



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 the Federated States of Micronesia (FSM).

FSM is located in the western Pacific Ocean and comprises over 600 islands, with a total land area of 701km² and a combined coastline of 6,112km. FSM forms part of the Micronesia region and is made up of four groups of island states:

- Yap - with four large islands, seven small islands, and 134 atolls;
- Chuuk - with seven major island groups;
- Pohnpei - the largest island of the Senjavin Islands; and
- Kosrae - a single, high island.

The national capital is Palikir on the island of Pohnpei. Its population is approximately 4,600.



Source: Google Maps.

Socioeconomic background

The total population of the FSM island group was 102,624 in 2010 (*GoFSM, 2010*), spread across the four island states as follows:

Island of Yap	population, 11,376 -state capital is Colonia with a population of 3,126
Island of Chuuk	population, 48,651 - state capital is Weno (population 13, 856)
Island of Pohnpei	population, 35,981-state capital is Kolonia (population 6,000); and
Island of Kosrae	population, 6,616-state capital is Tofol (population 1,500).

The rural population in FSM is approximately 79,020, or 77% of the total (*Knoema, 2015*). Visitors numbered 24,125 (*SPTO, 2017*) in 2016, which represented a decrease of 20% on the previous year.

FSM's gross domestic product (GDP) was US\$1.13 billion, or US\$3,500 per capita, in 2015 (*OECD, 2017*). In that year there was a trade balance deficit of US\$314 million, with exports at US\$20.6 million (-17.8% annualized) and imports at \$162 million (+15.8% since 2010).

The primary export market destinations in 2015 were the People's Republic of China, Japan, the Republic of Korea, Saudi Arabia, and Thailand. The main import origins in the same year were the People's Republic of China, Japan, the Republic of Korea, Russia, and the United States. (*OECD, 2017*)

The services sector, a major contributor to GDP, stood at 65%. Manufacturing, as a value adding activity, was responsible for only 0.45% of the country's economy (*GlobalEDGE, 2017*), indicating that there are few production-based enterprises.

Solid waste management

A waste composition survey, conducted in 2011 as part of the first phase of the Promotion of Regional Initiative Solid Waste Management (J-PRISM I) program, found that household waste generation rates varied across the country. These are as follows:

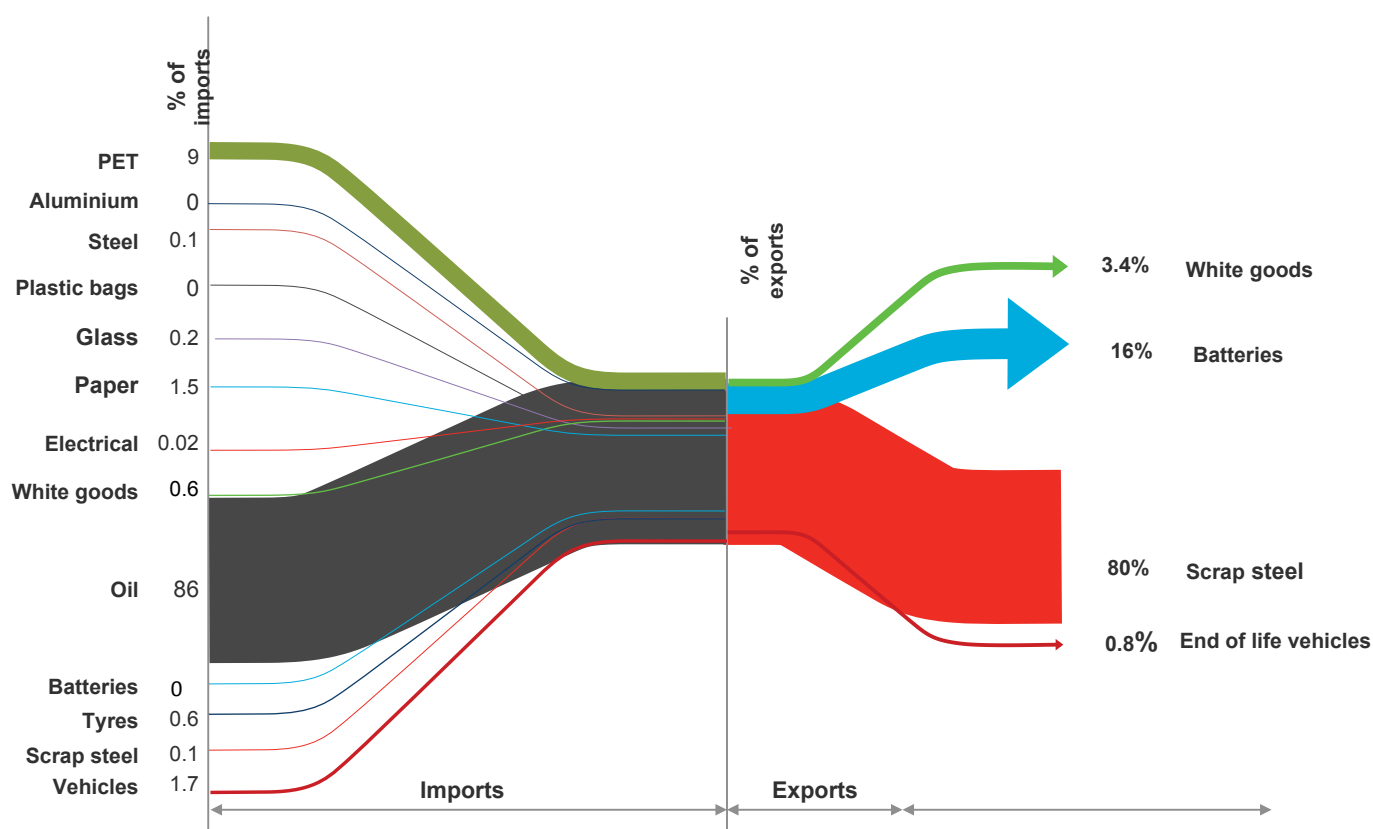
- Pohnpei: 0.1kg per day, comprising approximately 25% plastic and 25% metal,
- Yap: 0.5kg per day, comprising over 37% of plastic and 20% organic;
- Chuuk: 0.2kg per day, comprising over 33% organic and over 22% plastic;
- Kosrae: 0.1kg per day, comprising 26% organic and 20% plastic.

This 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 FSM'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 FSM'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*).

Polyethylene terephthalate (PET) beverage containers were imported at a steady rate, with imports of other beverage containers (e.g., aluminium and glass) having fallen sharply since 2013. As with other Pacific Island Countries, paper and cardboard imports have held reasonably steady, whereas imports of electronic and whitegoods have increased over time. Similar increased trends were observed for crude oil until 2012, having since decreased. Tyre and vehicle imports have been steady, with minor upward or downward trends.

Material flow - FSM



Source: Anne Prince Consulting 2017.

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

The only two exports of note for the FSM are lead-acid batteries and scrap metal. The remaining 13 materials have no substantial exports out of the FSM.

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 2.1kg (*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*).

Federated States of Micronesia	
Forecast of Recyclable Materials	Estimated Metric Tonnes
Polyethylene terephthalate (PET) beverage containers	69
Aluminium cans	124
Glass beverage containers	87
Steel cans	99
Plastic shopping bags	45
End-of-life (EOL) renewable energy equipment	-
Paper/cardboard	413
E-waste	3
Whitegoods	27
Used motor/cooking oil	626
Used lead-acid batteries	24
Used lithium batteries	35
Scrap steel/nonferrous metals	148
EOL tyres	24
EOL vehicles	380
Total	2,104

Future waste management

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

The European Union has a funding commitment of €12 million for renewable energy and energy-efficient programme initiatives, commencing in 2016 and continuing to 2020. Objectives include:

- increasing access to modern and sustainable energy services, with a focus on outer island populations;
- improving the overall efficiency of the energy sector; and
- increasing the share of renewable energy and decreasing dependence on imported petroleum.

FSM National Energy Policy aims to generate 30% of power from renewable sources, increasing end-use efficiency by 50% and achieving a 90% rate of rural household electrification by 2020. The State of Chuuk will install solar photovoltaic (PV) systems that include battery storage and solar-diesel hybrid systems. The State of Pohnpei will install solar and hydropower systems to reduce reliance on diesel power generation.

Through the installation of an integrated solar, wind and high-efficiency diesel power system, the State of Kosrae will increase its PV capacity.

These projects are funded by the Asian Development Bank, respective state governments, and other co-financing arrangements (ADB, 2017). The United Arab Emirates-Pacific Partnership Fund also has supported the installation of a 600 kilowatt PV plant. Based on these projects, there is potential for an increased presence of household electrical items and end-of-life renewable energy in the waste stream.

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 light-weight plastic materials from products that are consumed or used on a daily basis become marine debris if not managed appropriately. An estimated 13% of the FSM's waste stream is comprised of plastic.

With a combined coastline of 6,112km, a recent study (Jenna et al., 2015) indicates a daily plastic waste generation of approximately 15.8 tonnes in coastal communities living within 50km of the seaboard in FSM. Approximately 13t of this are mismanaged daily and are predicted to enter the marine environment through release from uncontained disposal sites or by direct littering. An estimated 4,794t of plastic waste were released into the waters around the FSM in 2010, becoming marine debris. If not addressed, the amount is expected to rise to 10,699t by 2025.

Of the 13t of plastic generated each day, approximately 1.8t may comprise 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 0.58t 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 4,582t of plastic becoming marine debris each year.

The outcome of mismanaged plastic is split 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 the beach. A CDS that recovers 40% of HDPE and PET plastic bottles in the FSM may achieve the following reductions in marine debris each year:

- 32t in floating plastic
- 149t in sunken plastic
- 32t in beach plastics.

Further benefits attributed to a CDS are possible with a reduction in annual damage costs to PNG's 175 local fishing vessels of approximately US\$1,359. If beaches were cleaned up, over US\$53,800 would be saved, of particular relevance to the amenities of coastal communities and the tourism sector.

Infrastructure and services

Approximately 35% of the FSM's urban population (representing only 8% of national population) is provided with a weekly waste collection service. Fees for the services are levied in some areas up to US\$5 a month.

FSM has 14 authorised open and three controlled dumps, respectively, while Pohnpei has two recycling collection stations. There are three private sector recycling companies that operate in Kosrae and Yap. Each exports glass bottles, aluminium cans, PET bottles, PET cooking oil containers, and e-waste, as well as ferrous and nonferrous metals and used lead-acid batteries.

Pohnpei has an aluminium beverage container recycling scheme that was revived in 2012, operated by the Pohnpei Environmental Protection Agency. Yap has a CDS, although it is uncertain how well this is performing (ADB, 2014).

Logistics

The FSM has the following four international ports:

- Port of Lele, operated by Pohnpei Port Authority;
- Port of Colonia on the island of Yap, operated by the Tomil Harbour Authority;
- Port of Kosrae, operated by the Kosrae Port Authority; and
- Port of Chuuk, for which a Bill was presented to Parliament to create the Chuuk State Port Authority.

The terminal of the Port of Pohnpei is approximately three hectares. Facilities include a main quay (320 metres (m) long by approximately 12m deep) and a warehouse. There is no shore crane, private stevedore services, or quarantine incineration infrastructure available.

The Port of Pohnpei is serviced by the Kyowa Shipping Co. Ltd. Estimated twenty-foot equivalent unit (TEU) shipping container rates, presented in the table below, are based on the cargo of nonhazardous goods, inclusive of un/loading and a bunker adjustment factor. They do not account, however, for customs clearance, duties, and quarantine inspection.

Federated States of Micronesia: Shipping Line		
Kyowa Shipping Company		
Destination	Schedule	Est. USD per TEU
North Asia	14-day	4,210
Guam	21-day	1,110

Source: AMSTEC Pty Ltd

Notes: USD = U.S. dollar; TEU = twenty-foot equivalent unit.

The Port of Pohnpei is capable of handling 10,000 TEU per year. The port has a current throughput of approximately 3,200 import, 400 export and the return of 2,800 empty containers each year which may potentially be made available for reverse logistic arrangements. The port also loads and unloads approximately 500 transshipment containers each year.

The Port of Yap is capable of handling 8,000 TEU per year. The port has a current throughput of approximately 2,000 import, 100 export and the return of 1,900 empty containers each year which may potentially be made available for reverse logistic arrangements.

The four states of the FSM each has its own public domestic shipping fleet, and the national government operates one local ship to service the islands. The vessels are a mix of roll-on/roll-off container and passenger boats.

Institutional framework

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

FSM has national overarching laws, policies, and strategic development plans that provide the framework for solid waste management (SWM) for the country. While the four states have enacting laws and utilities for the management of waste services and facilities, there appears to be an overlap in national and state responsibilities with regard to the construction of disposal facilities.

The FSM National Strategic Development Plan, Infrastructure Development Plan 2023, FSM Code of Law and its Constitution stipulate the legal and policy frameworks for SWM. Now expired, the FSM National Solid Waste Management Strategy for 2010-2014 was built on the polluter-pays principle, as well as that of precautionary, proximity, consultation, and waste hierarchy. The strategy identifies the need to establish financial mechanisms to support waste management systems. These include a CDS and a tax on vehicle imports to finance the collection of abandoned vehicles. The strategy also recognizes various key projects up to 2023 in terms of closing or rehabilitating landfills and developing new ones in each state.

The Division of Environment and Sustainable Development of the National Office of Environment and Emergency Management administers the Environment Protection Act. Based on this, it is responsible for policy development, legislation, environmental management, and protection. It also coordinates with state environmental protection agencies. Chapter 4, Title 19, of the FSM Code (Requirements for Vessels Environmental Quality Protection Act) addresses marine pollution prevention measures.

The Kosrae Island Resource Management Authority administers State Constitution, Article 2, as well as the following state codes that provide the legal and policy framework for waste management:

- Littering Law, Title 13, Section 506;
- Pollution Law, Title 13, Section 530; and
- Kosrae Recycling Program, Title 7, Chapter 22.

Solid waste disposal facilities are covered under the aegis of the Department of Transportation and Infrastructure, while the municipalities are responsible for waste collection services and operation of disposal sites. In the State of Chuuk, Chuuk State Law's Littering Law (191-33) is regulated by the Director of Public Safety. Its State Law's Public Law 02-94-01 and the Recycling Law (for aluminium cans) are administered by the state Environmental Protection Agency. These provide the legal and policy frameworks for waste management, while the Department of Transportation, Communication and Public Works Division of Chuuk Public Works provides waste services.

Article 7 of the Constitution, State Law No. 3L-26-92, the Environmental Protection Act and Solid Waste Regulation 3/30/95 come under Pohnpei's Environmental Protection Agency. These provide for the abatement of litter and the disposal of solid waste, as well as shipping container and motor vehicle waste disposal fees. The Environmental Quality Fund and the Litter Reward Fund, established by the agency, stipulate the legal basis for waste management, as does State Law 6L-66-06. Waste collection services and the operation of disposal sites are contracted to Pohnpei Waste Management Services.

In the State of Yap, Law No.4-4 (State Public Service Corporation), under Recycling Program Law 2008, allocates responsibility for waste collection and disposal. Recycling Program Regulations 2008 and Recycling Finance Law 2009 stipulate the legal and policy frameworks for waste management. They are administered by the State of Yap's Environmental Protection Agency. In the meantime, a Bill is being prepared to cease the importation of nonrecyclable plastic bags.

FSM is a party to various multilateral environmental agreements and conventions, listed below.



Federated States of Micronesia	
Multilateral Environmental 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
Montreal Protocol on Substances that Deplete the Ozone Layer	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

Source: SPREP, 2016.

Financial mechanisms

Currency: United States dollar (US\$)

The financial system of the FSM relies on the intergovernmental transfer of funds through its Compact of Free Association with the United States. In Kosrae, approximately 80% of funds derive from U.S. aid support and 20% locally from import and export taxes.

SWM operations in the FSM mainly rely on funding as a result of the Compact of Free Association, together with CDSs in Kosrae and Yap, a soft drink tax in Chuuk, and private collection fees as described below. The 2009 Solid Waste Management Strategy has mechanisms to sustainably fund SWM, including a tax on imported vehicles to cover the cost of removing abandoned vehicles by 2013. It also recommends the introduction of an Infrastructure Maintenance Fund and a Waste Recycling Support Fund.

Systems for solid waste collection services, under the user pays principle, are in place in some municipalities in Kosrae. In Lelu, residents pay US\$18 every six months, while in Tafunsak, they pay US\$2 every two months.

Customers in Pohnpei, who use the services of a private operator, pay between US\$40 and US\$70 a month. The state government subsidises the company's operations with an annual amount of US\$100,000 to collect the waste and manage the disposal facility.

The Kosrae Island Resource Management Authority manages the beverage container recycling program. A deposit fee of US\$0.06 is levied on each imported aluminium, plastic, and glass beverage container. Consumers redeem US\$0.05 per item with the remaining portion to cover handling charges.

A similar deposit programme for imported lead-acid batteries charges a fee of US\$4 per battery. The levies collected are managed through a recycling fund that is used to finance the recycling program. In 2011, US\$60,000 was recovered from recyclables, shipped to the People's Republic of China, the Republic of Korea, and Taipei, China.

Crushed glass is distributed locally for free and is used for paving projects. Kosrae has a scrap metal recycling programme that enables the sale of end-of-life cars and scrap to licensed dealers for export.

Conclusions

The legal and policy frameworks for waste and environmental management appear relatively robust in the FSM. Nevertheless, there is evidence of overlap in state and national responsibilities.

The primary ports of the State of Pohnpei and the State of Yap lack sufficient capacity to handle increased cargo volume. Direct shipping services are currently limited in terms of destination routes and schedule.



Abbreviations

ADB	Asian Development Bank	km	kilometre
CDS	Container deposit scheme	km ²	square kilometre
DOEE	Department of Environment and Energy (Australia)	m	metre
EOL	End of life	MFAT	Ministry of Foreign Affairs and Trade (New Zealand)
FSM	Federated States of Micronesia	OEC	Observatory of Economic Complexity
FY	Financial year	PET	Polyethylene terephthalate
GDP	Gross domestic product	PV	Photovoltaic
GoFSM	Government of Federated States of Micronesia	PRIF	Pacific Region Infrastructure Facility
HDPE	High-density polyethylene	SPREP	Secretariat of the Pacific Regional Environment Programme
JICA	Japan International Cooperation Agency	SPTO	South Pacific Tourism Organisation
JPRISM	Promotion of Regional Initiative Sold Waste Management	SWM	Solid waste management
kg	kilogram	t	tonne
		TEU	Twenty-foot equivalent unit
		UNIDO	United Nations Industrial Development Organisation

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