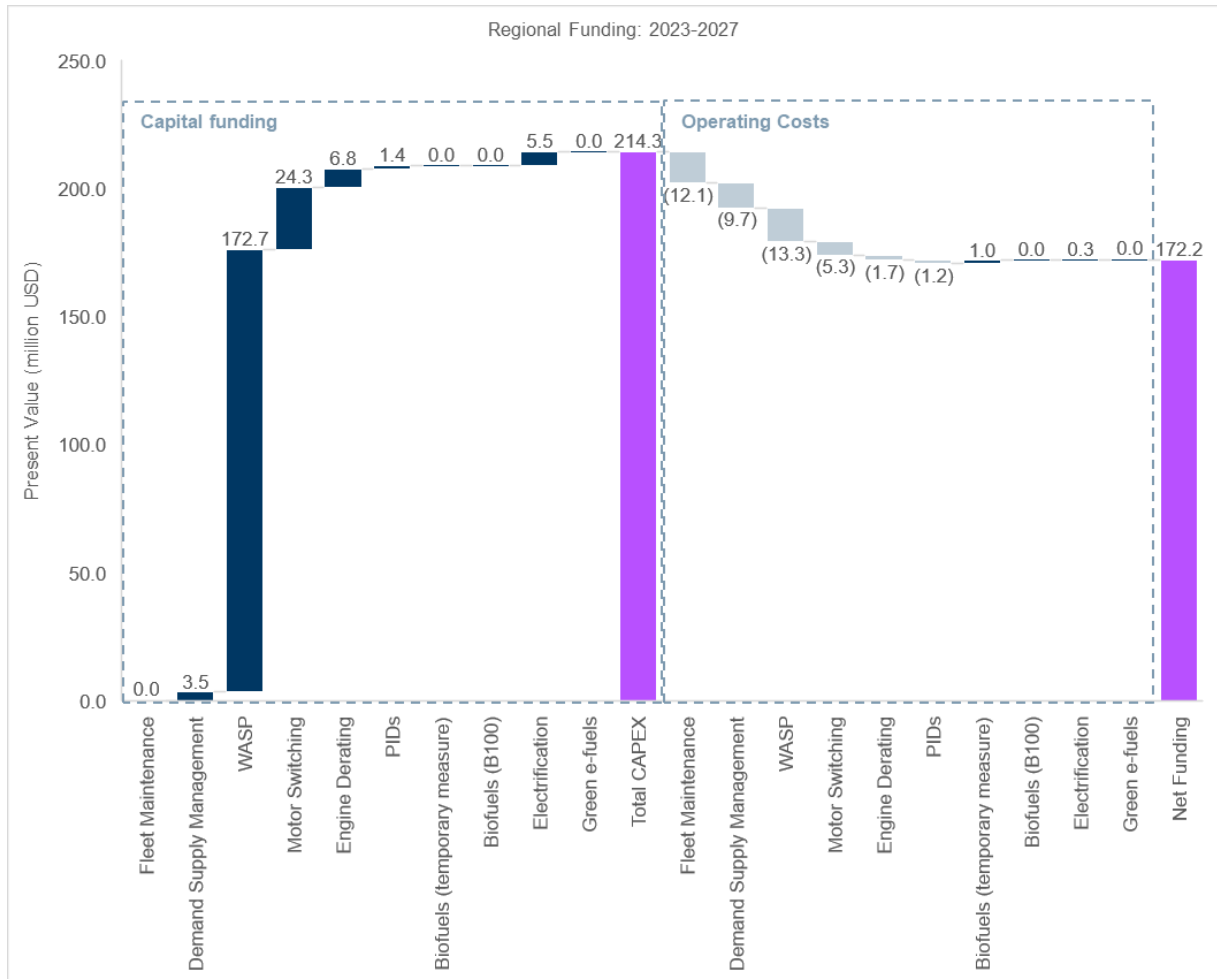


Figure 4: Regional Capital and Operating Costs 2023-2027 (PV USD Millions)

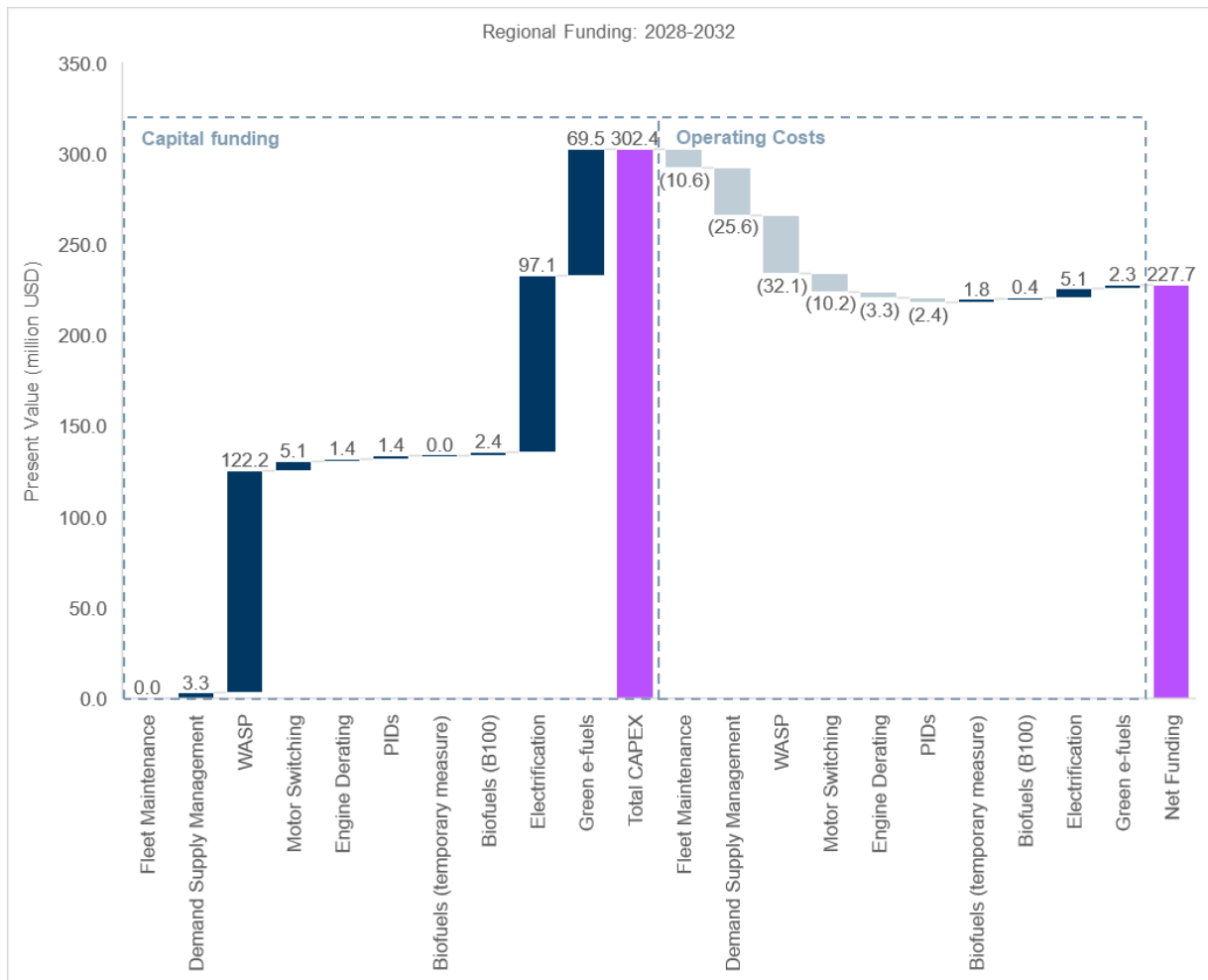


Figure 5: Regional Capital and Operating Costs 2028-2032 (PV USD Millions)

This total funding requirement is broken down by PBSP country in Table 4.

Table 4: 10-year capital and operating costs by country

	2023-2027		2028-2032		10-year total		Net Funding
	PV USD Millions		PV USD Millions		PV USD Millions		PV USD Millions
	CAPEX	OPEX	CAPEX	OPEX	CAPEX	OPEX	
Fiji	51.6	-40.7	66.1	-71.8	117.7	-112.5	5.1
Kiribati	17.0	-1.7	19.7	-3.3	36.7	-5.1	31.6
Marshall Islands	8.0	0.4	10.3	0.8	18.3	1.1	19.4
Solomon Islands	85.2	-10.0	114.7	-20.7	199.9	-30.7	169.2
Tonga	25.6	7.6	58.4	15.3	84.0	23.0	107.0
Tuvalu	26.8	2.3	33.2	5.0	60.1	7.4	67.5
Total	214.3	-42.1	302.4	-74.7	516.7	-116.8	399.8

Table 5 presents a more detailed breakdown by initiative and identifies potential funding instruments and actors. This summary road map identifies the measures to be progressed in the 2023-2027- and 2028-2032-time bands, as determined by the technical pathways and indicates the scale and nature of the investments involved.

As discussed above, the implementation of many of the proposed abatement measures is conditional upon sufficient capability in vessel maintenance infrastructure (slipways and maintenance facilities) to implement the measures in the proposed timeframes. The capital investment requirements presented in Table 4 and Table 5 do not include capital provision for the construction or upgrade of vessel maintenance facilities. Review of the condition of these assets was outside of GHD Advisory's scope of work. A detailed assessment of vessel maintenance capability and asset condition should be undertaken, and additional capital investment needs identified accordingly.

Table 5: CAPEX Finance Roadmap

Abatement Measures	Technical Readiness Level (Ready, trialed but not commercialized, Concept phase)	Key Assumptions	Type of funding instrument	Funding Actors	Implementing entity	OPEX Order of magnitude	CAPEX Required (M USD)							
							Fiji	Kiribati	RMI	Solomon Islands	Tonga	Tuvalu	Region	
2023 - 2027														
Fleet Maintenance	Ready (conditional on infrastructure)	Based on a 3-year maintenance cycle. The ship lifts & port infrastructure is also applied.	Fiscal incentives, adaptation grants	National governments, donor governments and development partners	Vessel owners and infrastructure owners		-	-	-	-	-	-	-	-
Demand / Supply Management and associated operations	Ready (conditional on data and support systems)	High initial cost to get information systems, software and data sharing implemented. Funding required to establish information systems, recruiting personnel, consistent cargo logging systems.	Adaptation grants, technical assistance, fiscal budget, tax breaks	National governments, donor governments and development partners	Government		1.4	0.5	0.2	1.0	0.3	0.1	3.5	
WASP retrofitting and hybrid, traditional island vessel designs	Trialed but not commercialized	Retrofitting existing vessels.	Grants, technical assistance	National governments, philanthropic funding, donor governments and development partners	Government		33.9	11.7	6.4	74.1	22.9	23.7	172.7	
Engine derating	Ready (conditional on local capability)	Funding required for all large vessels where the operating speed is less than the engine design speed.	Grants, impact funding, guarantees	National governments, donor governments and development partners	SMEs, Vessel owners with fiscal incentive		1.1	0.4	0.2	3.1	1.0	1.0	6.8	
Propulsion Improving Devices	Ready (conditional on local capability and infrastructure)	Assume retrofit to all large vessels.	Adaptation grants, concessional financing (guarantees)	National governments, donor governments and development partners	SMEs, Vessel owners with fiscal incentive		0.2	0.1	0.1	0.7	0.2	0.2	1.4	
Biofuel (blended) - Large vessels	Ready (conditional on economic feasibility)	Investment into local biofuel markets to ensure reliable supply chain to meet the nominated demand and reduce reliance on international markets.	Grants, technical assistance (accelerator programs for CAPEX investment)	Philanthropic funding, donor governments, national governments and development partners	Government, vessel owners with fiscal incentive		-	-	-	-	-	-	-	
Biofuel (blended) - Small vessels							-	-	-	-	-	-		
Motor switching from 2-stroke to 4-stroke	Ready (conditional on economic feasibility)	Assume 50% of all 2-stroke switch to 4-stroke motors over a 5-year phase in period.	Grants, guarantees	National governments, donor governments and development partners	Vessel owners with fiscal incentive		10.9	4.0	1.2	6.3	1.2	0.8	24.3	

Abatement Measures	Technical Readiness Level (Ready, trialed but not commercialized, Concept phase)	Key Assumptions	Type of funding instrument	Funding Actors	Implementing entity	OPEX Order of magnitude	CAPEX Required (M USD)						
							Fiji	Kiribati	RMI	Solomon Islands	Tonga	Tuvalu	Region
Electrification - Large vessels (Government Fleet)	Partially ready (conditional on infrastructure and renewable energy supply)	Planning for pilot testing to begin in 2025.	Technical assistance, donations	Donor governments, development partners, Philanthropic funds	Government, SMEs, infrastructure owners		4.1	0.4	-	-	-	1.0	5.5
Electrification - Large vessels (Private/ Commercial Fleet)						-	-	-	-	-	-		
Electrification - Small vessels						-	-	-	-	-	-		
Green efuels - Large vessels	Concept phase for the region (globally – trialed but not commercialized)	Planning for pilot testing to begin in 2025, assuming technology is available.	Grant and technical assistance for trials	Donor governments, Philanthropic funds	Government, SMEs, vessel owners with fiscal incentive		-	-	-	-	-	-	-
Green efuels - Small vessels						-	-	-	-	-	-		
Biofuel (B100) / Green eFuels - Navy fleet						-	-	-	-	-	-		
Biofuel (B100)	Trialed but not commercialized (conditional on economic and land use feasibility)	Investment into local biofuel markets to ensure reliable supply chain to meet the nominated demand.	Grants, technical assistance (accelerator programs for CAPEX investment)	Donor governments, development partners	Government, vessel owners with fiscal incentive		-	-	-	-	-	-	-
2028 – 2032													
Fleet Maintenance	Same as 2023-2027	Based on a 3-year maintenance cycle. The ship lifts & port infrastructure is also applied.	Adaptation grants, owner investment	National governments, donor governments, vessel owners with fiscal incentive	Vessel owners and infrastructure owners		-	-	-	-	-	-	-
Demand / Supply Management and associated operations	Same as 2023-2027	Ship lifts & port infrastructure is also applied. Funding required to continue roll-out of information systems, software, recruiting personnel and data sharing.	Concessional financing	Commercial banks, donor governments, national governments	Government		1.3	0.5	0.1	0.9	0.3	0.1	3.3
WASP retrofitting and hybrid, traditional island vessel designs	Same as 2023-2027	When electrification and green e-fuels is introduced: these are new vessels will require WASP installation – WASP CAPEX applied again for new ships.	Concessional financing, market rate debt and equity, outcome funding with grants	Development banks, commercial banks, institutional banks	Government, SMEs		24.0	8.3	4.5	52.4	16.2	16.8	122.2

Abatement Measures	Technical Readiness Level (Ready, trialed but not commercialized, Concept phase)	Key Assumptions	Type of funding instrument	Funding Actors	Implementing entity	OPEX Order of magnitude	CAPEX Required (M USD)						
							Fiji	Kiribati	RMI	Solomon Islands	Tonga	Tuvalu	Region
Engine derating	Same as 2023-2027	Funding required for all large vessels where the operating speed is less than the engine design speed. Less funding anticipated for the 2029 – 2033 period.	Concessional financing	SMEs, national governments	Vessel owners with fiscal incentives		0.2	0.1	0.1	0.7	0.2	0.2	1.4
Propulsion Improving Devices	Same as 2023-2027	Assume funding required for retrofitting of all large vessels.	Adaptation grants, concessional financing (guarantees)	SMEs, national governments	Vessel owners with fiscal incentives		0.2	0.1	0.1	0.7	0.2	0.2	1.4
Biofuel (blended) – Large vessels	Same as 2023-2027	Continued investment into local biofuel markets to ensure reliable supply chain to meet the nominated demand and reduce reliance on international markets.	Grants, technical assistance	National governments, SMEs	Government, vessel owners with fiscal incentive		-	-	-	-	-	-	-
Biofuel (blended) – Small vessels							-	-	-	-	-	-	
Motor switching from 2-stroke to 4-stroke	Same as 2023-2027	New motors begin to be replaced by electric / green e-fuel motors from 2030	Concessional financing	SMEs, national governments	Vessel owners with fiscal incentives		2.3	0.8	0.2	1.3	0.2	0.2	5.1
Electrification – Large vessels (Government Fleet)	Same as 2023-2027	Half of 2-strokes will be electric, other half green e-fuels (even split as uncertain tech – to be reviewed in the next review). New motors begin to be replaced by electric / green e-fuel motors from 2030	Concessional financing, commercial asset impact schemes, credit guarantee schemes	Commercial banks, donor governments and development partners	Government, SMEs, infrastructure owners		8.2	0.8	-	-	-	1.9	11.0
Electrification – Large vessels (Private/ Commercial Fleet)							7.2	2.4	2.2	27.3	20.9	6.0	66.1
Electrification – Small vessels							9.1	3.4	0.8	5.3	0.8	0.7	20.1
Green efuels - Large vessels	Same as 2023-2027	Half of 2-strokes will be electric, other half green e-fuels. New motors begin to be replaced by electric / green e-fuel motors from 2030	Concessional loans, commercial funding for fuel production, concessional capital and guarantees	Commercial banks, National donor governments and development partners	Government, SMEs, vessel owners with fiscal incentive		9.9	2.6	2.0	25.0	19.3	6.3	65.1
Green efuels - Small vessels							1.9	0.7	0.2	1.1	0.2	0.1	4.3
Biofuel (B100) / Green eFuels - Navy fleet							1.7	-	0.01	-	-	0.7	2.4
Biofuel (B100)	Same as 2023-2027	Commences 2030 due to improvements required to supply chain reliability.	Concessional financing (for retrofitting and purchase), accelerator programs	Commercial banks, National governments	Government, vessel owners with fiscal incentive		0.01	0.002	0.002	0.02	0.02	0.01	0.1

8 Alignment with national strategies

For the roadmaps to contribute to the prosperity of the region, it is important that they align and integrate with other associated roadmaps and strategies of the partner countries. The following presents a review of relevant national policies to identify alignment and interactions with broader strategic needs.

8.1 Fiji

Current Policy Environment:

Fiji has a target to reduce 30% of BAU CO₂ emissions from the energy sector by 2030 and to reach close to 100% renewable energy power generation by 2030.⁵¹ The mitigation actions for Fiji's energy sector include land and Marine transport.

The Fiji NDC Implementation Roadmap (2021)⁵² identifies the following abatement measures for emissions reduction:

- Fleet maintenance
- Renewable energy driven sea vessels as an option, including wind, it is however, unclear if this is wind assist or wind generated electricity; and
- Switching from inefficient 2-Stroke to either direct injection 2-Stroke or 4-Stroke outboards.

The mitigation actions in the NDC include vehicle replacement programs for buses, taxis, private cars, lorries and minibuses, which would institute an enhanced sub-industry for the scrapping of older, less efficient vehicles.

Marine specific mitigation actions for Fiji are focused in sections T4 (Improved Maintenance for Sea Vessels) and T5 (Fuel Efficient Outboard Motors), as well as the long-term strategies for electric transportation and alternative propulsion systems. Other actions include the import and use of biodiesel, improved maintenance for sea vessels, and increased utilization of fuel-efficient outboard motors.

Alignment with blended finance roadmap:

Good alignment with the overall objectives. The goal for 100% renewable power by 2030 aligns well with the proposed rollout of vessel electrification post 2030, but it is unlikely that country plans to date include the generating capacity required to support the shipping sector.

The principle of vehicle replacement programs is recognized but this needs to be extended to include vessels.

These initiatives align well with the proposed roadmap.

⁵¹ Fiji NDC Implementation Roadmap 2017-2030

⁵² Fiji NDC Implementation Roadmap 2017 - 2030

8.2 Kiribati

Current Policy Environment:

The Kiribati NDC Implementation Roadmap 2021 has the goal of providing a temporal pathway for the mitigation actions in the domestic transport and energy efficiency sectors which contribute to the targets outlined for the period 2020 to 2030:

Target 1: To unconditionally reduce 12.8% of BAU greenhouse gas emissions and conditionally reduce 48.8% of BAU greenhouse gas emissions by 2030 compared to 2014 levels.

The plan will encourage decarbonization of international ships visiting the country's ports, ships flagged to Kiribati, and all other domestic vehicles. The Outboard Motor Transition action replaces 2,010 of the 2-stroke outboard motors with either 4-stroke motors (1,560) or electric outboards (450) by 2030.

The Low Carbon Mini-Container Ship action includes investment in a mini-container ship to be operated with the intention of maintaining essential sea connectivity. The vessel will be either low carbon new-build or a second-hand vessel retrofitted with a range of emissions abatement measures.

The Small-Cargo/Passenger action includes investment in a freighter with some passenger capacity to serve as a general service vessel. This vessel will be similar in design to the low carbon freighter being designed under the Cerulean Project.

The Zero Impact Cruise Liner action calls for the implementation of a pilot 'zero impact' small scale cruiser liner which will support the tourism industry, thus generating employment opportunities and foreign currency for Kiribati.

Kiribati's mitigation actions are expected to have a total estimated investment cost of US\$163 million, comprised of a total of US\$11.5 million for capacity development and technical assistance, and US\$151.5 million for investment capital.

Alignment with blended finance roadmap:

These targets align well with the objectives of the roadmap, but it is noted that they do not currently extend to 100% reduction in BAU emissions by 2050.

In principle these initiatives align well with those proposed as part of the technical pathway.

The focus is on short term trial projects, and it will be important to integrate long term plans around broad scale electrification, as indicated in the Technical Transition Pathway, to achieve long term zero emissions targets.

Over \$150 million in investment capital has been identified by development partners and development banks in the form of grants to achieve the proposed targets⁵³, but this does not extend to achieving zero emissions by 2050.

⁵³ <https://pacificaidmap.lowyinstitute.org/dashboard>

8.3 RMI

Current Policy Environment:

The Republic of Marshall Islands (RMI) submitted its Nationally Determined Contribution with the target to reduce greenhouse gas emissions to at least 32% below 2010 levels by 2025 and further to at least 45% below 2010 levels by 2030.

RMI also released an Electricity Roadmap which is targeted at reducing RMI's reliance on diesel. These emissions account for approximately half of RMI's GHG emissions. While many of the outer islands are 100% renewable, the main towns still rely on imported diesel.

To achieve targets, RMI will need to go from the current 2% renewables to over 50% renewables, at a cost of around US\$170 million. With around US\$130 million of additional capital investment to meet 2025 targets, and beyond that, US\$45 million to meet 2030 targets.⁵⁴

There are plans to use biodiesel as a 'last-mile' technology to achieve some portion of the last 30% of emission reduction

There is no specific mention of marine transport strategies, but there are some notable maritime projects including the "Transitioning to Low Carbon Sea Transport" project in RMI valued at \$805,000 and the "Marshall Islands Maritime Investment Project" valued at \$952,000, all supported by grant funding.

Alignment with blended finance roadmap:

These are broadly in line with the targets assumed in the Finance Roadmap, but do not extend to zero emissions in 2050.

The move from diesel to biodiesel and then to renewables align well with the overall approach in the Finance Roadmap.

The infrastructure and funding allocated to this is intended to target 45% emission reduction by 2030 and will need supplementing with significant further investment and infrastructure if the target for zero emissions in 2050 assumed in the Finance Transition plan is to be achieved.

It is possible that the needs of the marine transport sector have not been captured in the proposed infrastructure requirements. This sector should be specifically identified, and the proposed measures identified in the Technical Transition Pathway included in future planning.

⁵⁴ Marshall Islands Electricity Roadmap, 2018

8.4 Tonga

Current Policy Environment:

Tonga's Second Nationally Determined Contribution 2022, identifies a target to reduce 2006 GHG emissions by 13% (16 Gg) by 2030 through a transition to 70% renewable electricity as well as energy efficiency measures.

A specific example of projects in Tonga to improve marine transport is the project in Nuku'alofa, which is guided by ADB's upgrade to the port of Apia in Samoa. Upgrading ports in the Pacific with smart infrastructure and processes will remove inefficiencies, reduce costs, and protect against natural disasters and climate change. The Nuku'alofa Port Project is designed with green and smart components and includes gender aspects to promote the participation of women in port operations.

Alignment with blended finance roadmap:

This target is more onerous than that assumed in the Finance Roadmap but needs to be extended to zero emissions by 2050.

This project is aligned well with the operational efficiency measure but needs to be extended to capture the broader maritime sector with funding allocated.

8.5 Solomon Islands

Current Policy Environment:

The Intended Nationally Determined Contribution from the Solomon Islands Government commits to reduce emissions by 12% below 2015 levels by 2025 and 30% below 2015 levels by 2030 compared to a BAU projection. With international assistance, the Solomon Islands can contribute a further 27% reduction in GHG emissions by 2025, and 45% reduction in GHG by 2030, compared to BAU projection.

With appropriate international assistance, the Solomon Islands believe that they can reduce emissions by more than 50% by 2050.⁵⁵

There are currently no clear plans to address land and marine transport.

Alignment with blended finance roadmap:

These early-stage targets align well with those assumed for the Finance Roadmap.

The 2050 target at 50% reduction falls short of the zero-emission target assumed.

The proposed pathway for the marine transport sector needs to be integrated into national policy with appropriate funding sourced and allocated.

8.6 Tuvalu

Current Policy Environment:

The Government of Tuvalu submitted its Intended NDC in 2015, which states that they commit to a reduction of emissions of green-

Alignment with blended finance roadmap:

This target applies to electricity generation, which accounts for 41% of the countries

⁵⁵ Intended Nationally Determined Contribution, Solomon Islands Government, 2015

house gases from electricity generation by 100%, i.e., almost zero emissions by 2025. These emissions will be further reduced from other key sectors including agriculture and waste, which is conditional upon the necessary technology and finance.⁵⁶

Transport projects make up 5.2% of total aid flow spent in Tuvalu, including a Maritime Investment in a Climate Resilient Operations project where \$586k was spent⁵⁷.

emissions, about the same as the transport sector.

Tuvalu is currently very reliant on importing fossil fuels.

It is recognized that international support will be crucial to enable Tuvalu to implement further actions enshrined in its Policies and Plans. For example, the growing emissions in the transport sector, as evidenced from the increased numbers of vehicles on land and vessels for sea transport, needs to be addressed through technological innovations. The goal to pursue a zero-carbon development pathway by 2050 is dependent on availability of finance and technology.

⁵⁶ Intended Nationally Determined Contributions, Government of Tuvalu, 2015

⁵⁷ <https://pacificaidmap.lowyinstitute.org/dashboard>

9 Key actions for implementation

9.1 Enabling initiatives

The following outline describes some initiatives that are required to be implemented to promote the efficacy of the Finance Roadmap and the underlying Technical Pathway:

- Policy advocacy:
 - The pathway targets should be reflected in national policy.
 - Policies need to be aligned to some of the key long-term enablers of the pathway (e.g., biofuels and electrification).
 - Marine transport should feature prominently in national transport and ESG policies.
 - Appropriate legislative changes should be implemented over time to provide the necessary powers and incentives to promote the PBSP objectives.
 - Since the implementation of revenue-raising market-based measures in international shipping by the IMO and the related use of carbon revenues remain uncertain, PBSP countries should continue pursuing alternative funding opportunities.
- Discussions with funding partners
 - There is a need to capitalize on available funding and make sure that funding is targeted at achieving PBSP targets.
 - This is best undertaken by a coordinated approach to communicating with funders to achieve the scale required to secure investment for regional benefit.
- Infrastructure and information systems
 - There is a need to complete surveys of navigational areas. This will enable safe and efficient vessel routing between ports, reducing fuel consumption. These surveys should be regularly updated.
 - There is a need to complete surveys of navigational areas. This will enable safe and efficient vessel routing between ports, reducing fuel consumption. These surveys should be regularly updated.
- Demand management
 - The demand and supply management measure requires coordinated action across all partner countries to promote efficient movement of cargos.
 - This would ideally be managed and implemented holistically.
- Vessel procurement
 - Vessels in the Pacific are often donated or provided through concessional agreements. Consequently, vessels tend to have a limited life and poor emissions.
 - There would be benefit in standardized specifications for vessel procurement. This would apply to both new and donor vessels to make sure that minimum standards are met that support the achievement of the pathway goals.
 - Opportunities to manage vessel deployment and disposal across all PBSP countries to minimize impacts of early replacement and end-of-life disposal.
- Vessel maintenance scheduling

- Measures that require retrofitting of equipment to vessels and those related to long term operating efficiency will require access to slipways and vessel maintenance facilities.
- There will be peaks in demand during the early phases where retrofitting is implemented. This will transition to a steady demand over the long term with regular vessel maintenance programs.
- The ongoing vessel maintenance activities will also require management to optimize the use of vessel maintenance facilities and minimize vessel downtime.
- It may be that a series of vessel maintenance hubs are more efficient. The extent, location and operation of these facilities could be centrally managed to promote overall efficiency.
- Performance monitoring and assessment
 - Where impact funding is used, which is conditional on achieving defined goals, there will be a need to monitor performance against these goals.
 - If carbon revenues are to be secured, the supporting data needs to be captured. The process needs to be managed to maximize revenues in the short term, with a transition to retaining the emissions reductions to meet long term targets.
- Pathway iteration
 - It is possible that each country will follow a variation on the technical pathways because each are in different positions in implementation of SDG plans and the risk profiles and funding availability may vary.
 - There will be a need to continually review, update and adapt the pathway at a country level to account for the different policy settings and technology developments. This is best undertaken centrally so that the PBSP regional targets are achieved.

The most effective form of implementation of these initiatives is likely to be through an entity that capitalizes on the already collaborative function of the PBSP. The remit of that entity would be to implement the initiatives identified above on behalf of and across the partner countries. Acting in the best interests of all partner countries, this would promote an efficient and coordinated approach and is therefore likely to lead to the optimal overall outcome that could support each partner in achieving their long-term sustainability goals.

9.2 Areas of focus

Alignment with national plans National governments in PBSP countries have made sustainable maritime transport a priority through their National Development Plans^{58, 59, 60, 61, 62, 63} and Fiscal Budgets. The PBSP project links with overarching development objectives that are in line with the 2030 Paris Agreement. However, several of the countries' NDCs do not include maritime related targets.

There should be a focus on capturing maritime related targets within country NDCs and strategic plans.

⁵⁸ Fiji NDC Implementation Roadmap 2017 - 2030

⁵⁹ Kiribati NDC Implementation Roadmap 2021

⁶⁰ RMI Pacific NDC's Overview and RMI Electricity Roadmap

⁶¹ Solomon Islands INDC

⁶² Tonga's Second NDC

⁶³ Tuvalu INDC

Extended role of commercial finance

The study has demonstrated the limited scope for crowding in private finance in Pacific maritime shipping initiatives. Market failures have not been clearly identified as the sector is still nascent and work in this sector to date has mainly focused on safety and security rather than sustainability.

The initial funding is designed to focus on early-stage proof of concept and trials. This will identify any potentially bankable projects, whilst financing the market formation and an enabling environment to promote sector innovation and growth.

For long-term success, it is critical that the measures are locally led. There should be a focus on encouraging investment by local institutional investors and financial institutions over the long term. This will enable domestic capital to flow into the shipping sector which will drive the local currency financing and reduce the need for currency hedging.

Some of the abatement measures in the Technical Transition Pathway result in operating cost savings which could offset the initial investments. Some affect operating cost increases from the Business As Usual (BAU) scenarios. The financial components ideally need a mix of concessional and commercial funding at different stages of the project. Quantified studies of the costs and returns over time will be required to understand revenue streams and the long-term evolution of any commercial investment.

A more detailed review of country and sector specific risks should be undertaken. This will enable funding to be structured to allow for the difference in investment risks between countries.

Mobilizing SME involvement

SMEs could play a critical role in the achieving the pathways whilst enabling country economies to prosper. Fewer commercial finance options exist for SMEs. This means SMEs require higher equity thresholds which can be difficult to meet (for example, Fiji Development Bank in Fiji has fishing loans that exclude second hand outboard motors and requires 35% to 50% in cash contribution).⁶⁴

Participation in commercial operations is likely to increase in the longer term as opportunities spin off from the maritime sector transition. There may be opportunities for SMEs in engine servicing, charging facilities or technology for tracking and monitoring vessels.

There should be focus on understanding how green or blue funding strategies are being adopted in other sectors. The e-bus shuttle pilot testing in Fiji is an example where the private sector is being effectively engaged to reduce the financial burden in the public sector.

Focusing investment mandates

A lack of clear ESG strategies in institutional investment mandates means that these investors are more likely to focus on the likely rate of return when reviewing investment opportunities. There should be a focus on advocating for a shift in the institutional investors to include consideration of ESG goals within their mandates.

Rigorous monitoring regime

PBSP will need to promote transparency, data availability and knowledge sharing to continue the active collaboration between governments, multilateral development banks and development finance institutions.

There needs to be a focus on integrating key performance indicators into funding agreements. The indicator metrics should be agreed upon by stakeholders and projects will need to allocate sufficient resources for monitoring and evaluation.

⁶⁴ <https://www.fdb.com.fj/fishing-loans/>

For example, concessional financing of an engine upgrade from 2-stroke to 4-stroke will require the vessel owner to deliver a clearly set out contribution towards the decarbonization targets. The Project will need to adopt a common monitoring and evaluation framework for consistency across the sector.

Carbon revenues The implementation of a revenue-raising market-based measure in international shipping by the IMO has the potential to raise significant revenues. A small share of these revenues could be sufficient to cover the financing needs of PBSP countries to decarbonize their maritime sector. PBSP could continue support the implementation of revenue-raising market-based measures in IMO negotiations.

Since it remains unclear whether the IMO will implement a revenue-raising market-based measure nor it is clear how potential carbon revenues would be used, alternative funding opportunities discussed in this report need to be pursued in parallel.

Capacity Building For the maritime shipping to deliver investable opportunities, it will require market formation, capacity building and training, and the development of supporting infrastructure.

This will need to cover all aspects of vessel servicing, maintenance, and operation. This includes specific skills appropriate for each abatement measure, as well as training ship's crew in sailing vessels with different forms of propulsion.

The suggested centralized entity will require establishing and resourcing with appropriately trained personnel to promote achievement of emissions targets and the efficient long-term sustainability of the PBSP.

Vessel Insurance It is understood that commercial insurance is typically not economic for the current vessel fleet due to a combination of vessel age and perceived risk. Financial guarantees will be required to cover insurance gaps. Securing insurance on new (higher value) zero-carbon assets will mean the required insurance costs will be higher and this will add to the funding gap on non-commercial subsidized routes.

Appendix A: Stakeholder Interviews

Stakeholders engaged:

- MFAT
- AIFFP
- DFAT
- Office of the Pacific
- GGGI
- UNDF
- Fiji Government - Climate Change Division
- Fiji Development Bank
- MSME Fiji

Appendix B: SME Entrepreneurial Support Table

BDS Provider	Pacific Green Entrepreneurship Network	Market Development Facility	Business Link Pacific	Business Partnership Platform	The Difference Incubator	The Drua Incubator	Matanataki
Coverage	Fiji, Kiribati, Papua New Guinea, Samoa, Tonga and Vanuatu.	Fiji and Papua New Guinea expected to expand further in the Pacific	Cook Islands, Fiji, Papua New Guinea, Samoa, Solomon Islands, Vanuatu	19 countries across Asia, Africa and Pacific (including Fiji, Samoa, and Papua New Guinea)	Pacific economies including Samoa, Fiji, Tonga, Papua New Guinea	Pacific region	Fiji
Function/Role	a 3-year project funded by the Qatar Fund for Development and implemented by GGGI, supporting green and inclusive job growth	Uses a market-based approach to help promote sustainable economic development through technical and financial assistance to businesses operating in this space	Local business advisory services to enable access to finance and growth (SME Finance Facility also providing grants and concessional loans through FIs)	Creates partnership between across public and private sectors, non-governmental organizations, academia and community groups to optimize value add and inclusive development	business innovation and impact consulting business that works with social enterprises	bring together leaders in finance, investment, and insurance to develop and “incubate” transformational and scalable financial and insurance products	Business development and access to finance services
Scoping	From any stage from incubation to growth stage, businesses identified through incubator/accelerator programs	From any stage from incubation to growth stage, businesses identified through incubator/accelerator programs	Businesses seeking business, legal, financing and other advisory services either referred through the adviser or directly applying for subsidy	Call for partnership where businesses with commercial idea with social impact can apply.	Businesses that are identified through scoping and accelerator programs or those who directly get referred	Early-stage businesses	Early-stage businesses identified, screened, filtered and short listed for pipeline
Type of business	New and existing businesses	New and existing businesses	Existing businesses	New and existing businesses	New and existing businesses	New and existing businesses	New and existing businesses
Size of business	SMEs	SMEs	SMEs	All sizes	Micro and small businesses (some medium sized)	Micro and small businesses (some medium sized)	Larger businesses

BDS Provider	Pacific Green Entrepreneurship Network	Market Development Facility	Business Link Pacific	Business Partnership Platform	The Difference Incubator	The Drua Incubator	Matanataki
Funded by	Qatar Fund for Development	DFAT	MFAT	DFAT matches private sector investment (14% to 50%)	Self-funded with ad hoc funding by DFAT on specific assignments	UNDP	Private sector partnership funded through strategic partnerships with financiers and partners
Managed by	GGGI	Palladium	DT Global	Palladium	The Difference Incubator	UNDP	Matanataki
Impact	Green projects and inclusive job growth	Sustainable economic growth, women's economic empowerment and poverty reduction	Impact and Gender Equality and Social Inclusion	Inclusive development and impact	Social enterprises with Gender Equality and Social Inclusion	Blue economy	Impact measurement
Sectors	Green economy	All sectors including tourism -	All	Clean energy, education, tourism, health, agriculture, fisheries and water	All sectors	Marine	Blue and green economy with particular focus on sustainable ocean production, ecotourism, and sustainable infrastructure and waste management