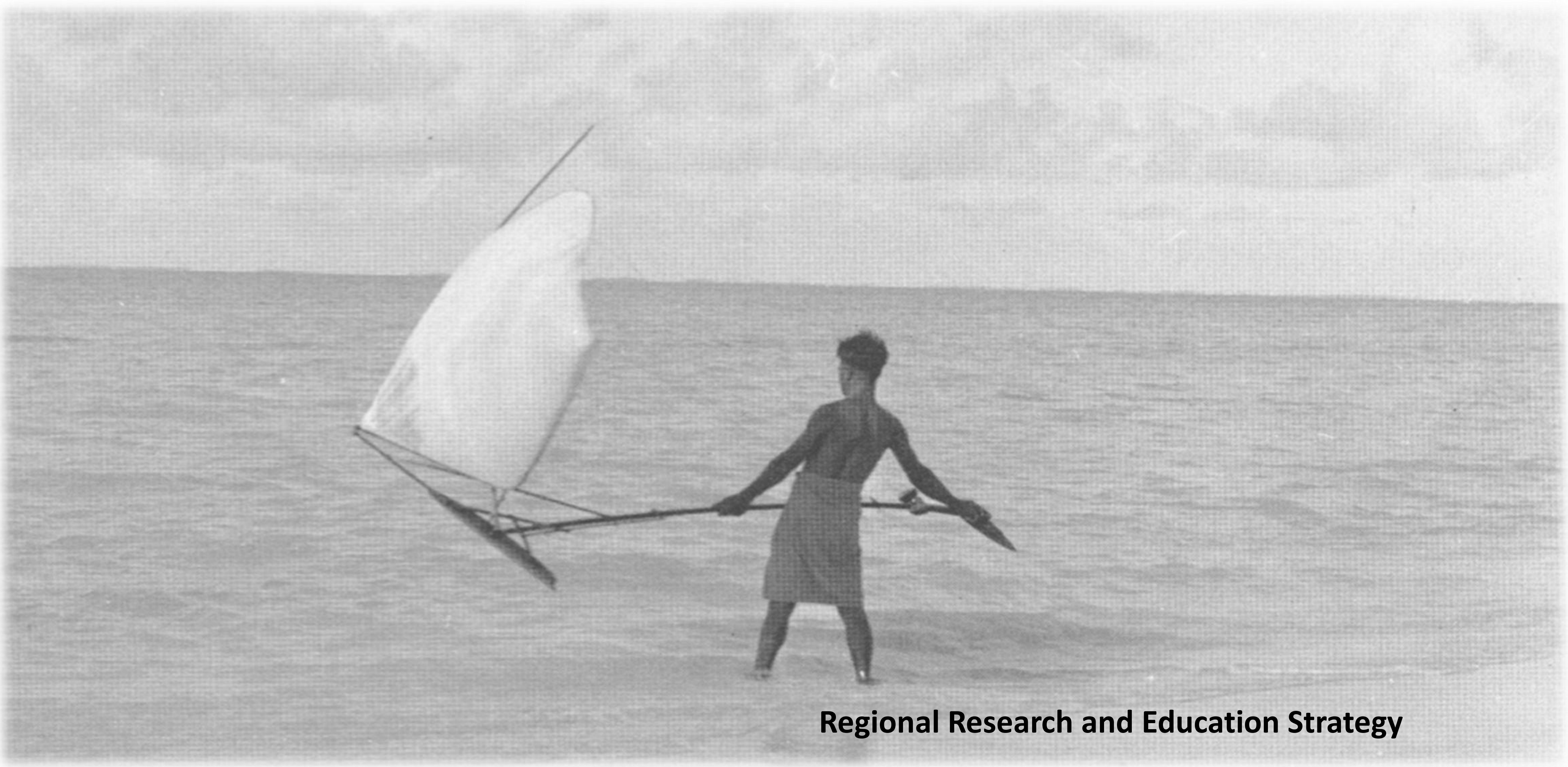
Transitioning to a low carbon sea transport future for Oceania



Regional Research and Education Strategy

February 2014

OCEANIA CENTRE FOR SUSTAINABLE TRANSPORT

Published by: Oceania Centre for Sustainable Transport

Website: www.oceaniatransportcentre.org

For more information contact:

Dr Peter Nuttall

peter.nuttall@usp.ac.fj

Sustainable Sea Transport Research Programme

University of the South Pacific

Laucala Bay Road

Suva

http://www.usp.ac.fj

Mark Borg

Mark.BORG@iucn.org

Oceania Regional Office

International Union for Conservation and Nature

5 Ma'afu Street

Suva

http://www.iucn.org/oceania

Foreword

Contents

Acronyms and Abbreviations

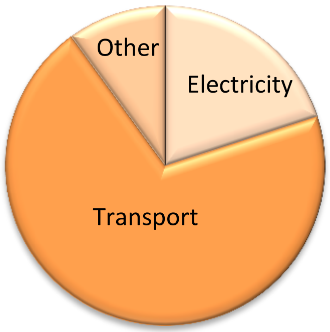
AOSIS	Alliance of Small Island States
CO_2	Carbon dioxide
ECA	Emission Control Area
EEDI	Energy Efficiency Design Index
FAESP	Framework for Action for Energy Security in the Pacific
FATS	Framework for Action for Transport Services
FIVS	Fiji Islands Voyaging Society
GHG	Greenhouse Gas
IMO	International Maritime Organisation
IUCN ORO	International Union for Conservation and Nature Oceania Regional Office
MBM	Market-based Measures
MBI	Market-based Incentives
MEPC	Marine Environment Protection Committee
NOx	Nitrous oxide
OCST	Oceania Centre for Sustainable Transport
PICs	Pacific Island Countries
PIDF	Pacific Island Development Forum
PIFS	Pacific Island Forum Secretariat
PM	Particulate Matter
RRES	Regional Research and Education Strategy
SIDS	Small Island Developing States
SOx	Sulphur oxide
SPC	Secretariat for the Pacific Community
USP	The University of the South Pacific

Rationale for this Regional Research and Education Strategy

The Oceania Centre for Sustainable Transport has prepared this Regional Research and Education Strategy as a means of supporting Pacific Island governments and communities in their efforts to reduce dependency on imported fossil fuels and to transition to a low carbon sea transport future. The sea transport issues facing Oceania, especially at the domestic level, have always presented a particularly difficult issue for PICs to find long-term, sustainable, and cost-viable solutions for, even in periods of relatively low energy costs. The unique characteristics of Pacific shipping (long routes, minute economies, imbalance in inward and outward loadings, financing barriers, high risk, high infrastructural costs, etc) present a greater challenge than for many other countries and regions. Imported fuel prices and the demand for global emissions reduction will continue to rise in the long-term.

There is potential for increasing sustainability in all aspects of the maritime transport sector. Efficiencies are achievable in all sectors of the industry. There are two strategies available to Pacific decision-makers at government, industry and consumer levels: pay increasing penalties and wait until alternative technologies become affordable as 2nd to 5th hand (which will not necessarily be tailored or even appropriate to Oceanic scenarios); or request sufficient domestic and international assistance and investment to develop locally-appropriate low carbon solutions through a coordinated programme. This strategy prioritises the needs of the small-scale local transport users as its initial primary focus.

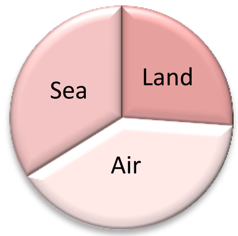
Regional Imported Fuel Use by Sector



The barriers to developing and implementing solutions for sustainable sea transport are complex. This strategy identifies priorities for both research and action across the inter-related fields of policy, economic analysis, technology development and deployment, training and qualifications, regulatory measures and education and research. It requires collaboration of stakeholder and partner interest from international and regional agencies, relevant government departments and ministries, the existing maritime industry of shipping operators, ship builders, maritime insurance, freight forwarders, local communities, researchers, trainers and donor/development partners.

Oceania is the most dependent region in the world on imported fossil fuel. Major investment has been made in reducing fuel dependency for electricity. Transport is currently the 'missing link' in a regional drive to a low carbon energy future. Of the transport sub-sectors, the marine sector should be the first priority, reflecting its critical importance to all aspects of socio-economic development and recognising the growing move toward 'green growth'.

Transport Fuel Use by Sector (Fiji)



Globally there is increasing research and innovation into shipping efficiency. The UN and most development agencies are now calling for reform of transport energy. The seven global Development Banks have mobilised $175 billion for this sector. However, global initiatives do not currently prioritise the critical importance of sea transport for this region and the unique Pacific operating scenario.

This Strategy is a medium-term work plan. It is complementary to existing regional transport, energy, climate change and economic development strategies. It favours a 'bottom-up' approach by focusing first on the domestic scenario of local transport needs. The lack of profile to date on renewable energy transport allows the region an opportunity to learn from the lessons from introduction of renewable energy electricity generation and to develop a region-wide, coordinated and monitored programme of transition in this critical sector.

The Oceania Centre for Sustainable Transport

Our long-term vision is a Centre of Excellence providing coordinated applied research, development and a delivery hub for sustainable transport to service the needs of PICs.

The OCST will fulfil a critical need as the region comes towards the end of the "Millennium Development Goals" and enters an era focused on sustainable development. To this end, the Centre will:

- Work with Pacific Island governments to develop national Sustainable Transportation Roadmaps and Strategies for sustainable transport
- Coordinate research and development
- Develop undergraduate and post-graduate educational programs around sustainable transport solutions
- Build national and regional capacity in sustainable transport policy and planning
- Coordinate expertise in sustainable transport
- Undertake demonstration projects, including independent monitoring and evaluation
- Provide economic modelling and advice on sustainable transport
- Where appropriate, fast track implementation of appropriate technologies and other solutions for Oceania

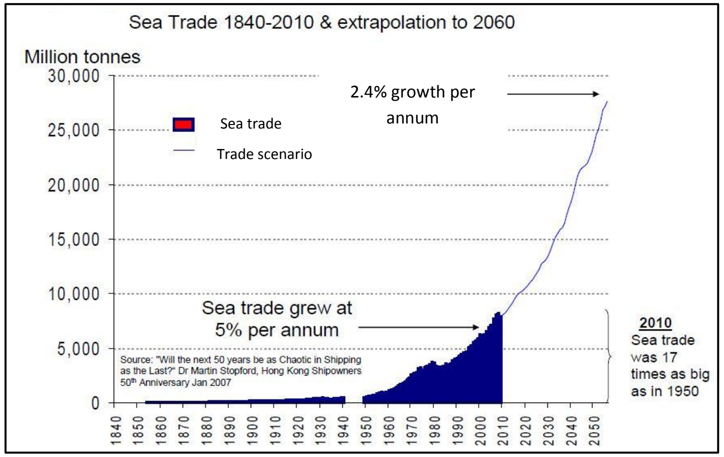
There are a growing number of governments, agencies, organisations and communities who are looking at the issue of sustainable transport in the Pacific and around the world. As regional organisations USP and IUCN ORO are uniquely positioned to provide research and analysis, capacity building, policy advice, and practical trials across the Pacific. Both have strong networks across the region and globally.

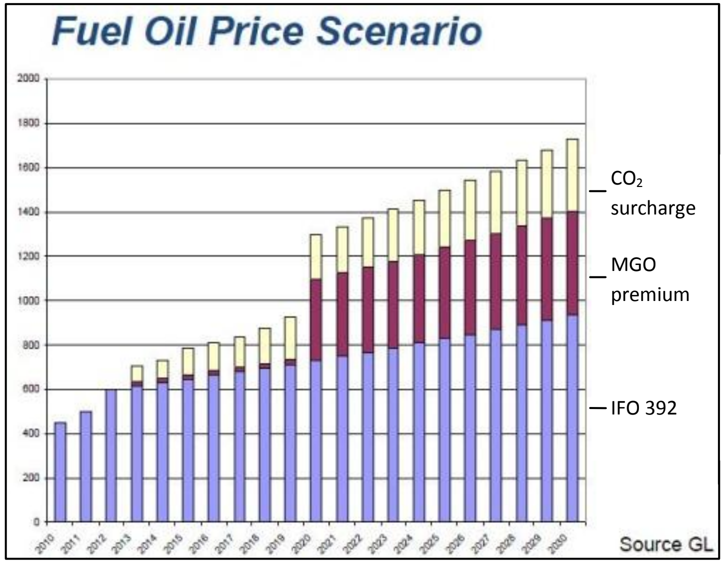
Collaboration is essential and the Centre provides a focal point for those wishing to work together to achieve significant fossil fuel reductions, long-term sustainable transport for the Pacific. USP and IUCN ORO offer the Centre as a catalyst for regional collaboration and invite other partners to join. Fiji Islands Voyaging Society (FIVS) is one such partner who has been actively involved.

Global Drivers

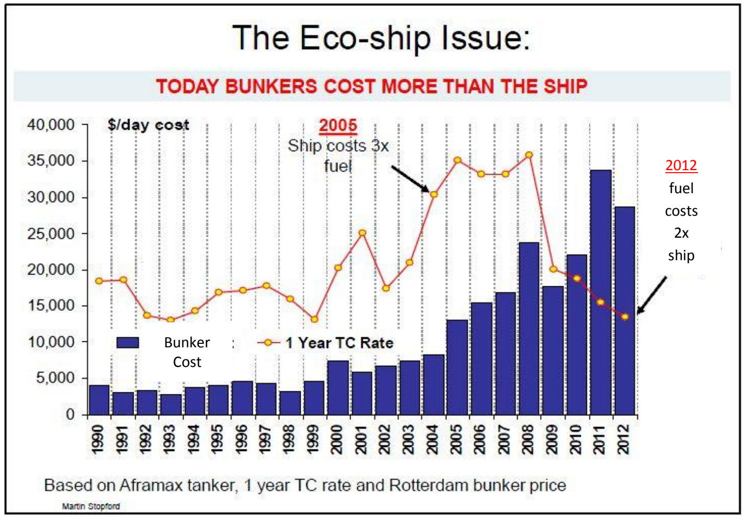
The current transition to an energy efficiency focus for global sea transport is unprecedented since the 1970/80's oil crisis and had 3 primary drivers: cost of fuel, climate change and the health costs from airborne emissions.

Cost of Fuel



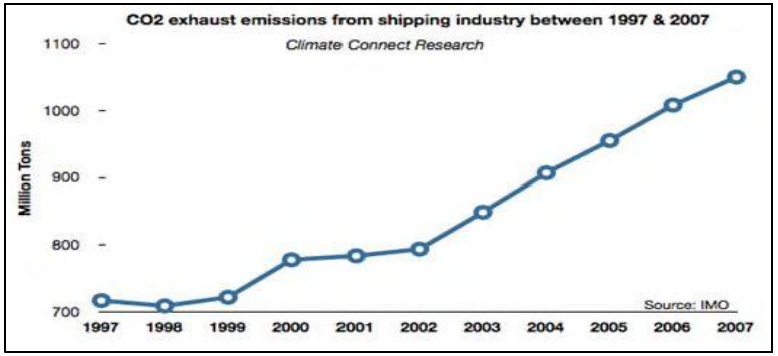


International trade volumes are recovering from the 2006 credit crisis and all projections show steadily increasing cargo volumes and fuel use over time. Since 2007 fuel has replaced capital and operational costs as the key driver of investment decisions. Smaller scale shipping is proportionally more inefficient and fuel is a larger proportion of overall cost. Fuel costs also mean asset and operational cost will increase driven by compliance with new fuel standards or transition to alternative technologies.



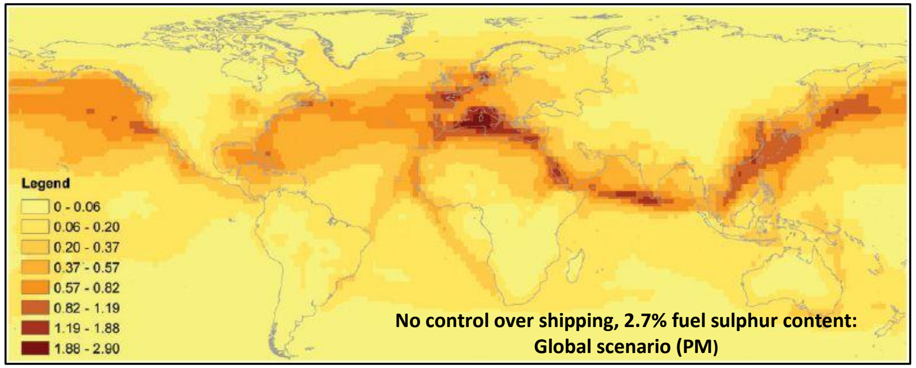
Cost of retrofitting existing assets is usually 2-5 times more expensive than incorporation into new build. There is a current short-term oversupply of world tonnage using existing technologies that is depressing the returns for shipping. Shipping asset has a usual replacement life of 20-25 years and the cost of bunker over the full operating lifespan needs to be considered in all current and future fleet replacement planning. Marine fuel cost is projected to at least double in less than 20 years under the currently proposed IMO framework without including additional penalties of carbon charges.

Climate Change



Shipping is the last major energy sector to undergo regulation for GHG emissions. Industry CO_2 emissions are more than 1 billion tons p.a. and even under optimistic forecasts are unlikely to decrease to the levels needed to meet broadly sanctioned international targets. Shipping currently represents some 3.5% of global GHG totals and is projected to increase to 10-12% by 2050. Carbon efficiency has a strong relationship to ship size. The bigger the ship, the less CO_2 emitted per tonne-mile. Small-scale shipping (<10,000 ton) moves only 4% of world cargo but contributes 26% of all industry emissions. The current IMO regulatory framework provides a stepped programme for reduction in SOx and NOx content in fuel by 2021. Energy Efficiency Design Indexing for shipping has been introduced and regulation of CO_2 and PM emissions will follow. A range of MBM and MBI are now under negotiation. ECAs have been established in Europe and the US with much stricter standards. There will be increased compliance costs to port and flag states. There are major issues connected with the supply of cleaner fuels to all shipping sectors and the availability and cost of emissions reduction technology.

Public and Ecosystem Health



No control over shipping, 2.7% fuel sulphur content: Global scenario (PM)

In addition to the effects of airborne emissions from shipping on climate change, shipping emits disproportionally large amounts of airborne particulates which have an adverse and increasing effect on human and ecosystem health. It is increasingly recognised that these have an enormous public cost, especially to coastal communities. In 2009 shipping emissions were estimated to directly cause 65,000+ deaths p.a. Such risks and costs are becoming increasingly unacceptable. This issue has also been a major driver for the establishment of the ECAs in Northern Europe and the US. The emissions from shipping also lead directly and indirectly to increasing effects on ecosystem health and resilience, especially in the oceans. As a repository of emissions, the primary effects are ocean warming and acidification leading to stressing of species and eventually coral bleaching. Under conditions expected in this century, the compromise of carbonate accretion will see corals becoming increasingly rare on reef systems. Climate change worsens local stresses caused by declining water quality and over-exploitation of key species, driving reefs increasingly toward the tipping point for functional collapse. Globally 30% of all marine species face extinction. For Oceania, with its huge reliance on the bounty of the ocean as a source of protein, basic food security and a high proportion of foreign exchange earnings, this poses enormous threat.

Regional Drivers

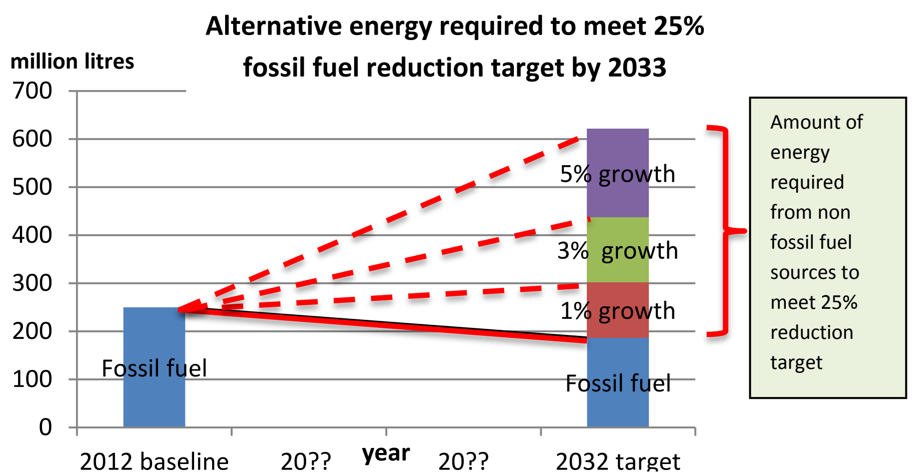
Regional drivers for more efficient and sustainable sea transport are contained in policy on climate change, transport, energy, and economic development. All prioritise the central role of national policies, strategies and legislation in setting the basis for current and future change.

Majuro Declaration for Climate Leadership – adopted at the 44th Pacific Island Forum, Marshall Islands, 2013

Climate change is the greatest threat to PICs. Under the Majuro Declaration, Pacific Island leaders have called for energy revolution and economic transformation to low carbon development as an unprecedented opportunity to enhance security and protect and ensure the sustainability of natural resources and the environment, and to improve people's health. It calls for an upward spiral of action at all levels to urgently reduce and phase out GHG pollution. This includes further development and implementation of policies, strategies and legislative frameworks to climate-proof essential physical infrastructure, adapt key economic sectors and ensure climate-resilient sustainable development for present and future generations.

SIDS DOCK – Small Island Developing States: Island Energy for Island Life

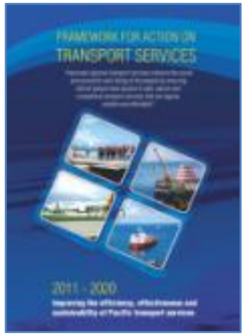
SIDS DOCK is an initiative among member countries of AOSIS to provide SIDS with a collective institutional mechanism to assist them transform their national energy sectors into a catalyst for sustainable economic development. SIDS DOCK identifies a need to mobilize in excess of USD20 billion for clean energy needs of SIDS.



Most PICs have established targets for reducing fossil fuel use in relation to electricity generation by up to 100% (with international investment of over $500m committed to support these). To date, targets for transport fuel use reduction have only been set by the Marshall Islands.

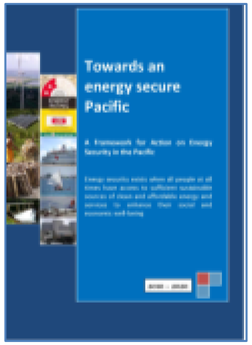
13 PICs are signatories to the SIDS DOCK programme which has set a transport fuel reduction target of 25% by 2033. The SIDS DOCK target 20-year timeframe roughly coincides with the fleet replacement cycle for shipping. Decisions made now for introduction of new asset shipping to the region directly affect the SIDS DOCK target. The graph shows the amount of energy required from alternatives to fossil fuel for Pacific maritime use to achieve this target under 1%, 3% and 5% average annual growth scenarios.

Framework for Action for Transport Services (FATS) and Framework for Action for Energy Security in the Pacific (FAESP)



These two frameworks have been developed by SPC under the mandate of the Pacific Plan and are currently being reviewed. Both champion a "one team, many players" approach.

FATS maps out national and regional priorities and action themes to improve maritime (as well as air) transport in the region. To enhance economic development for Pacific communities through effective responses to transport challenges, gains in the transport sector need to be made at the national level, under strong national leadership. Regional initiatives and interventions should help PICs improve economies of scale and enhance national capacity through implementation of national transport policies and plans.



FAESP outlines a new approach to achieving a collective goal of an 'energy secure Pacific' through urgent action to develop and invest in effective clean energy programmes, both to improve the ability of PICs to withstand and adapt to economic shocks, as well as to contribute to wider efforts on climate change mitigation and adaptation.

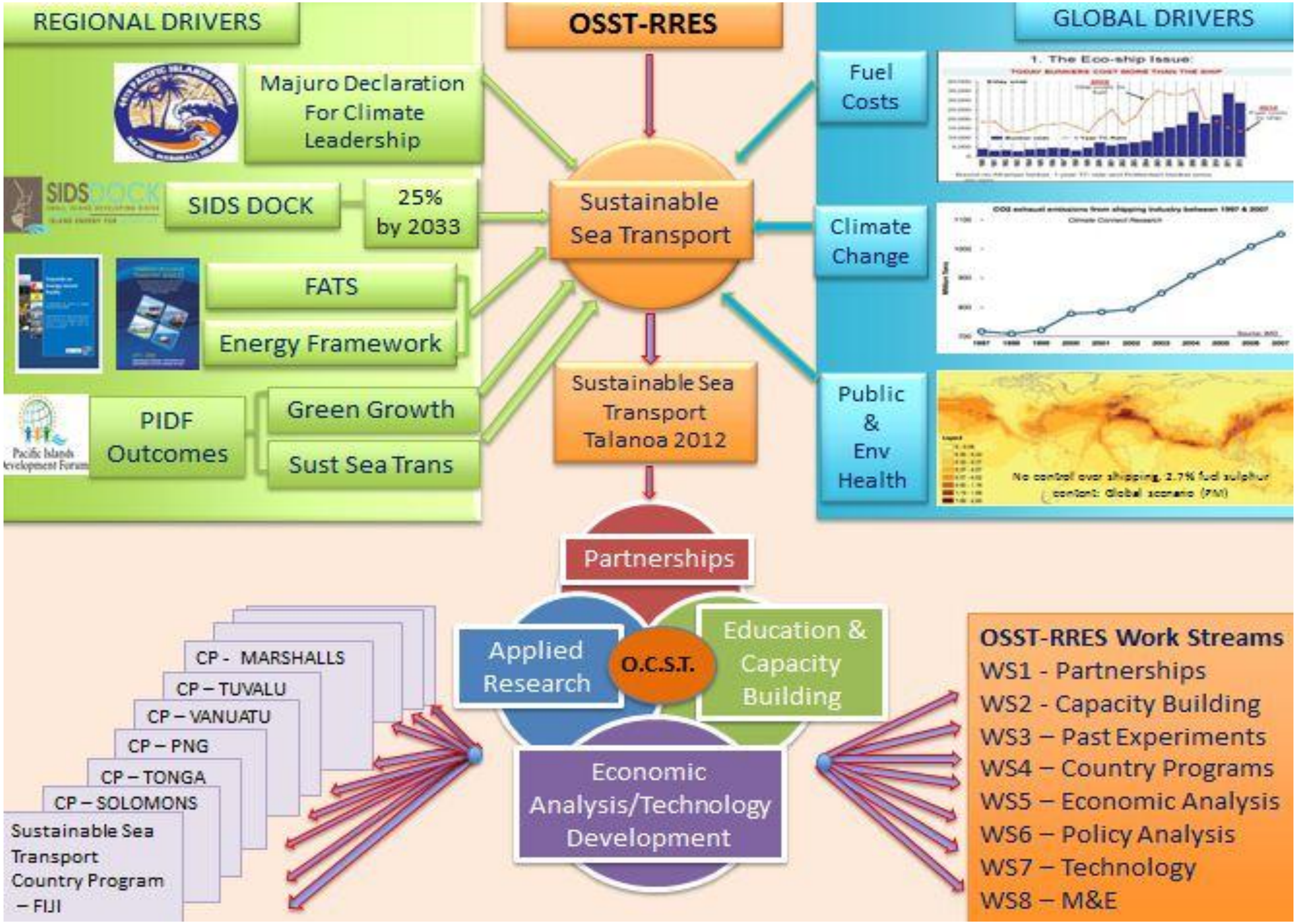
SPC's corporate plans have been aligned closely to the four pillars of the Pacific Plan: economic growth, sustainable development, good governance, and security.

Pacific Island Development Forum

In their communiqué at the inaugural meeting of the PIDF in August, 2013, Pacific leaders noted that the development of sustainable sea transport would reduce the reliance on imported and expensive fuel and thus open up sea routes that today are considered unprofitable to service. The PIDF prioritises transition to Blue/Green Economies as the future development direction for the Pacific. Blue/Green Economies are predicated on the region adopting a transition from current extreme dependency on imported fossil fuels to innovative low carbon technologies. At their inaugural meeting the PIDF endorsed "ten things" that must be done in order to achieve Blue/Green Economies including:

Pacific Islands Development Forum

> *"Prioritise alternatives to existing petroleum driven land and sea transportation that significantly reduce fuel imports. Sustainable sea transport approaches are to be promoted and adopted as an alternative to provide effective services for remote island communities."*


REGIONAL DRIVERS
OSST-RRES
GLOBAL DRIVERS
Majuro Declaration For Climate Leadership
SIDS DOCK
25% by 2033
FATS
Energy Framework
PIDF Outcomes
Green Growth
Sust Sea Trans
Sustainable Sea Transport
Sustainable Sea Transport Talanoa 2012
Fuel Costs
1. The Eco-ship Issue:
Climate Change
Public & Env Health
No control over shipping, 2.7% fuel sulphur content: Global scenario (FMI)
Partnerships
Applied Research
O.C.S.T.
Education & Capacity Building
Economic Analysis/Technology Development
CP - MARSHALLS
CP – TUVALU
CP – VANUATU
CP – PNG
CP – TONGA
CP – SOLOMONS
Sustainable Sea Transport Country Program – FIJI
OSST-RRES Work Streams
WS1 - Partnerships
WS2 - Capacity Building
WS3 – Past Experiments
WS4 – Country Programs
WS5 – Economic Analysis
WS6 – Policy Analysis
WS7 – Technology
WS8 – M&E

Work Programme Overview

The programme for implementing this strategy comprises of four inter-related areas:

- **Partnerships, Networking and Advocacy**: A successful pathway to low carbon shipping for PICs requires a strong country and regional network supported by leading international partners. It requires active collaboration with multiple actors and strong advocacy.
- **Capacity Building and Education**: Empowering today's decision-makers at all levels of Pacific government and industry requires targeted training and exchange, and provision of quality information and analysis. Preparing future decision-makers and embedding in-country expertise through education and internships is also required.
- **Economic Analysis and Technology Development**: Building collaborative programmes with leading international research centres to deliver quality economic and technical analysis and support.
- **Applied Research**: Transition to a low carbon scenario requires proof of concept. This can best be achieved by applying research and development trials in the areas of greatest benefit. A coordinated regional programme allows differing technologies, processes and applications to be tested at differing scales and locations and also monitoring and exchange of knowledge acquired and lessons learnt.

Country Programmes

Developing and supporting country programmes that provide a pathway to low carbon sea transport solutions for individual PICs is the overall objective of this strategy. The Tongan Energy Roadmap is an example of how this approach has been undertaken for the electricity sector. Each country has differing needs and priorities and PICs are at differing stages in policy development and fleet replacement cycles. Country scenarios range from major regional transhipment hubs to atolls without ports. There are also strong regional synergies and similarities. Country programmes require consideration of policy in a number of sectors including energy, transport, climate change, economic development, infrastructure, and disaster management. Work Stream 4 provides a template for developing country programmes with the other work streams providing support, tools, analysis, capacity building and partnerships.

Work Streams

8 primary work streams have been designed to support development of Country Programmes:

WS1 – Regional and International Networks to build long-term partnerships and facilitate exchange with international experts.

WS2 - Capacity Building and Education of current and future decision-makers, planners, industry leaders, operators and regulators.

WS3 – Restart Past Renewable Energy Experiments including retrofits, energy efficient freighters, artisanal fishing and local passenger craft.

WS4 – Country Programmes: Phased development of Sustainable Sea Transport programmes for each PIC.

WS5 – Policy Development: Required across the sector from response to global changes to development and implementation of country policies for transport, energy, climate change and economic development.

WS6 – Economic Analysis: Required across the sector from analysis of the regional implications of IMO regulation compliance to the cost/benefit analysis of individual routes and vessel types.

WS7 – Technology development: Global technology innovation is happening at speed, mostly for large ships. Pacific solutions must target smaller vessels. Renewable energy solutions will play an increasing role.

WS8 – Monitoring & Evaluation: All projects need to be monitored and evaluated so that lessons learnt are available locally, regionally and internationally.

Work Stream 1: Partnerships, Networking and Advocacy – village to global

Sea transport, particularly for domestic use, has long been one of the most difficult sectors for PIC governments to address. The current global scenario of increasing climate change and fuel prices adds greatly to the scale of the dilemma faced by Pacific decision-makers at all levels. No Pacific village, island, country or even the regional collectively has sufficient mass to effect a transition to a low carbon future effectively without strong advocacy by Pacific leaders and without strong inter-regional and international collaboration.

WS1.1 Regional Networks

Networks and partnerships between PICs are essential if knowledge acquired and lessons learnt in one location are to be transferred to others. OCST is designed to facilitate and enable such collaboration through:

- A strong programme of inter-regional exchange between Pacific counterparts in transport and related energy, climate change and economic development sectors.
- The development and use of the Pacific's greatest resource, its people and in particular its graduates, as a tool to empower the processes set out in this strategy through country directed research and internships.
- Harnessing the analytical capacity inherent in regional tertiary and research institutions, particularly schools of economics, business management, climate change, marine studies and technology to provide specialised research support to the practical development of Country Programmes for PICs.
- Providing accurate and appropriate information, knowledge and exchange to Pacific decision-makers at all levels.
- Continuing to host the Sustainable Sea Transport Talanoa as a biennial event.

WS1.2 International Networks

Low carbon shipping is an emerging and fast growing sector internationally, largely led by researchers and industry innovators in developed countries. OCST has worked hard to establish working relationships and information sharing networks with many of these. There is growing interest from these quarters in now assisting Pacific countries in addressing the unique issues of the Pacific. OCST will:

- Continue to work with existing and new international industry and research partners to share knowledge, information and data.
- Implement collaborative research programmes with leading international partners.
- Establish international exchange programmes with postgraduate students, researchers and officials.

Work Stream 2: Capacity Building and Education

Capacity building and education is critical to the longevity and overall success of any transition. Providing Pacific Island decision-makers (whether village chief or UN diplomat) with the skills, knowledge and analysis to make informed choices is critical. This includes provision of information in a form that is appropriate and relevant, and this will vary widely across the Pacific community. This work stream emphasizes formal and informal training to build such capacity; targeting current and future decision makers, policy and planning advisors, international negotiators, regional and national officials (e.g. those working in fields of transport, energy, environment, climate change and strategic planning), industry managers and operators, advisors, and financers.

WS2.1 Growing Current Human Capacity

- Providing a regional knowledge and information repository and dissemination hub as a conduit between village and globe.
- Conducting an ongoing series of workshops/talanoa, policy briefings and short courses on sustainable sea transport and the opportunities and implications for Oceania, ranging from international policy (e.g. IMO) to real world village level implementation.
- Establishing and maintaining relationships and exchange inter-regionally and with leading international researchers and industry innovators.

WS2.2 Developing Future Human Capacity

- Developing inter-regional and international exchange programmes for research and operational staff development.
- Integrating new undergraduate papers into existing programmes in Economics, Marine Studies, Climate Change and Technology.
- Creating a multi-disciplinary programme of postgraduate development and applied research to support developing and implementing Country Programmes.
- Providing postgraduate (PG Dip, Masters and PhD level) courses and directed research and internships with the necessary support (e.g. scholarships, internships, work placements, student exchanges).

Work Stream 3: Restart Past Renewable Energy Experiments

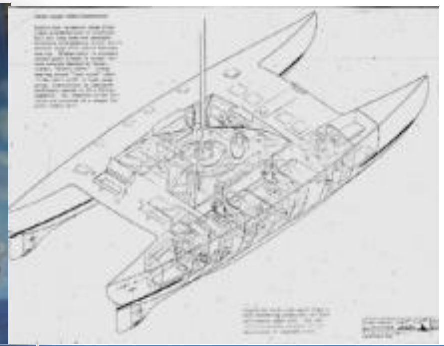
The current efficiency revolution for global shipping is unprecedented since the 1970/80's oil crisis. Responses at that time included a small number of critical experiments and projects in the Pacific. Although the abrupt end of the crisis curtailed all public investment in such programmes, those experiments were demonstrating significant fuel savings and additional benefits. The primary target of these initiatives was at local village and island level, primarily for local transport and artisanal or small-scale commercial fishing.

These experiments were achievable through the innovation of a number of Pacific governments, UN agencies, NGOs, ADB and EU. The records of those experiments have left a portfolio of analyses and vessel designs and most projects could be reactivated, in most cases incorporating advances in technology that have occurred in the interim. Overall, this portfolio of projects demonstrated that in times of high fuel cost, use of renewable energy technologies, where possible locally sourced and developed, achieved results for modest investment and usually with a high Investment Rate of Return. There were critical lessons learnt in each example that need to be now fully evaluated. In all cases the need to demonstrate direct economic efficiency to local communities was paramount. Recent research shows that while corporate memory of these projects may have faded for the agencies involved, the communities still remember and retain knowledge of these programmes and in several cases would welcome their reintroduction.

These projects are an obvious starting point for a practical programme of retrofit and new design small-scale vessels. Ideally the same development agencies would be encouraged to recommit to the same project areas.

The project design for each need to follow a similar path:

1. Review previous project and outcomes, noting recommendations from previous analysis of findings.
2. Undertake current transport surveys and needs assessments of target communities.
3. Review build designs for appropriateness and potential new advances in technology. Preference to be given to local sourced materials, build and servicing ability.
4. Determine capacity of local communities to manage and operate vessels and implement capacity building programmes to suit local requirements.
5. Commission and construct vessels.
6. Monitor, evaluate and maintain on-going programme support.



PROJECT	Description	Outputs	Agencies	Comments
Fiji soft sail retrofit	Auxiliary rig retrofitted to two government vessels of ~300t. Rigs built and installed in-country	Fuel savings 23-30%, but also 30% engine/prop wear reduction, greater stability, incr passage times. IRR on best route = 127%, average route = 30%	ADB, Southampton University	Provides historical wind data for all Fiji routes and produced fuel saving ratios for all routes.
Lau passenger / cargo	50 ton primary sail powered trading vessel, designed and built on Kabara by local builders (1984-87). First of 3 planned vessels	*Tai Kabara* became the main vessel operating on the Southern Lau route until she was scuttled in 2006. Used local materials wherever possible.	European Union	Construction of the other two ships was cancelled when the oil crisis abated.
Ha'apai Freighter	Needs assessment and design analysis led to commissioning of build plans for a 100 ton energy efficient freighter	Needs assessment, transport census and full build plans for a 100 ton energy efficient freighter.	UNESCAP, UNCTAD, UNDP, ADB	Vessel never constructed due to end of crisis. Similar needs assumed today.
SCF / Jim Brown	Save the Children Fund Tuvalu employed catamaran designer Brown to develop locally built boats for Tuvalu/Kiribati	Range of designs and processes for locally built/ operated catamarans for artisanal and commercial fishing and local and inter-island transport. Training of local shipwrights. Local materials favoured	SCF	This project closely associated with the FAO/UNDP project. Local build/materials used wherever possible. Fuel savings up to 60%.
FAO / UNDP	A multi-county fisheries programme to develop RE artisanal and small-scale commercial vessels for local community benefit.	A portfolio of 10 designs from single dugouts to 11m trimarans. 350 vessels built in 8 countries. Demonstrated need for vessels to be affordable and locally appropriate.	FAO UNDP	Uptake ceased with end of project. Communities with 'living tradition' of sail had greatest uptake.

Work Stream 4: Country Programmes

Country Programmes (CPs) will provide a national integrated framework for transition to a low carbon sea transport future. CPs will vary according to the specific country situation. CPs will follow generic development of a matrix-based approach across six primary sectors:

- **Policy:** The CPs are designed to feed into and support existing and future national policies and strategies for transport, energy, climate change and sustainable development; support development of sub-national strategies (particularly for maritime communities) and inform national negotiating positions in regional and international fora.
- **Economic analysis:** Macro and micro analysis of national and sub-national maritime transport fuel use; case study analysis of representative local and international routes; determine viability of new generation technology including Investment Rate of Return; assessing cost/benefit at community and national levels of transition to low carbon marine transport.
- **Technology:** Practical trials of 'proof of concept' alternative technology, as both retrofit and new build options. This will target community or sector-based pilot programmes in response to previous experience or expressed interest e.g. Ha'apai, Nuia – Tonga; Lomaiviti, Lau, Rotuma – Fiji; Oro Province, Milne Bay, Manus Is – PNG; Malaita – Solomons; Kwajalein, Fisheries – Marshalls.
- **Education and Training:** Building the in-country capacity of current and future decision-makers, planners and regulators in governments, communities and industry and greatly improving their access to existing and emerging information and analysis is the key to long-term sustainability. This strategy preferences use of in-country expertise through bonded postgraduate applied research programmes and international exchange over hire of short-term external consultants.
- **Heritage Revitalisation:** "*We carry the cultural and historical inheritance of ocean navigators of peerless skill and their courageous kin who crossed vast distances before the tribes of Europe had ventured forth from their small part of the earth"* - Ratu Kamisese Mara. Prowess in seafaring and navigation and excellence in vessel design innovation from a minimalist resource base is the greatest technical heritage legacy of Pacific cultures. Revitalisation of this heritage at country and community level provides an iconic means of promoting use of renewable solutions.
- **Additional Research Targets:** Includes country specific objectives; for example, Malaita in the Solomons is a traditional centre of wooden boat building excellence. How can this resource be harnessed to provide low carbon shipping solutions for Malaita and the rest of the Solomons today and tomorrow? Does Fiji's molasses by-product from sugar processing provide a renewable energy source for Fiji shipping?

OCST-RRES Country Programme Framework: Fiji

	Policy								Economics							Heritage			Practical Trials				Teaching			Additional Research
	Strategic				Infrastructure				Fiji route case studies				International route case studies										Practical	Theory		
	International	Regional	National	Agency	Qualifications	Survey	Licensing	Finance: tax, insurance	Southern Lomaiviti	Kadavu	Lau	Rotuma	Central Polynesia	MSG	Micronesia	Traditional Knowledge	Vessel construction	Voyaging	SVV (Sustainable Village Vessels)	100 ton cargo/pax	200-300 ton freighters	Retrofitting Sail/Rotor rigs		Undergraduate (Dip , Bachelors)	Postgraduate (Dip, Masters, PhD)	
Relevant Plans	IMO regulations – MARPOL Annex VI and associated MDM/MMBIs	Pacific Plan; FATS; FAESP; etc	Transport, Energy, Climate Change; economic Development policies/plans,	World Bank; ADB; UNESCAP; UNDP; Bilateral donor strategies; etc	Master/crew. Intentional standards, MSAF standards	MSAF regulation	MSAF, FIRCA												Design, Build, Pilots, Ops, Ownership/Management models	Design, Build, Pilots, Ops, Ownership/Management models	Lease Pilot for trials. Ownership/Management models	Sail and Rotor designs, testing	Seafaring (Mariner – Master IV), Construction, Naval Architecture, Engineering, Survey, Heritage)	Economics, Marine Studies, Physics, Technology, Climate Change, Law, Pac Studies, History		Data collection (all sectors), MARPOL Annex VI, Carbon Trading (financial mechanisms), Flettner technology, Electric motors, Franchise/Subsidies, emerging technologies
Scoping (current, gap analysis, needs analysis)																										
Research / Action Project Plan																										
Monitoring and Reporting Framework																										

Work Stream 5: Policy Development, Analysis and Implementation

Ensuring a comprehensive, robust and integrated policy framework at all levels is key to improving energy efficiency in the sea transport sector. National level policy is the primary driver of action and change for Oceania. New policy to direct a revolution in sea transport towards a low carbon model appropriate and affordable to PICs needs to be cognisant of international policy and build from existing regional and national strategies. Some aspects of existing policy will require little or no change, (ship safety for example is always going to be a universal and dominant policy driver regardless of the technology used). Other aspects, (e.g. political prioritisation of investment by governments and international partners) may require significant realignment.

Transitioning to a low carbon transport future requires a cross-sectoral approach, involving transport, energy, economic development, climate change and financing. National policies need to ensure all are aligned to common targets. Various policy initiatives have been developed for the Pacific maritime sector. While there is passing reference to renewable energy technologies and 'greening' of port side infrastructure, in general terms policy development toward low carbon and other blue/green economic development is currently lacking. Policy can be divided into strategic policy (overall political direction and priority) and infrastructural policy (the regulatory and practical measures needed to achieve or comply with strategic policy). The shipping sector at all levels is becoming increasingly complex and regulated. PIC governments have increasing needs for policy and planning across the sector and from international to village levels. PICs role as flag states allows them a strong platform for advocating the unique position SIDS face under international regulation and for stronger efforts to curb the threat of global warming that shipping collectively contributes to.

WS5.1 Policy - Capacity Building

- Capacity building via targeted training, policy briefings, regional and international exchange and knowledge dissemination to current decision makers, policy analysts, national and sub-national planning units (in transport, energy, climate change, economic development), industry managers and advisors.
- Introductory undergraduate papers in policy and planning and sustainable development.
- Multi-disciplinary postgraduate programmes in policy and planning including directed research and internships.
- International postgraduate exchange at Masters/PhD level.

WS5.2 Policy - Research Priorities

- Compensatory mechanisms for intentional emission regulations and MBM for SIDS.
- Introducing international CO_2 and GHG emission targets for shipping.
- Tools and templates for CPs including policy preparation for national transport, energy, climate change, economic development strategies.
- Knowledge acquired and lessons learnt from electricity energy policy development and regulation that can be applied to sea transport sector.
- Analysis of the role of governments and the private sector in providing shipping services.

Work Stream 6: Economic Analysis

Inadequate transport continues to exacerbate poverty and inequality, inhibiting access to schools, healthcare, markets, and job opportunities. Yet despite the importance of the transport sector, which also directly contributes 5-10% of GDP in most countries, it has been largely neglected in the global sustainable development agenda. Transport in developing countries is the one of the largest, and fastest growing, source of GHG emissions. Transport-related CO_2 emissions are expected to increase by 57% by 2030, and it is estimated that transport (passenger and freight) in developing countries will contribute about 80% of this increase. At the same time transport is largely missing in climate change mitigation policies and actions worldwide and in particular those aimed at developing countries. The need for sustainable sea transport is vital for regional cooperation and integration; economic integration depends on connectivity between countries. More sustainable shipping is not only expected to boost connectivity between countries but within countries as well. Air transport is likely to remain underdeveloped in the Pacific and even if it improves it is unlikely to provide an effective substitution for sea transport. The future of PIC economies and potential for trade will depend on sea transport for the foreseeable future. A transition to low carbon shipping in the Pacific must be underpinned by strong macro and micro economic analysis and the development of an economic tool kit for national and sub-national decision-makers and planners. This needs to model not only the cost and benefits of using low carbon technology but also the wider implications for national economies of not making such a transition, the benefits to secondary industry and support services of more accessible and affordable transport, global modelling including regional cost and compliance, and the ramifications of compensatory mechanisms for PICs arising from MBMs for emissions control.

WS6.1 Capacity Building

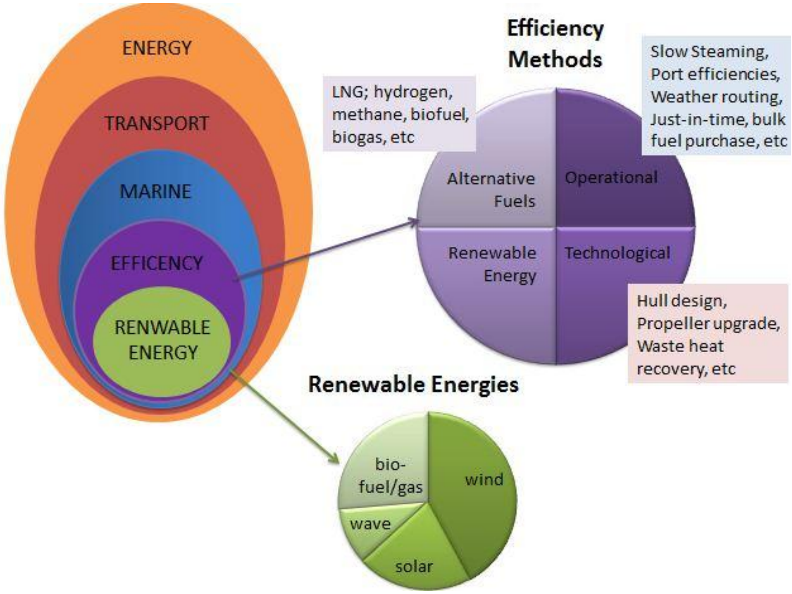
- Targeted training, policy briefings, regional and international exchange and knowledge dissemination to current decision-makers, economists, policy and business managers and advisors servicing the sector.
- Introductory undergraduate papers in Economics and Business Management.
- Multi-disciplinary postgraduate research programmes including country directed research and internships and international postgraduate exchange.

WS6.2 Research Priorities

- Compensatory mechanisms of MBM for SIDS, shipping subsidies and the role of financing in transitioning to a low carbon shipping future.
- Economic cost/benefit modelling of projects in WS3.
- Economic tools and templates for Country Programmes.
- Case studies of cost benefit analyses of introducing renewable energy technology for maritime communities’ transport needs and cost benefit analyses of low carbon shipping for intra-regional trade.

Work Stream 7: Technology Development

Global shipping innovation is happening at speed, led by Northern Europe. Most research investment is in large-scale shipping for global trade. Efficiency measures can be grouped into operational, technological, alternative fuels and renewable energy. Operational measures such as slow steaming are already being used. Technology advances such as improved hull design are largely restricted to new ships and the cost of retrofitting equipment for reducing emissions or using alternative fuels is likely to be prohibitive. Because renewable energy has greatest returns for smaller vessels and as most alternative fuel technologies require expensive new storage and supply infrastructure, renewable energy solutions are likely to be more important in the Pacific. Technology is not the limiting factor. Because vessels are smaller and trade volumes are low, use of alternative fuels such as LNG or methane is likely to limited in the Pacific, with the possible exception of major trade routes and PNG. If the Pacific is to take advantage of new technologies, local researchers and innovators must keep abreast of global developments and ensure they are suited to the region. Building enduring partnerships with international research institutions and Centres of Excellence is critical; fortunately many are offering to help.

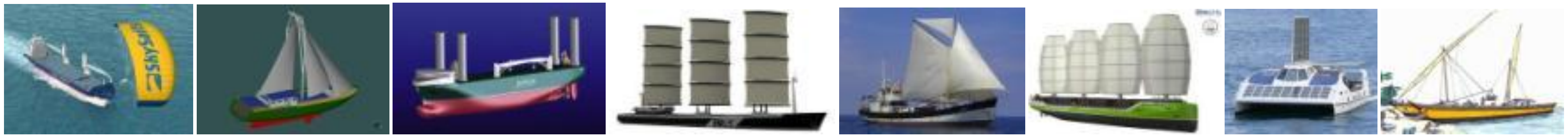


WS7.1 Capacity Building

- Capacity building and knowledge dissemination to current decision-makers and planners in governments and industry.
- Introductory undergraduate papers in technology and multi-disciplinary postgraduate programmes in policy and planning.
- International postgraduate exchange at Masters/PhD level.

WS7.2 Research Priorities

- Technical support, monitoring and evaluation of the projects listed in WS3.
- Selection and adoption of technologies most suited to Oceania's domestic shipping scenario.
- Use of locally sourced and appropriate bio fuel/gas and related technologies.
- Practical trials of renewable energy technologies, including retrofitted soft sail, fixed wing and rotor technologies on passenger/cargo and fishing vessels.



Work Stream 8: Monitoring and Evaluation

Renewable energy applications for shipping, both in Oceania and globally, are not a new initiative. In fact, recent European research has been tracking the development of such innovation and its relationship to global energy shocks back to the 1920s. In the Pacific there has been a long history of such projects, for example, the *MV Tuncurry* which was brought into service on the Samoa-Tokelau route in 1909 was retrofitted with a sailing rig to address the difficulties of adequate coal bunkering at the time.

Some initiatives, such as the retrofitting of passenger/cargo vessels in Fiji in the mid 1980s, have been extremely well documented and analysed. Others have been poorly reported or evaluated, sometimes making claims of savings or benefits that are not supported by solid research. Still others were never formally recorded. In general terms, successful programmes get reported and 'failures' tend not to be. This means it is difficult to fully understand the lessons learnt from past trials and initiatives.

As issues of sea transport will remain critical for PICs for the foreseeable future, it essential that work undertaken now is fully monitored and evaluated – whether such projects are deemed successful or not – and a repository of such knowledge kept to inform both current and future work in this area.

There is also a tendency with renewable energy projects generally to claim that because they use energy sources that are not fossil fuel based they are therefore 'cleaner' or more cost effective than alternatives. It is essential that analysis of the costs and benefits of such initiatives are fully evaluated before making any claim that they are better, cleaner or cheaper than other options. For example, vessels that use renewable energy propulsion but have a high carbon construction footprint may not necessarily be any greener or more efficient than using fossil fuel powered motors.

Consequently OCST will:

- Build comprehensive monitoring and evaluation frameworks into all work it undertakes and encourage our partners to do likewise. Where resourcing allows this will include independent review of all work undertaken.
- Establish a repository of past and future projects and related analysis and evaluation concerning sustainable sea transport from both Pacific and international experience.
- Establish best practice in monitoring and evaluation for this sector, including use of postgraduate research and exchange with leading international institutions to monitor and evaluate initiatives under this Strategy. Evaluation of costs and benefits will use a quadruple bottom line approach (economic, environmental, cultural and social).
- Publish peer-reviewed results of all projects undertaken under this Strategy.

Financing and Resourcing

This Strategy has been prepared by the Oceania Centre for Sustainable Transport to meet an urgent and critical need for PICs in the face of increasing global climate change and extreme regional imported fossil fuel dependency**.** The work programme is envisaged to be on-going with the 8 work streams described constituting the initial work priorities for the next 3-5 years. This strategy is currently unfunded, and the various components will be implemented as funding and support is secured.

Implementation of this Strategy is anticipated to cost in the order of $25-40 million. To place this in perspective, more than $500 million has been committed by the international community for programmes to substitute fossil fuel for electricity generation in the Pacific. Electricity has been the highest priority to date due to the perception that gains in this sector are 'the low hanging fruit' of Pacific energy use. It is now time to address transport, the major energy user in the Pacific.

Investment in transitioning to a low carbon sea transport future needs to be offset against the ever increasing cost of maintaining a "business as usual" approach and the potential for a low carbon model to produce real and quantifiable benefits to Pacific communities, in particular those currently most isolated and disadvantaged. Such costs and benefits need to be measured across the sector as a whole (including construction, maintenance, secondary industries, etc.) as well as the transport service itself, and across economic, environmental, social and cultural well-beings.

Achieving sustainable transport will require the coordinated efforts and support of multiple donor/investment partners. The April 2013 Auckland Pacific Energy Forum demonstrated this is achievable for the electricity sector. UN Secretary General Moon announced in late 2012 that the global Development Banks have mobilised $175 billion for transformation of the energy used by transport. In addition there is acknowledgement, despite the lack of implementing mechanisms, that global regulation of shipping emissions is extremely likely to have a disproportionate financial effect on SIDS, and PICs in particular, which will need to be compensated for.

Providing initial funding to generate momentum in a transition to low carbon Pacific sea transport is needed now. The 2012 Barbados Declaration includes:

> *"9. Further emphasize that there are commercially feasible options for providing energy such as wind, solar, geothermal, and ocean energy, and that many SIDS are particularly suited to these options because of their geographical location. However, these technologies must be made, accessible, affordable and adaptable to the needs and particular circumstances of SIDS communities. In this regard, we strongly urge the international community, particularly developed countries, to ensure the provision of financial resources, technology transfer and capacity building to SIDS."*

Implementation Plan: 2014 - 2016

Work Stream	Activities	Outputs	Timeline		
			2014	2015	2016
1: Partnerships, Networking and Advocacy	Establish Oceania Centre for Sustainable Transport	USP/IUCN Centre	X		
	Develop website for Centre	Website	X		
	Advocate Sustainable Transport and work of Centre	Advocacy material	X		
	Sustainable Sea Transport Talanoa	Talanoa, papers, presentations, Talanoa Report	X		X
	Enrol new national, regional and international partners	New partners enrolled	X	X	X
2: Capacity building and Education	Workshops	At least one workshop per year	X	X	X
	Policy briefings	Policy briefings prepared for all PICs	X	X	X
	Design Short Courses	Short Courses developed	X	X	X
	Deliver Short Courses	At least one course per year		X	X
	Postgraduate Courses provided by USP	At least 2 students per year	X	X	X
3: Restart Past Renewable Energy Experiments	Assessment of Past Experiments	Review Report	X		
	Transport Surveys	Report of Findings	X		
	Needs Assessments	Report of Findings	X		
	Review designs	Revised designs	X		
	Construction of Renewable Energy vessels	At least one per programme country		X	X
4: Country Programmes	Design Fiji Country Programme	Fiji Programme	X		
	Design Tonga Country Programme	Tonga Programme	X		
	Design RMI Country Programme	RMI Programme	X		
	Design Nauru Country Programme	Nauru Programme		X	
	Design Vanuatu Country Programme	Vanuatu Programme		X	
	Design Kiribati Country Programme	Kiribati Programme		X	
	Design Solomon Islands Country Programme	Solomon Islands Programme		X	
	Implementation of Country Programmes		X	X	X
5: Policy Development	Develop Regional Strategy	Strategy document	X		
	Workshops for policy makers	At least two Country Policy Workshops per year	X	X	X
	Assist government with development of national strategies	National Strategies of programme countries		X	X
	Analyses of Public/Private ownership of Shipping services	Report		X	
6: Economic Analysis	Conduct Economic/Cost Benefit modelling studies	Economic/Cost Benefit modelling studies of projects		X	
	Develop economic tools and templates for Country Programmes	Country specific tools and templates		X	
7: Technology Development	Undergraduate papers produced by USP students	Published papers		X	X
	International Postgraduate Exchange by USP	At least 1 student per year		X	X
	Trials of renewable energy technologies for shipping			X	X
8: Monitoring and Evaluation	Develop monitoring and evaluation framework	M&E Framework	X		
	Develop monitoring plan	Monitoring Plan	X		
	Update framework and plan	Framework and Plan updates		X	X
	Document best practices	Best Practices Reports		X	X
	Peer reviews of OCST projects	Peer Review Reports		X	X

USP Supporting Publications:

Holland, E. et al (2014) Connecting the Dots: Policy Connections between Pacific Island Shipping and Global Carbon Dioxide and Pollutant Emission Reduction*, Carbon Management* 5(1) 99-105.

Newell, A and Bola A (2014) Solodamu: A Survey of Fuel and Transport Use in a Coastal Village on Kadavu, Fiji, submitted to *Journal of Pacific Studies.*

Prasad, B. et al (2013) Sustainable Sea Transport Research Programme: Toward a Research-based Programme of Investigation for Oceania, *Journal of Pacific Studies* (33): 78-95.

Nuttall, P. (2012). Steering a course for the future with sticks, stones, grass and a little sharkskin: The case for revitalisation of sail technology and sailing culture, *Journal of Pacific Studies* (32): 163–175.

Nuttall, P. et al (2014) A Review of Sustainable Sea Transport for Oceania: Providing context for renewable energy shipping for the Pacific, *Journal of Marine Policy* Vol. 43 (Jan 2014) 283-287.

Nuttall, P. et al "*Policy and Financing – Why is Sea Transport Currently Invisible in the Search for a Low Carbon Future for Pacific Island Countries?*" in Asia Pacific Viewpoint Manuscript No. APV-2013-055 – currently under review.

Nuttall, P. and Kaitu'u, J. (2014) *"The Magnus Effect and the Flettner Rotor*" submitted to *Journal of Pacific Studies*.

For information on the **Sustainable Sea Transport Talanoa 2012** including programme, Outcomes Record, presentations, see https://www.usp.ac.fj/index.php?id=12456

For information on the **Sustainable Sea Transport Talanoa 2014** see https://www.usp.ac.fj/index.php?id=14096

For information on the **Oceania Centre for Sustainable Transport** see https://oceaniatransportcentre.org

Other Sources:

Wilensky, M. (2014) Authority of Pacific Island States to Regulate Greenhouse Gases from the International Shipping Sector, *Columbia Law School: Centre for Climate Change. http://web.law.columbia.edu/sites/default/files/microsites/climate-change/cccl shipping_emissions_in_the_pacific_white_paper_2-3-2014.pdf*

Buhaug, Ø. et al. (2009) *Second IMO GHG Study 2009.* London: International Maritime Organization.

International Council on Clean Transportation (2011) *"Reducing Greenhouse Gas Emissions from Ships: Cost effectiveness of Available Options".* Washington: ICCT.

Fuglestvedt, J. et al (2009) Shipping Emissions: From Cooling to Warming of Climate – and Reducing Impacts on Health, *Environ. Sci. Technol*., 43: 9057–9062.

Lloyds Register (2012) What is the future of shipping? *Horizons,* Special Supplement February 2012. Retrieved January 22, 2014.

Mofor, L. et al (2013) *Pacific Lighthouses: Renewable Energy Roadmap for Islands.* IRENA, Bonn.

Peters, K. et al (2012) Aerosol indirect effects from shipping emissions: sensitivity studies with the global aerosol-climate model ECHAM-HAM, *Atmos. Chem. Phys*., 12: 5985–6007.

Rehmatulla N. et al (2013) Implementation Barriers to Low Carbon Shipping. *Low Carbon Shipping Conference, London 2013.*

Royal Academy of Engineering (2013) *Future Ship Powering Options: Exploring alternative methods of ship propulsion.* Royal Academy of Engineering, London.

Smith, T. et al (2013) Analysis techniques for evaluating the savings associated with wind assistance. *Low Carbon Shipping Conference London 2013,* UCL, London.