

Introduction

The increasing presence of plastic marine debris in the South Pacific Ocean is focusing attention on strengthening recycling policies and systems in the region. Unique challenges associated with shipping commodities of low value over long distances to recycling markets, however, reduce the economic viability to do so. This country profile includes the current technologies, material flow, logistics, public policies, institutional framework, financial mechanisms, and initiatives that are being designed or have been implemented to strengthen recycling systems in Samoa.

Samoa comprises an archipelago of islands covering an area of 3,000 square kms with a combined coastline of 403 km. It is situated in the central South Pacific region, forming part of Polynesia. There are 10 islands, six of which are uninhabited. The majority of the population lives on Upolu Island, where the centre of government and the country's capital of Apia are located. The Samoan Islands are generally rocky, with volcanic soil from which lush vegetation grows. The islands are ringed by coral reefs and shallow lagoons.

Socioeconomic background

The country offers low-impact tourism activities such as cycling, scuba diving, fishing, and surfing. Visitors numbers (139,043 in 2015), increased 5.6% over the previous year (SPTO, 2015), and 9.4% in FY2016. Tourist accommodation, such as resorts, hotels, and beach *fales*, contribute to the volume of waste on the islands.

Samoa has two levels of government. The central government is a modern, state system, while the village local administrations are based on traditional structures. The latter is an expansive system that comprises 286 traditional and 56 nontraditional village councils.

Samoa's gross domestic product (GDP) in 2015 was US\$5,930 per capita (OEC, 2017). It had a trade balance deficit of US\$356 million in the same year, with exports at US\$83 million (-1.2% annualised) and imports at US\$439 million (+1.2% since 2010).

The primary export market destinations for 2015 were Australia, American Samoa, Colombia, New Zealand and the United States. The main import origins for the same year were Australia, the People's Republic of China, New Zealand, Singapore and the United States. (OEC 2017).

Samoa's economy increased by 6.6% in FY2016, driven by a 41% increase in fisheries, as a result of a newly established local fishing operation. With recent increases in visitor numbers, hotels and restaurants grew by 36.9%. Transport also grew by 21.9% (ADB 2017).

Building construction, food manufacturing, and beverages increased substantially. As such, contributions to GDP were led by the services sector. Manufacturing contributed approximately 7.7% to the economy, indicating the level of value addition of the industry, and the consequent support of the utilities sector (GlobalEDGE, 2017).

Samoa's total population was 192,196 in 2016 (GoS, 2016). A rural population of approximately 80%, or 153,756, was predominantly living in villages on the coastal fringes of the islands (Knoema, 2015). The approximate population distribution shown in the table below is based on Samoa's 2016 Census.

Samoa		
Island	Urban	Rural
Upolu	Apia 35,454	111,730
Savai'i		43,819
Manono		1,118
Apolima		75
Fanuatapu, Namu'a, Nu'utele, Nu'ulua and Nu'usafee	Non populated	

Source: Village Directory 2016: Census 2016 Preliminary Count. Samoa Bureau of Statistics.

Solid waste management

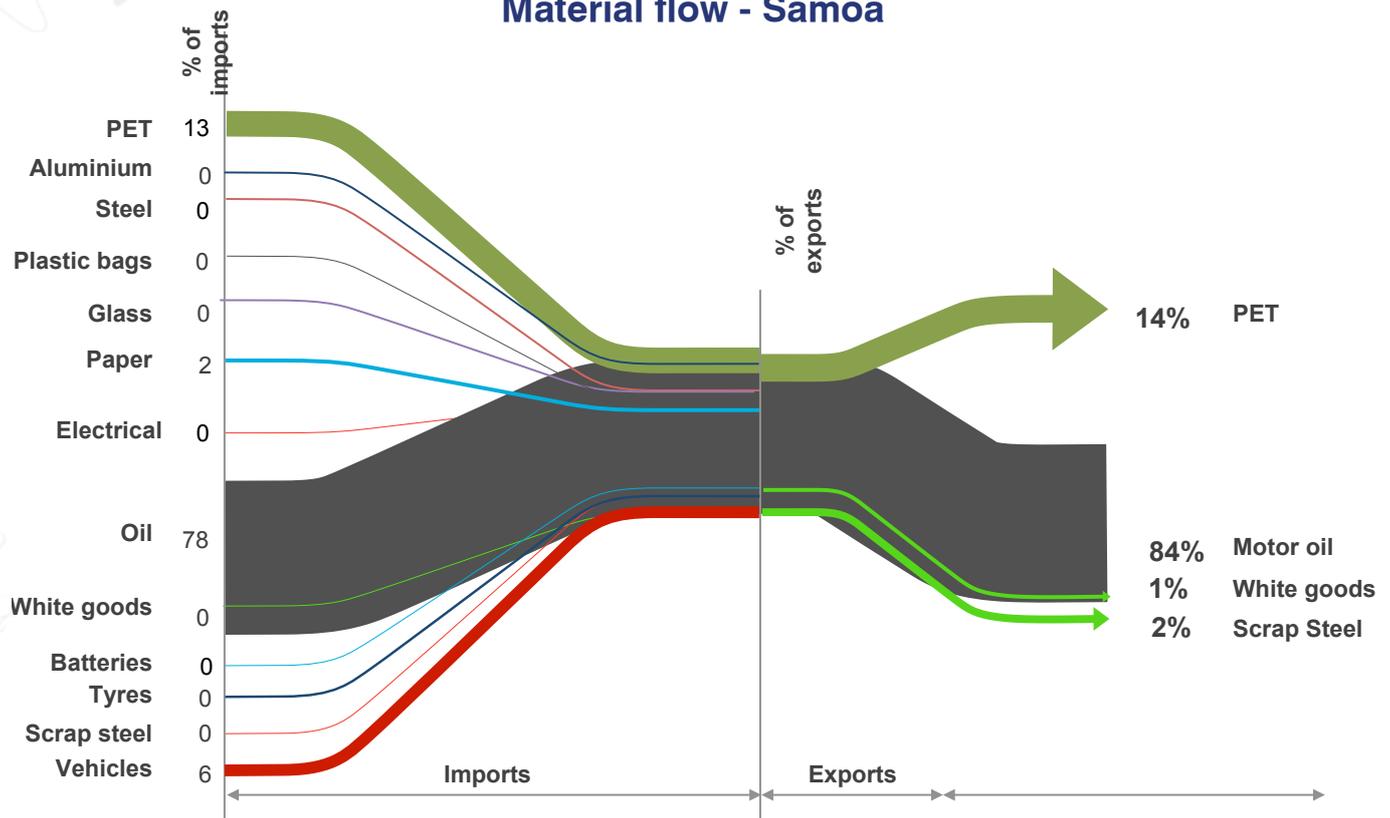
A study of waste characteristics, undertaken by the Ministry of Natural Resources and Environment and reported in JICA's Data Collection Survey on Reverse Logistics in the Pacific Islands, January 2013, indicated a daily waste generation rate of 0.38 kg per person. This comprised 42% organic waste and over 13% plastic waste.

The regional study coordinated by PRIF models the potential recovery of 15 materials types. A defined set of recovery rates was applied to the urban, rural, and outer island population distribution to calculate Samoa's potential recovery tonnage. The PRIF study compares various data to establish the context for the 15 waste materials.

The material flow chart below is based on an analysis of Samoa's imports of the 15 material categories studied, averaged over a seven-year period to 2016, compared with exports of those recovered recyclable materials, averaged over a two-year period 2015-2016, presented as a percentage of the total of the 15 categories. (UN Comtrade, 2017).

Beverage containers made of plastic and aluminium are imported at a steady rate, while there was an increase in the number of glass ampules used for making glass bottles. Samoa has experienced a large uptake of renewable energy equipment in recent years, including heat pumps, air conditioners, vehicles, and whitegoods. Paper and cardboard imports remain stable. As in most other Pacific island countries, large volumes of petroleum and cooking oil were imported over the seven years under consideration. Furthermore, market intelligence indicates that Samoa may be receiving waste beverage containers from other Pacific island countries.

Material flow - Samoa



Source: Anne Prince Consulting, July 2017

Note: The percentage of imports and exports displayed relate only to the proportion of the 15 materials categories studied, not total imports/exports

Samoa exports a wide variety of the materials listed. Furthermore, it is one of the few Pacific island countries to have exported a substantial volume of whitegoods in the last two years. In addition, an average of more than 2,600 tonnes (t) of polyethylene terephthalate (PET), 16,000 t of motor oil and cooking oil, and a large amount of scrap steel and end-of-life vehicles were exported. While not yet quantified, it does appear that Samoa also exported used lead-acid batteries on a regular basis.

Modelling of potential recovery of recyclable materials, presented in the table below, is based on an estimated average daily per capita municipal solid waste generation of 0.79kg (World Bank, 2012). It also applies a range of location-specific estimated recovery rates that are based on a set of assumptions of existing or introduced incentive-based policies and programs, such as container-deposit schemes and import levies. The resulting ratios were used to estimate average annual tonnages that could be recovered for recycling. (JICA, 2013; SPREP 2016; Mobile Muster, 2013; DOEE, 2017; Jambeck et al., 2015; MFAT, 2016; UNIDO/ICSHP, 2013).

Samoa	
Recyclable Materials Forecast	Estimated Metric Tonnes
Polyethylene terephthalate (PET) beverage containers	94
Aluminium cans	170
Glass beverage containers	120
Steel cans	135
Plastic shopping bags	61
End-of-life (EOL) renewable energy equipment	-
Paper/cardboard	564
E-waste	28
Whitegoods	141
Used motor/cooking oil	983
Used lead acid batteries	78
Lithium batteries	158
Scrap steel/nonferrous metals	202
EOL tyres	78
EOL vehicles	2,085
Total	4,897



Future waste management

Future increases in recovered materials are expected as a result of the PacWaste (2014-17) programme, implemented by SPREP. The programme aims to improve the management of e-waste, with activities that include the establishment of a pilot project for the safe dismantling and export of e-waste and the creation of a community awareness campaign (SPREP, 2017).

The second phase of the Promotion of Regional Initiative Solid Waste Management (J-PRISM II) project, implemented by JICA in early December 2016, supports capacity building in waste management. Target initiatives include improved governance and human resource development, expected to generate increased volumes of recoverable materials.

The Government of Samoa is targeting 100% renewable energy by 2025. Some solar power generation is in place, and wind turbines are installed on the island of Upolu. Work on the first hydropower scheme is underway on the island of Savaii.

The Renewable Energy Development and Power Sector Rehabilitation Project will increase access to renewable energy generation and improve existing power infrastructure. This project is funded by the Asian Development Bank, European Union, Government of New Zealand and Government of Samoa, as well as the Multi-Donor Clean Energy Fund (ADB, 2017). While 95% of the population has access to electricity, the expansion of renewable energy systems may yet result in an increased presence of end-of-life renewable energy equipment in the waste stream. Coca Cola South Pacific has announced that over the past couple of years, there has been a significant rise in the presence of PET in the waste stream, possibly as a result of a surge in local water production and the establishment of over 30 bottling plants in Samoa within the same period. Local and imported cans (Chinese Traders, Brandes Shasta, and Coolma) also dominate market share.

Plastic marine debris

Mismanaged plastic waste eventually enters the marine environment by way of inland rivers and waste water outfalls or is transported by wind and tide. Rigid and lightweight plastic materials from products that are consumed or used on a daily basis become marine debris if not managed appropriately. An estimated 13% of Samoa's waste stream is comprised of plastic.

The Samoan islands have a combined coastline of 403kms and a recent study (Jenna et al., 2015) indicates that approximately 17.1t of plastic waste is generated each day. An estimated 14t is mismanaged daily and are predicted to enter the marine environment through release from uncontained disposal sites or by direct littering. An estimated 5,122 t of plastic waste was released in the waters around Samoa in 2010. If not addressed, the amount is expected to rise to 10,989 t by 2025.

Of the 17.1 t of plastic generated each day, approximately 1.9 t may comprise polyethylene terephthalate (PET) or high-density polyethylene (HDPE) plastic, eligible for recycling under a container deposit scheme (CDS). Based on

an average reduction rate of 40% in mismanaged waste with a CDS in place, approximately 0.62 t of PET and HDPE plastic could be recycled each day. This could increase to an 80% or above reduction rate, depending on access to recycling collection services and viable markets, among others. Nonetheless, a 40% reduction in mismanaged PET and HDPE would result in approximately 4,895 t of plastic becoming marine debris each year.

The outcome of mismanaged plastic can be divided into three groups: plastic that remains on the surface of the sea as floating debris, plastic that sinks to the ocean floor, and plastic that washes up on beaches. A CDS that recovers 40% of HDPE and PET bottles in Samoa may achieve the following reductions in marine debris each year:

- 34 t in floating plastic
- 159 t in sunken plastic
- 34 t in beach plastic.

Further benefits attributed to a CDS are possible with a reduction in annual damage costs to Samoa's 181 local fishing vessels (approximately US\$1,400). If beaches are cleaned up, over US\$57,486 would be saved, of particular relevance to the amenities of coastal communities and the tourism sector.

Infrastructure and services

Information relating to the solid waste and recycling infrastructure and services in Samoa is sourced from *Solid Waste Management in the Pacific: Samoa Country Snapshot*. (ADB 2014). Other information has been drawn from "Data Collection Survey on Reverse Logistics in the Pacific Islands". Final Report 2013. Japan International Cooperation Agency (JICA), Tokyo.

A significant level of support has been provided to Samoa to improve its waste management under the first phase of the JICA (J-PRISM I) project. A number of improvements were achieved between 2011 and 2015, including recycling promotion through the Reduce, Reuse and Recycle (3R HEART) community awareness programme; strengthening of landfill operations; and development of a landfill operation training programme.

There are three recycling operations on the main island of Upolu which source steel and nonferrous scrap from abandoned vehicles and the local landfill (JICA, 2013; ADB, 2014). Together, these export approximately 12 x 20 foot shipping containers a month to Australia, the Republic of Korea, and New Zealand. Whitegoods, PET bottles, paper and cans are baled and exported to Indonesia and New Zealand. Used lead-acid batteries are sent to Fiji, India, New Zealand, and Singapore.

Household solid waste is usually collected twice a week and, in some cases, on a daily basis in urban areas. Services are provided to 100% of the population, although this excludes the collection of separate dry recyclables. Waste compactor vehicles are operated by five private companies under government contract and managed by the waste management section of the Ministry of Natural Resources and Environment (MNRE).

Contractors also service commercial and institutional organisations, transferring waste materials to the Tafa'igata Sanitary Landfill, operated by the government and located approximately 10 kms west of Apia. JICA and SPREP have been extensively involved over the long term in the development and operation of the Tafa'igata landfill and the solid waste collection system.

Bulky waste is collected by private sector firms once every three months, free of charge. The waste, including whitegoods, vehicles and furniture, among others, is transported to the landfill, where it is placed in a designated area facing the landfill entrance for community reuse. The island of Savaii also has a semi-aerobic landfill structure, developed with the cooperation of JICA.

Logistics

The islands of Samoa are well serviced by the Samoa Shipping Corporation, a state-owned entity under the Ministry of Works, Transport and Infrastructure, which provides shipping, slipway, and port management services. It also transfers hazardous goods.

The corporation operates a fleet of seven ships, including three roll-on/roll-off passenger vessels; two cargo and landing vessels; one cargo and one passenger ferry. Regular domestic, inter-island, and international services depart from Apia. Various cargo, courier, vehicle and passenger services operate daily between the islands of Upolu (Mulifanua) and Savai'i (Salelologa). The international route between Apia and Pago Pago in American Samoa is serviced on a weekly basis.

Domestic freight charges are estimated to be approximately US\$300 per twenty-foot equivalent (TEU) between Manifanua and Salelologa. A loaded, heavy vehicle is charged at US\$1/t (JICA, 2013).

The port of Apia is the only international and commercial container port in Samoa, with approximately 204 ships visiting annually. The port handles Samoa's foreign trade cargo of mostly imports, as well as cruise ships.

Samoa

Source: Google Maps.

Apia

The terminal at the Port of Apia is approximately three hectares and is equipped with a main quay, 166 metres by approximately 12 metres deep, and a warehouse. The construction of an extended berth is currently underway. There is no shore crane, although there are private stevedore services.

The Port of Apia is capable of handling 35,000 twenty-foot equivalent units (TEU) per year. The port has a current throughput of approximately 12,800 import, 1,500 export and the return of 11,300 empty containers each year which may potentially be made available for reverse logistic arrangements. The port also loads and unloads approximately 500 trans-shipment containers each year.

The port of Apia is serviced by multiple international shipping lines. Estimated TEU shipping container rates, presented below, are based on the cargo of nonhazardous

goods, inclusive of un/loading and a bunker adjustment factor. They do not account for customs clearance, duties, and quarantine inspection.

Samoa: Shipping Lines

Swire Shipping; ASUPAC Consortium,
including SOUTHPAC Service;
Kyowa Shipping Co. Ltd.; Polynesia Line

Destination	Schedule	Est. USD per TEU
North Asia	30-day	2,400 to 3,600
Australia	16-day	2,650 to 4,600
Fiji	21-day	2,500 to 4,400
New Zealand	14-day	2,682 to 4,600
Southeast Asia	14-day	2,500 to 4,400
United States, West Coast	14-day	TBD

Source: AMSTEC Pty Ltd

Notes: USD = U.S. dollar;

TEU = twenty-foot equivalent unit.

The port of Apia receives sewerage and waste from domestic ships only. The port does not accept oil tankers, oily water/bilge water, ozone depleting substances, or exhaust gas cleaning system residues. Recyclables from international ships are subject to quarantine, and small amounts of quarantine waste are incinerated on site, with larger quantities sent to the landfill for deep burial.

A 2015 review of the port's waste reception facilities considered them of a satisfactory standard, as are those relating to quarantine waste (SPREP, 2015). Nevertheless, improvements are called for to upgrade the port in line with the International Convention for the Prevention of Pollution from Ships (MARPOL 73/78), of which Samoa is a signatory, as well as to ensure that the disposal of ship waste meets environmental standards. Recommended improvements from the review include the planning of the disposal of general and hazardous waste from ships within national waste strategies and management systems; extending sewerage infrastructure to the port; communicating waste service information to visiting ships; considering options for servicing anchored ships; and entering into regional arrangements for exhaust gas cleaning system residues and ozone depleting substances.

Institutional framework

Data relating to the institutional framework of Samoa have been gathered from the database of the Pacific Islands Legal Information Institute (PacLII, 2017). ECOLEX is also an information service that relates to environmental law (ECOLEX, 2017), from which various data also have been collected.

The waste management section of the MNRE administers the Waste Management Act 2010. It also monitors and enforces the planning and management of solid waste services, including Samoa's six collection contracts. The Act covers the collection, management, disposal, and recycling of solid waste. It also provides for the registration and licensing of waste operators; issuance of dumping and incineration



permits; establishment of environmental standards; and ensures community involvement in waste management. This Act also provides for the issuance of permits to vessels in relation to the dumping or incineration of waste at sea and the application of penalties due to noncompliance with the London Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter (1972) and its London Protocol 1996, as well as the 1995 Waigani Convention.

Planning and Urban Management Act 2004 relates to urban planning and development. It guides the sustainable management of urban areas and environmental impact assessments. A National Waste Management Policy was developed in 2001. It does not appear to have been revised.

The National Chemical Management Strategy 2007-2017 provides a framework for sustainable management of all chemicals. It includes the activities of procurement, transportation, storage, distribution, use, and disposal.

Plastic Bag Prohibition Regulation 2006 considers plastic products as 'environment pollutants', as defined in Land Surveys and Environment Act 1989. The regulation establishes minimum biodegradability standards, rules, and licensing for the importation of plastic products. These are defined as plastic bags, plastic film sheets, and the pellets that are used in their manufacture.

The Ministry of Health is responsible for Health Ordinance 1959 and Board of Health (Rubbish) Regulations that relate to the operation of the National Health Service. The Ministry of Women, Community and Social Development, the Samoa Umbrella for Non-Government Organisations Inc., (which represents 300 villages), and various international donor agencies play a key role in the institutional and community management of solid waste. While the former is responsible for waste management and the environment at the local government level, the latter two are responsible at the central and local levels.

Marine Pollution Prevention Act 2008 falls under the MNRE and relates to the prevention of pollution to the marine environment, as well as to response to incidents of marine pollution discharged from vessels. It ensures adherence to marine pollution conventions.

Quarantine Biosecurity Act 2005 relates to 'regulated articles'. These are soil, garbage, litter, fodder, animals, animal products, plant, and plant materials, among others.

Water Resources Management Act 2008 is led by the MNRE. It relates to the management, conservation, and use of water resources, including coastal waters where freshwater accumulates or discharges and is mixed with seawater.

In 2015, Cabinet approved the prohibition of end-of-life (waste) tyre imports due to public health concerns. Such concerns include the potential effects of these materials in the waste stream.

Samoa is a party to various multilateral environmental agreements and conventions. These are listed in the table below.

Samoa	
Multilateral Agreements and Conventions	Status
Stockholm Convention on Persistent Organic Pollutants	Ratified
Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal	Ratified
1995 Waigani Convention	Ratified
Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade	Ratified
Montreal Protocol on Substances that Deplete the Ozone Layer	Ratified
Minimata Convention	Signed
MARPOL 73/78: International Convention for the Prevention of Pollution from Ships, 1973 as modified by the Protocol of 1978 (Annexes I, II, III, IV, V, and VI)	Ratified
International Convention on Civil Liability for Oil Pollution Damage 1969 (renewed 1992)	Ratified
International Convention on the Establishment of an International Fund for Compensation for Oil Pollution Damage 1992 (FUND92)	Ratified
International Convention on Oil Pollution Preparedness, Response and Co-operation (OPRC)	Ratified
Hazardous and Noxious Substances by Sea Convention (HNS Convention 1996)	Ratified
International Convention on Civil Liability for Bunker Oil Pollution Damage (BUNKER) 2001	Ratified
Noumea Convention:	Ratified
Protocol on Dumping	Ratified
Protocol on Combatting Pollution Emergencies	Ratified
Protocol on Oil Pollution Preparedness, Response and Cooperation	Signed
Protocol on Hazardous and Noxious Substances Pollution, Preparedness, Response and Cooperation	Signed

SPREP. 2016.

Financial mechanisms

Currency: Samoan tala (ST)

The MNRE solid waste budget for 2012 was ST 2,281 million (US\$0.97million), which funds landfill operations, maintenance work, and cleaning of public areas. Households are not charged for collection or disposal services. Private collection companies charge for commercial and institutional collection services and are, in turn, pay a tipping fee on entry to the Tafaigata Landfill. This provides the government with additional revenue. It appears that waste pickers at the Tafaigata Landfill recover and sell aluminium cans to recycling companies for US\$0.90/kg.

The government at the central level makes transfer payments to village councils for capital development as necessary. Village councils have the power to levy taxes in line with village usage to support community activities, although there is no legal provision to enforce this.

Samoa Breweries Ltd. operates a redemption scheme for the return of glass bottles through its distributors. The distributors pay 20 cents per 750 ml bottle.

Conclusions

Specific waste management legislation was introduced in Samoa in 2010, with regulations to address plastic environment pollution in 2006. Samoa's National Waste Management Policy, however, has not been updated since 2001.

No fees are charged for household collections. As a result, financial mechanisms can be considered to support improved waste management systems.

A number of recyclers and recyclable waste generators in Apia have recently formed the Samoa Waste Management Recycling Association Inc. The Association is undertaking strategic planning and seeks to work closely with the national government to progress improvements to solid waste management systems in Samoa.

Samoa has an extensive inter-island shipping service and a relatively strong private sector recycling industry. This indicates that there is potential to further support the deposit schemes and extend producer responsibility schemes.

Construction work to extend the berths at the Port of Apia is currently underway. The port, which is on a rather efficient shipping route, has the capacity to handle increased cargo volumes.

Abbreviations

ADB	Asian Development Bank	ml	millilitre
CDS	container deposit scheme	MNRE	Ministry of Natural Resources and Environment
EOL	End of life	OEC	Observatory of Economic Complexity
ECOLEX	Environmental Law Database	PET	polyethylene terephthalate
FY	Financial year	PRIF	Pacific Region Infrastructure Facility
GDP	Gross domestic product	SPREP	Secretariat of the Pacific Regional Environment Programme
HDPE	high-density polyethylene	SPTO	South Pacific Tourism Organisation
J-PRISM	Promotion of Regional Initiative Solid Waste Management	t	tonne
JICA	Japan International Cooperation Agency	TEU	twenty-foot equivalent unit
km(s)	kilometre(s)	UNIDO	United Nations Industrial Development Organization
MARPOL	International Convention for the Prevention of Pollution from Ships	ICSHP	International Centre on Small Hydro Power
MFAT	New Zealand Ministry of Foreign Affairs and Trade		



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