

## 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 indicates 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 Kiribati.

Kiribati is located in the Micronesia region of the central Pacific Ocean. The country's 33 coral atolls and islands are dispersed among the three groups that form Kiribati, which are the Gilbert, Line, and Phoenix islands. Covering a land area of 810km<sup>2</sup>, the island groups are spread over approximately 3.5 million square kilometres in the Central Pacific Ocean. The nation's capital is South Tarawa, situated on the Gilbert Island group.

Kiribati's landscape is mostly a series of ring-shaped atolls with central lagoons, except for Banaba Island in the Gilbert Island group, which is a raised limestone island. With 1,140 kilometres of coastline, the majority of the atolls are approximately 6 metres (m) above sea level and surrounded by barrier reefs.



Source: Google Maps.

## Socioeconomic background

Visitors to Kiribati are attracted by extensive water-based activities that include scuba diving and fishing. In 2016, 5,018 tourists visited Kiribati (SPTO, 2017), representing a 15% increase on the previous year.

Kiribati has a tradition of strong leadership and culture, having remained relatively untouched because of its isolation. Approximately 60,500, or 55%, of the population live in rural, outer island locations. (Knoema, 2015)

Kiribati is a republic with two levels of government, central and local. The Ministry of Internal and Social Affairs oversees the three local urban councils (Teinainano (South Tarawa), Betio, and Kiritimati (Christmas Island)) and 23 island (rural) councils.

Approximately 50% of Kiribati's population of 110,136 (GoK, 2015) live on South Tarawa. The following table provides the approximate population distribution, based on the 2010 census across the districts (islands) of Kiribati.

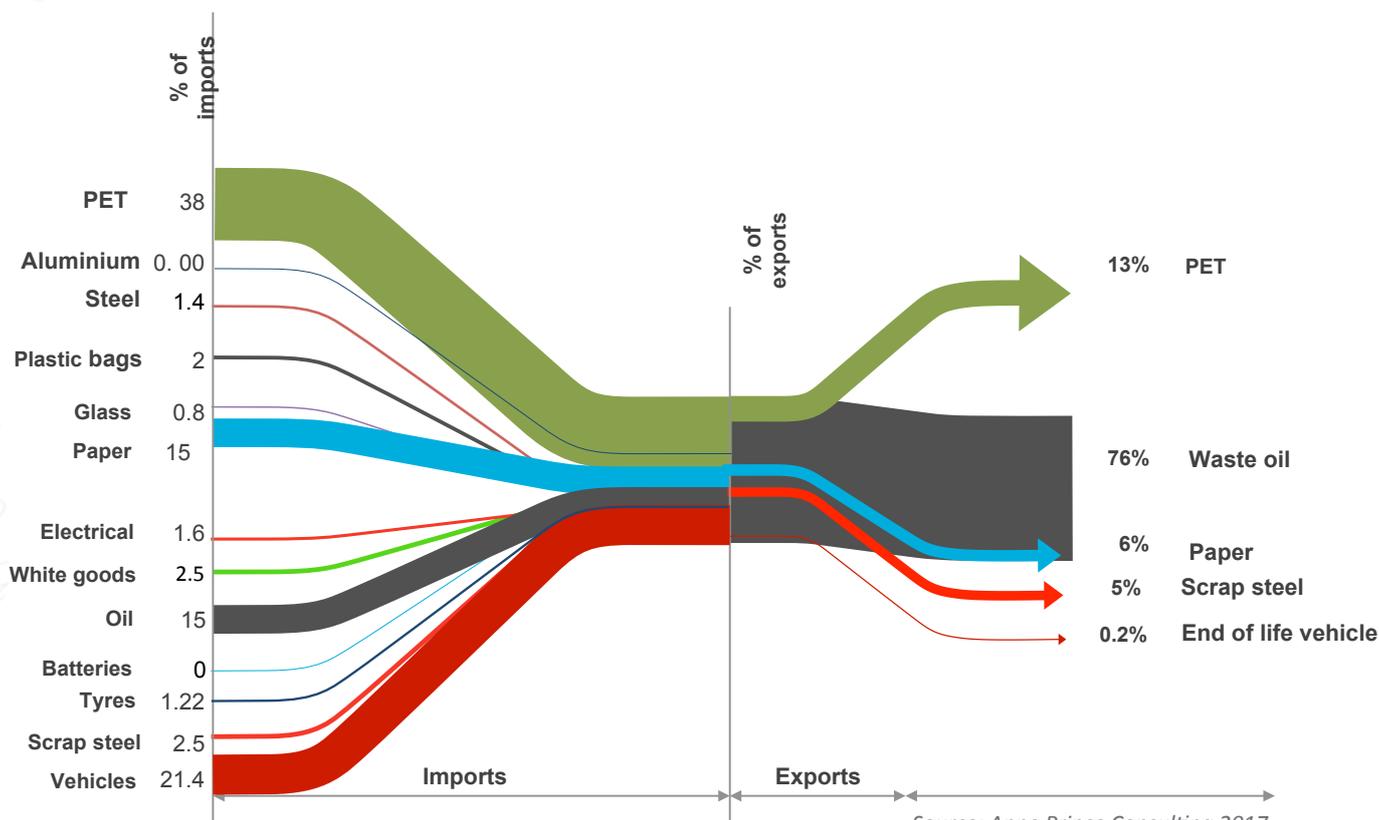
Kiribati: Population Distribution		
Island Group	Location	Population
Gilbert Island Group	Banaba	268
	Makin	1,990
	Butaritari	3,224
	Marakei	2,799
	Abaiang	5,568
	Nth. Tarawa	6,629
	Sth.Tarawa	56,388
	Maiana	1,982
	Abemama	3,262
	Kuria	1,046
	Aranuka	1,125
	Nonouti	2,743
	Nth. Tabiteuea	3,955
	Sth. Tabiteuea	1,306
Northern Line Islands	Beru	2,051
	Nikunau	1,789
	Onotoa	1,393
Phoenix Island Group	Tamana	1,104
	Arorae	1,011
	Kanton	20
Central Line Islands		No record
Southern Line Islands		No record

Source: GoK, 2015

Kiribati's gross domestic product in 2015 was US\$160 million/US\$1,990 per capita (OECD, 2017). In the same year, there was a trade balance deficit of US\$41.8 million, with exports at US\$119 million (+36.6% annualised) and imports at US\$161 million (+5.6% since 2010).

The primary export market destinations for 2015 were Australia, American Samoa, Colombia, New Zealand, and the United States. The main import origins included Australia, the People's Republic of China, the Fiji, Japan, and the Republic of Korea. Contributors to Kiribati's gross domestic product include the services and agriculture sectors, with manufacturing as a value adding activity, responsible for 4.82% of the country's economy (GlobalEDGE, 2017)

## Material flow - Kiribati



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

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### Solid waste management

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 Kiribati'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 Kiribati'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*).

The import of plastic beverage containers increased steadily from 2009 to 2013 before reversing. Since then, however, there has been an increase in the import of pelletised polyethylene terephthalate (PET) for the on-shore production of PET bottles. Plastic bag imports also peaked in 2013, although have shown a downward trend since. Significant growth in the import of printing paper

has been observed from 2009 to 2016, as has a decrease in the import of toilet paper or similar. Electronics and white goods are holding steady, while the number of cars being imported has increased.

Of the 15 materials considered for this study, Kiribati exported only paper, waste oil, and scrap metal in quantities of note in 2014-16. While the analysis did not detect a significant export of used lead-acid batteries, it is understood that it does, in fact, take place. This is based on the number of used lead-acid batteries that have been recovered through the Kaoki Mange! (Keep Kiribati Beautiful) recycling project.

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*).



Kiribati	
Recyclable Material Forecast	Estimated Metric Tonnes
Polyethylene terephthalate (PET) beverage containers	122
Aluminium cans	219
Glass beverage containers	154
Steel cans	174
Plastic shopping bags	79
End-of-life (EOL) renewable energy equipment	-
Paper/cardboard	727
E-waste	3
Whitegoods	24
Used motor/cooking oil	563
Used lead-acid batteries	18
Lithium batteries	56
Scrap steel/nonferrous metals	261
EOL tyres	18
EOL vehicles	346
<b>Total</b>	<b>2,764</b>

## Future waste management

Future increases in material recovery are expected as a result of the PacWaste (2014-17) programme, which is in the process of being implemented by the Secretariat of the Pacific Regional Environment Programme as a means for improving the management of e-waste. Activities under this programme include an e-waste pilot project for the safe dismantling of e-waste, shipping and logistical support, a community awareness campaign, and assistance in developing a national e-waste strategy (SPREP, 2017).

Kiribati aims to achieve at least a 45% reduction in the generation of fossil-fuel energy by 2025. Ten percent renewable energy will be achieved at completion of various projects that include the installation of photovoltaic solar on Tarawa, a photovoltaic-diesel hybrid system on Kiritimati Island, and 1,700 household solar systems on outer islands. Approximately 65% of the population has access to electricity.

As the transition to renewable energy progresses, equipment such as solar panels and batteries will have a greater presence in the recoverable waste stream, as will household electrical items, computers, and communication equipment as a result of improved power access (ADB, 2017). These projects have been supported by the Asian Development Bank, European Union, United Arab Emirates, World Bank and Japan.

## 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 material from products that are consumed or used on a daily basis become marine debris if not managed appropriately.

An estimated 13% of Kiribati's waste stream is comprised of plastic, and a recent study (Jenna *et al.*, 2015) indicates a daily plastic waste generation of approximately 9.7 tonnes (t). An estimated 86% of this is mismanaged daily and is predicted to enter the marine environment. Approximately 8.1 t may enter the ocean, released from uncontaminated disposal sites, and 0.19 t will originate from littering (i.e., a total of 8.3 t). An estimated 3,045 t of plastic waste was released into the waters around Kiribati in 2010, becoming marine debris. If not addressed, the amount is expected to rise to 6,977 t by 2025.

Preliminary data modelling suggests that 80% of PET and high-density polyethylene (HDPE) plastic are eligible for recycling under a container deposit scheme (CDS), a potential of 300 t per annum. The remaining 2.7 t of non-CDS plastic and other plastic types (e.g., plastic bags/film and rigid containers) would continue to enter the marine environment

A CDS that recovers 40% of HDPE and PET plastic bottles in Kiribati may achieve the following reductions in marine debris each year:

- 20 t in floating plastic
- 94 t in sunken plastic
- 20 t in beach plastic.

Further benefits attributed to a CDS are a potential reduction in annual damage costs for Kiribati's 141 local fishing vessels (approximately US\$1,098). If beaches were cleaned, over US\$34,172.78 would be saved, of particular relevance to the amenities of coastal communities and the tourism sector.

## Infrastructure and services

Kiribati operates the Kaoki Mange! project, launched in February 2005, including a container deposit/advance disposal scheme for aluminium cans, PET bottles, and lead-acid batteries. Early reports indicate 89% recovery of these commodities, which have now largely been excluded from the general waste stream. Given the success of this project, the authorities are considering extending it to include vehicles.

Current private recycling efforts located in Betio show good recovery, in general, from the CDS, with one shipping container of aluminium cans and other nonferrous materials exported to Australia every four weeks. Another container of PET bottles and lead-acid batteries is exported to Hong Kong (China) every seven weeks. This private recycler, under contract with the Ministry of Environment, Lands and Agricultural Development, also manages the CDS collection and container refund centres in Kiribati.

Community recycling drop-off facilities are located at Bonriki, Bikenibeu, Teoraereke, and Bairiki (main island only). Residents bring eligible containers to the centres to receive a redemption, based on volume. The receptacles are standard-size steel cages capable of housing 500 containers. Rural councils, in contrast, tend to struggle to provide basic infrastructure and services in contrast to Kiribati's urban centres, where this is mostly provided by the central government.

Recyclables collected at the community drop-off facilities are transferred for further processing to the Kaoki Mange Waste Recycling Facility that is located adjacent to the Materials Recovery Facility on the main road to Betio Port. A 10 m by 8 m hanger facility provides cover for the bailer and the processing of recyclables, later to be containerised prior to transfer to the port. Collection and community centre recycling services are restricted to the main island only.

Residents from the outer islands enter the main island through Betio Port. This way, they are able to deposit their bulk bags of CDS recyclables at the recycle centres.

Residents on Kiritimati Island may participate in the CDS through their local council, which collects and pays them the deposit on the containers. The materials are then transferred to Betio or sent direct to market and the local council receives the income from the contractor of the Kaoki Mange facility.

The Materials Recovery Facility receives and stockpiles whitegoods, e-waste, scrap metal, and end-of-life vehicles for export. These are then collected (uncompacted) by international recyclers in a barge for direct transfer to market. Vehicle tyres currently are stockpiled, cardboard and paper is reused, and lithium batteries landfilled.

Council waste services use tractors and trailers to collect household waste in 167 litre drums or rice bags that are located on roadsides. These services, which are meant to operate on a weekly basis, are somewhat unreliable.

A private contractor also offers a weekly collection service to accessible households, using waste compactor vehicles. This service collects the pre-purchased green bags under the Green Bag Programme, a user-pay system whereby special green garbage bags are purchased at A\$0.20 per bag.

The Tarawa Urban Council (TUC) operates landfills at Nanikai and Bikenibeu, while Betio Town Council (BTC) operates the Betio landfill. Some compacting is undertaken at Betio and Nanikai, although at the time of writing, it is understood that the landfill leachate pumps are inoperative at the Nanikai and Bikenibeu facilities.

## Logistics

Kiribati has three international seaports, operated by the Kiribati Ports Authority. They are located at Banaba, Betior, and Kiritimati. Betio is the primary port of arrival, as well as a container terminal. Other domestic ports include English Harbour and Fanning Island.

Inter-island services from Betio Port are frequent to islands that are closer to the mainland. These are operated by the Kiribati Shipping Services Ltd., a wholly-owned government

shipping company established in 2008. The fleet includes a roll-on/roll-off vessel with the capacity to carry 35 cars and 315 passengers, as well as a container vessel with a 60 twenty-foot equivalent unit (TEU) capacity and two cranes.

The Tarawa Port terminal is approximately 2 hectares. Facilities include a main quay that is 200 m long by approximately 9 m deep and a warehouse. There are neither shore cranes, private stevedore services, nor quarantine incineration facilities on site.

The Port of Tarawa is capable of handling 4,000 TEU per year. The port has a current throughput of approximately 2,500 import, 200 export and the return of 2,300 empty containers each year which may potentially be made available for reverse logistic arrangements.

Tarawa Port 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, however, for customs clearance, duties, and quarantine inspection.

Kiribati: Shipping Lines		
Auspac Consortium; Kyowa Shipping Co. Ltd.; Polynesia Line		
Destination	Schedule	Est. USD per TEU
Australia	21-day	2,100 to 4,600
Fiji	21-day	2,450 to 3,342
North Asia	21-day	2,600 to 4,530
	30-day	

Source: AMSTEC Pty Ltd

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

## Institutional framework

Data relating to the institutional framework of Kiribati 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.

The Environment and Conservation Division of the Ministry of Environment, Lands and Agriculture Development administers Environment Act 1999 (amended in 2007) and Environmental Regulations 2001. While the Act authorises the local councils to manage waste, the Division plans and implements National Solid Waste Management Strategy 2007. Together with the Secretariat of the Pacific Regional Environment Programme, the latter prepared the 2012 Kiribati Integrated Environment Policy. In addition, Special Fund (Waste Materials Recovery) Act 2004 regulates the container deposit scheme and is administered by the Ministry of Finance.

Other legislations that impact the management of waste include the Public Health Act Ordinance and Local Government Act 1984 (amended 2006). These allocate control of waste collection and disposal services to the local councils, authorizing them to issue by-laws with regard to waste management fees (*ADB, 2014*).



In the Gilbert Island Group, TUC is responsible for Tanea town in the east of Bairiki. BTC is responsible for Betio Islet, which is linked to Bairiki by a causeway. Settlements and commercial premises outside of these areas must manage their own waste, which may be composted, although there are reports of waste being disposed at sea, on the beach, buried, or burned.

Maritime Act 2017 was passed by Parliament in April/May 2017. It addresses issues that relate to internal and marine waters, toxic and hazardous substances, marine conservation, and social impact.

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

Kiribati	
Multilateral and 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
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
London Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter 1972	Ratified
International Convention on Civil Liability for Oil Pollution Damage 1969 (renewed 1992)	Ratified
International Convention on the Protocol of 1992 to Amend the International Convention on the Establishment of an International Fund for Compensation for Oil Pollution Damage, 1971	Ratified
International Convention on Civil Liability for Bunker Oil Pollution Damage (BUNKER) 2001	Ratified
Control of Harmful Anti-fouling Systems in Ships (AFS Convention) 2001	Ratified
International Convention for the Control and Management of Ships' Ballast Water and Sediments (BWM) 2004	Ratified

Source: SPREP, 2016.

## Financial mechanisms

Currency: Kiribati dollar (K\$); Australian dollar (A\$)

Under the CDS, a deposit of A\$0.05 is levied on beverage containers and A\$5 on lead-acid batteries at the point of import. These fees are collected by Kiribati Customs and deposited into a special fund, established under the Special Fund (Waste Materials Recovery) Act. Consumers are then able to redeem A\$0.04 in return for the containers that are meant for recycling and the remaining A\$0.01 covers handling fees. In the case of lead-acid batteries, the full AU\$5 levied on importation is redeemed on return.

Service charges are levied by councils for household waste collection at A\$29 per annum and at A\$650 per annum for commercial premises. It is reported, however, that only around 25% of the levies are recovered from billed properties.

The Green Bag programme is a user-pay system. The purchase price of garbage bags is A\$0.20 per bag, and the revenue helps to cover the cost of collection services. It is anticipated that future increases of the green bag price will fund fully the collection services.

Annual budgets are prepared annually, with the central government providing funding to local authorities for waste management. BTC annual revenue is at a surplus of A\$120,000, with expenses at approximately A\$90,000. With regard to the TUC, its expenses are greater, at an approximate annual rate of A\$210,000, with budget revenue at only A\$190,000.

The landfill infrastructure is largely supported by donor funding as there are no disposal fees applied.

The most recent national solid waste management strategy indicates the potential expansion of the import tax system to include glass bottles, steel cans, and vehicles.

## Conclusions

Kiribati successfully established the Kaoki Mange! (Keep Kiribati Beautiful) project with a recovery achievement of approximately 89% in recyclable materials. A green bag project was also implemented with a user-pay approach to increase access to sustainable waste collection services.

It is evident that Kiribati has the capacity to extend resource recovery systems outside of Tarawa, based on the success of these financial mechanisms and on the availability of its inter-island shipping services.

Tarawa Port lacks the capacity to handle increased cargo volume, and current shipping services are limited in terms of destination routes and schedules. There is, nevertheless, ample capacity for backload freight for the export of recyclables.

## Abbreviations

ADB	Asian Development Bank	m	metre
AFS	Anti-fouling systems	MARPOL	International Convention for the Prevention of Pollution from Ships
BTC	Betio Town Council	MFAT	Ministry of Foreign Affairs and Trade (New Zealand)
BWM	Ballast water and sediments	OEC	Observatory of Economic Complexity
CDS	Container deposit scheme	PET	Polyethylene terephthalate
DOEE	Department of Environment and Energy (Australia)	PRIF	Pacific Region Infrastructure Facility
EOL	End of life	RTRC	Regional Tourism Resource Centre
FY	Financial year	SPREP	Secretariat of the Pacific Regional Environment Programme
GoK	Government of Kiribati	t	tonne
HDPE	high-density polyethylene	TEU	Twenty-foot equivalent unit
ICSHP	International Centre on Small Hydro Power	TUC	Tarawa Urban Council
JICA	Japan International Cooperation Agency	UNIDO	United Nations Industrial Development Organisation
kg	kilogram	USD	United States dollar
km	kilometre		
km <sup>2</sup>	square kilometre		

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