PACIFIC ISLANDS FORUM SECRETARIAT

PiRRC Pacific ICT Regulatory Resource Center

Pacific Community
Communauté du Pacifique

2016 Pacific Infrastructure Performance Indicators

'PIPIs'

Pacific Region Infrastructure Facility

ADB

Australian Aid

European Union

JICA

NEW ZEALAND Aid Programme

WORLD BANK GROUP

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Acronyms

3G	Third Generation
4G	Fourth Generation
ACD	Actual Commencement Date
ADB	Asian Development Bank
ADO	Automotive Diesel Oil
ADSL	Asymmetric Digital Subscriber Line
AUD	Australian Dollars
Avg	Average
BTC	Betio Town Council (Kiribati)
CDL	Container Deposit Legislation
DFAT	Department of Foreign Affairs and Trade
EIB	European Investment Bank
EPR	Extended Producers' Responsibility
EU	European Union
FEA	Fiji Electricity Authority
FSM	Federated States of Micronesia
FTE	Full Time Equivalent
Gb	Gigabytes
GDP	Gross Domestic Product
GNI	Gross National Income
Govt.	Government
GSM	Global System for Mobile
HCC	Honiara City Council
HH	Households
IATA	International Air Transport Association
ICAO	International Civil Aviation Organization
ICT	Information Communication and Technology
IFC	International Finance Corporation
ITU	International Telecommunication Union
JICA	Japan International Cooperation Agency
JMP	Joint Monitoring Program (*of the MDGs)*
J-PRISM	(Japan-sponsored) Pacific Region Information System
kbps	Kilobytes per second
km	Kilometre
KUA	Kosrae Utilities Authority
kW	Kilo Watt
kWh	Kilo Watt Hour
LOS	Level of Service
LTE	Long Term Evolution (used in regard to mobile phone technologies)
MAWC	Majuro Atoll Waste Company
Mb	Megabytes
mbps	Mega bits per second
MDGs	Millennium Development Goals
MEC	Marshall Energy Company

Mgt	Management
mins	Minutes
MJ	Megajoules
mths	Months
mWh	Mega Watt Hour
NRC	Nauru Rehabilitation Corporation
NZMFAT	New Zealand Ministry for Foreign Affairs and Trade
PASO	Pacific Aviation Safety Office
PCO	PRIF Coordination Office
PET	Polyethylene Terephthalate
PIAC	Pacific Infrastructure Advisory Centre
PIC	Pacific Island Countries
PICASST	Pacific Islands Safety and Security Treaty
PIFS	Pacific Islands Forum Secretariat
PIPIs	Pacific Infrastructure Performance Indicators
PiRRC	Pacific ICT Regulatory Resource Center
PMC	PRIF Management Committee
PNG	Papua New Guinea
PPE	Personal Protective Equipment
PPL	PNG Power Ltd.
PRIF	Pacific Region Infrastructure Facility
PV	Photovoltaic
RMI	Republic of Marshall Islands
SAIDI	System Average Interruption Duration Index
SAIFI	System Average Interruption Frequency Index
SPC	Secretariat of the Pacific Community
SPREP	Secretariat of the Pacific Regional Environment Programme
SWG	Sector Working Group
SWM	Solid Waste Management
SWMBPW	Solid Waste Management Office of the Bureau of Public Works (Palau)
TAU	Te Aponga Uira O Tumu-Te-Varovaro
TFEC	Total Final Energy Consumed
TOE	Tonne of Oil Equivalent
TUC	Teinainano Urban Council
ULP	Unleaded Petroleum
UNDP	United Nations Development Programme
UNELCO	UNELCO Vanuatu Ltd.
UNESCO	United Nations Organization for Education, Science and Culture
UNICEF	United Nations Children's Fund
USD	United States Dollar
WBG	World Bank Group
WHO	World Health Organization
WSS	Water Supply and Sanitation
YSPSC	Yap State Public Service Corporation
yrs	Years

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1. Introduction

1.1 Background

The Pacific Region Infrastructure Facility (PRIF) aims to support Pacific Island Countries (PICs) in infrastructure development through coordination between seven development partners[1]. It operates in 13 developing countries in the Pacific region. As one of PRIF's initiatives, the Pacific Infrastructure Performance Indicators (PIPIs) were first developed under the Pacific Infrastructure Advisory Centre (PIAC) and they are currently managed through its successor program, the PRIF Coordination Office (PCO). This is the second PIPIs Report, the first being produced in 2011.

In the PIPIs Report for 2011[2], data gaps and limitations were identified. These have been addressed as far as possible in preparation of this report, though reliable data sets are yet to be achieved for all the PIPIs.

A new feature in the current exercise is that it has been developed in collaboration with three regional organisations – the Pacific Islands Forum Secretariat (PIFS), the Pacific ICT Regulatory Resource Centre (PiRRC) and the Secretariat of the Pacific Community (SPC). This has resulted in a better data collection process and enabled production of a single data set to be held on behalf of the agencies by SPC. The main data collation exercise was conducted during the second half of 2014 and first half of 2015 with ongoing analysis into the second half of the year. The year of the data is shown in each data set and varies according to what the latest available data was at the time of the collation exercise.

1.2 Purpose

The purpose of the PIPIs is to measure and report on infrastructure performance in the Pacific. This report presents data for individual performance indicators as well as some comparative analysis over two points in time (i.e. PIPIs 2011 and 2014/2015), in order to facilitate monitoring of trends in the sectors included in the report.

1.3 Scope

The report covers five economic infrastructure sectors:

- energy
- information and communications technology (ICT)
- solid waste (as part of urban development)
- transport (including aviation, maritime and road sub-sectors), and
- water and sanitation (WSS).

1 Asian Development Bank (ADB), Australian Department of Foreign Affairs and Trade (DFAT), European Investment Bank (EIB), European Union (EU), Japan International Cooperation Agency (JICA), New Zealand Ministry of Foreign Affairs and Trade (NZMFAT) and the World Bank Group including the International Finance Corporation (IFC).

2 Austin, J., Overbeek, J.W., Larcombe, J., Alejandrino-Yap, M.C., & Platkov, V. (2011). *Pacific Infrastructure Performance Indicators 2011*. Sydney, Australia: Pacific Region Infrastructure Facility.

The performance in these sectors was measured through five 'markers' i.e. access, quality, efficiency, affordability and safety (though safety does not apply to all of the sectors).

There are 14 countries included in the data collection:

- Cook Islands
- Federated States of Micronesia (FSM)
- Fiji
- Kiribati
- Nauru
- Niue
- Palau
- Papua New Guinea (PNG)
- Republic of the Marshall Islands (RMI)
- Samoa
- Solomon Islands
- Tonga
- Tuvalu, and
- Vanuatu.

1.4 List of PIPIs

The list of PIPIs for the 2015 report is provided in Table 1, showing the changes since the last data collection in 2011. A key decision for each set of indicators concerned whether to adopt the 2011 PIPIs for comparative purposes or to modify or replace some of them to reflect evolving infrastructure priorities (for example, the increased role of off-grid solar energy and the tectonic shift in ICT to mobile coverage). This resulted in a number of changes indicated in Table 1. However, during data collection, it became apparent that some of the indicators may not be the best measure for the category in question and that data was not available (in whole or in part) for 19 of the indicators. To illustrate the first of these issues, in some sub-sectors the indicators measuring 'access' are focused on the assets themselves rather than levels of service. Whilst the information is interesting, it means that further honing of the indicators should be considered in future. In the case of unavailable data, alternative equivalent data is presented for six of these but, again, the availability of data should be considered in determining the indicator set in the future. Despite this, the data presented in the report provides a useful overview of the situation in the PICs and improvements that are being achieved through the combined efforts of governments, communities and their development partners.

Table 1. List of PIPIs

Sector	Category	2011 Indicators	2015 Indicators
ENERGY	Access	1) Access to electricity (% of total households - HH)	1) Access to electricity (% of total HH):
			1a) % of HH with access to grid connected electrification
			1b) % of HH with access to off grid electrification
		2) Electricity production capacity kW per capita	2) Electricity production capacity kW per capita
		3) Electricity production (actual) kWh per capita	3) Electricity production (actual) kWh per capita
	Quality		4) % of reserve capacity
			5) System Average Interruption Frequency Index (SAIFI) – mins per customer per year
			6) System Average Interruption Duration Index (SAIDI) – mins per customer per years
	Efficiency /Energy use	4) Total fuel imports (% of GDP)	7) Total fuel imports (% of GDP):
			7a) Total fuel imports for power generation (% of GDP)
			7b) Energy Intensity (fuel imports) – Amount of petroleum fuel consumed in country to produce USD1GDP (MJ/USD)
		5) Distribution losses (% of output)	8) Distribution losses (% of output)
		6) Tons of oil equivalent (TOE) per capita	9)Tonne of oil equivalent (TOE) per capita
		7) Renewable energy share %)	10) Renewable energy share (%)
		8) Clean energy contribution (%)	
	Affordability	9) Average end-user electricity tariffs (US cents/kWh) (residential)	11)Total fuel imports as a percentage of total imports
			12) Average end-user electricity tariffs (US cents/ kWh)
			12a) residential
			12b) commercial
			12c) industrial
		10) Average end-user electricity tariffs (US cents/kWh) (commercial)	13) Average annual wholesale fuel price (US cents/ litre)
			13a) Automotive Fuel Oil (ADO)
			13b) Unleaded Petroleum (ULP)
			13c) Kerosene
			14) Average annual retail fuel price (US cents/litre)
			14a) ADO
			14b) ULP
			14c) Kerosene

Table 1 (cont.)

Sector	Category	2011 Indicators	2015 Indicators
ICT	Access	Fixed lines per 100 persons	1) % of population covered by a mobile-cellular network
		Mobile subscriptions per 100 persons 3) Internet users per 100 people 4) Total tele-density per 100 population	2) % of population covered by at least a 3G mobile network
			3) % of population covered by a 4G mobile network
			4) Fixed broadband subscriptions per 100 people *Noting that subscribers are not necessarily individuals*
	Quality	5) International internet bandwidth per person or inhabitant (bits per internet user)	5) International internet bandwidth (bit/s per person)
	Efficiency		No indicator (as per 2011)
	Affordability	6) Telecommunications service price as % of avg. monthly income - Fixed telephone 7) Telecommunications service price as % of avg. monthly income – Mobile 8) Telecommunications service price as % of avg. monthly income – Internet 9) Competition – Number of service providers for phones, mobile and Internet 10) Secure Internet servers (per 1 million people)	6) Mobile-cellular prepaid - price of 1 min local call (off-peak, on-net) in USD (avg) *Note: Original PIPI was for 3 min calls but this is no longer the way calls are costed in the Pacific, so the indicator has been adjusted accordingly*
			7) Price of 1 min call to major market destinations (Sydney and San Francisco) – peak business time *Note: Original PIPI was for 3 min calls but this is no longer the way calls are costed in the Pacific, so the indicator has been adjusted accordingly*
			8) Price of 3G data bundles
			9) Price of monthly ADSL

Sector	Category	2011 Indicators	2014 Indicators
SOLID WASTE	Access	1) Access to regular solid waste collection service in urban areas (% of urban population)	1) Access to regular solid waste collection service in urban areas (% of urban population)
		2) Frequency of solid waste collection service per week in urban areas (number)	2) Frequency of solid waste collection service per week in urban areas (number)
	Quality	3) Does the landfill meet environmental standards? Y/N	3) No. of each type of waste management facility in urban areas
			4) % of facilities that meet environmental best practice standards
			5) % of facilities with up-to-date environmental monitoring reports readily available
	Efficiency		6) Cost per capita for waste disposal
	Sustainability	4) Does a system exist for sorting and/or recycling (part of) solid waste? Y/N	7) No. of systems for sorting solid and/or hazardous waste
			8) No. of shipping containers exported that contain recyclable commodities or waste
			9) No. of Extended Producer Responsibility programs

Table 1 (cont.)

Sector	Category	2011 Indicators	2015 Indicators
TRANSPORT-AVIATION	Access	1) Number of operational airports (paved/ unpaved)	1) No. of operational airports (paved/ unpaved)
		2) Scheduled take-off and landing by airport (Inbound international flights/week)	2) Scheduled take-off and landing by airport (in-bound international and domestic flights/week)
		3) Average passenger numbers (international scheduled seats/week)	3) Average air cost (international freight, USD/ton-km)
		4) Average (or range) air cost per ton-km (freight) (USD/kg)	4) No. of in-bound international passenger seats per week
		5) Paved and unpaved airports (number)	
		6) Inbound flights from Aus/NZ (per week)	
		7) Inbound flights from other international countries (per week)	
		8) Inbound intra-regional flights from other PICs (per week)	
		9) Inbound seats from other international countries (per week)	
		10) Inbound intra-regional seats from other PICs	
	Quality		5) IATA Level of Service (LOS) by country
	Efficiency	11) Private Ownership of Airport Infrastructure	6) Number of international flights per week to dominant hub
		12) Private Ownership of Terminal Facilities	
		13) Private Sector Participation in Ground Handling	
	Affordability	14) Air travel costs (AUD) from Fiji, NZ, Aus	7) Average cost of economy air travel (% of per capita GDP)
		15) Domestic air services - flights per week	
		16) Domestic air services - seats per week	
		17) International air freight rates Standard/Min $AU per kg	
	Safety		8) No. of aviation incidents per annum
			9) International Civil Aviation Organization (ICAO) safety audit indicator
TRANSPORT-MARITIME	Access	1) Number of main ports	No. of international ports
		2) All international container shipping services (per month)	2) No. of international commercial vessels per mth or container services to ships per mth
	Quality		
	Efficiency		3) Vessel turnaround time (days)
			4) Delay waiting to enter port (days)
	Affordability	3) Stevedoring charges (USD/TEU)	5) Port charges (USD/TEU)
	Safety		6) No. of maritime incidents per annum

Table 1 (cont.)

Sector	Category	2011 Indicators	2015 Indicators
TRANSPORT-ROADS	Access	1) Total road network (km)	1) Total road network (kms)
		2) Paved roads (km)	2) Paved roads (kms)
		3) Unpaved roads (km)	3) Unpaved roads (kms)
		4) Paved roads (km) as % of total road network (km)	
			4) No. of motor vehicle registrations
			5) Road density (kms of road/100 km²)
	Quality		6) Condition of roads
	Efficiency		7) % of road network receiving regular routine maintenance
	Affordability		
	Safety		8) No. of road accidents per 10,000 registered vehicles

Note: The terms 'paved' and 'unpaved' as used in the PIPIs indicators refers to 'sealed' and 'unsealed' roads or tarmacs.

Sector	Category	2011 Indicators	2015 Indicators
WATER & SANITATION	Access	1) Access to improved urban water source (% total population – men/women)	1) Access to improved urban water source (% total population)
		2) Access to improved rural water source (% total population)	2) Access to improved rural water source (% total population)
		3) Access to improved urban sanitation (% total population)	3) Access to improved urban sanitation (% total population)
		4) Access to improved rural sanitation (% total population)	4) Access to improved rural sanitation (% total population)
		5) Incidence of water borne diseases (estimated deaths of diarrhoea per 100,000 inhabitants)	
	Quality	6) Availability of water supply in piped water supply systems (average hours per day)	5) Availability of water supply in piped water supply systems (average hours per day)
		7) Metered connections (%)	6) Metered connections (%)
	Efficiency	8) Employees per 1000 connections	7) Employees per 1000 connections
		9) Difference between water produced and sold (%)	8) Difference between water produced and sold (%) – non-revenue water
	Affordability and Financial Sustainability	10) Cost recovery (revenues from tariffs/ operating cost) (%)	9) Cost recovery (revenues from tariffs/ operating cost) (%)
		11) Average tariff (USD per m^3) for water and sewerage services	10) Average tariff (USD per m^3) for water and sewerage services
			11) No. of qualified personnel in water utilities (% of staff with a diploma/ certificate that qualifies them for their position)
	Safety		12) Proportion of population with access to drinking water that meets World Health Organization (WHO) guidelines (% of water treated by urban/rural)
			13) Incidence of water-borne diseases (reported cases)
			14) Diarrhoea and dysentery per year as a percentage of the total population (if possible divided into urban/rural and gender)

1.5 Methodology

The PIPIs 2015 is based on secondary data published in various websites and hard copy reports. The process consisted of three phases:

- development of the indicators
- research and data collation, and
- data analysis and reporting.

An Implementation Committee was formed consisting of staff from PCO, PIFS, PiRRC and SPC. The role of this group was to provide oversight to the project and practical support in the event of difficulties in collecting the data.

1.5.1 Development of Indicators

Draft PIPIs were prepared by PCO in conjunction with each of the PRIF Sector Working Groups (SWGs), PIFS, PiRRC and SPC. These were then approved by the PRIF Management Committee (PMC).

1.5.2 Data Collation

Based on the agreed indicators, a sector-specific data collection template was developed. Sources for the data included:

- www.SPC.int//PRISM website where all PICs Statistics Offices post their data and reports
- web pages of line ministries and departments in the 14 PICs
- web-based marketing materials of ICT operators in the region
- benchmarking reports from the Pacific Power Association
- online databases for a range of organisations including the Asian Development Bank (ADB), World Bank, United Nations Development Programme (UNDP), United Nations Children's Fund (UNICEF), United Nations Organization for Education, Science and Culture (UNESCO), International Telecommunications Union (ITU), and the Central Intelligence Agency's (CIA) World FactBook, and
- direct contact with PRIF agencies and project representatives.
- The data was collected across a period of time and more recent data may since have been released for some indicators.

1.5.3 Data Analysis and Reporting

The data was analysed by the PCO, PIFS and SPC personnel. Most of the collated data is expressed in terms of raw numbers, percentages and averages. In addition to the mean and median (used in PIPIs 2011), weighted mean/percentages were calculated for some of the PIPIs in this report (2015). Thus, this PIPIs report consists of three types of measures, as follows:

- **Mean**: Means are the average from among numbers or percentages or from among a group of means without any 'weighting' (i.e. treating countries with different populations as if they were the same). For example, PNG (with a population of 7,398,456) and Niue (with a population of 1,535 population) are treated equally in the dataset.
- **Median**: Medians are the value which lies in the centre of a spread of values in any data set. A median ignores any value or 'weight' differences such as those that result from differences in populations between countries, land areas, Gross Domestic Product (GDP), volume of imports and exports and so on.
- **Weighted average/percentage**: In 'weighted' averages or percentages, data is 'weighted' by the size of the population in the country using population data for the same year as the reference year of the PIPIs data.[3] This makes the data more comparable between the PICs.

3 All population data is taken from the SPC EDD Database except for the chapter on ICT for which World Bank data was used.

The use of means, medians and weighted averages needs caution. The PICs have vastly different populations, they are geographically dispersed, and they differ in level of development and development challenges, so comparison can sometimes be problematic. A decision was therefore taken to only calculate 'weighted' data for those datasets where it is considered reasonable to do so, including for illustrative purposes. The 'weighted' data should be interpreted with explicit recognition of the range of data in the individual data sets. The results are also sometimes presented in this report according to sub-regions where this aids interpretation.

In the case of some indicators, it was not possible to obtain any data or sufficient data for inclusion in the report. Where there was only partial data available for a country, it has generally been excluded unless it is likely to represent almost all of the data for that country. In other cases, data is shown for some countries while others are left blank in the relevant tables or graphs. There are instances where data is not available for the listed indicator, but alternative data is presented as a 'proxy'. Additionally, where per capita data is shown, the source of the original data is referenced along with the source of the population figure that was used to create a per capita result (e.g. in the case of some of the power benchmarking data).

1.6 Limitations

In preparing this report, keen attention was paid to the limitations reported in PIPIs 2011. The major actions taken to overcome these are:

- **PNG and Fiji included:** The population of PNG and Fiji has been included in the PIPIs 2015 which represents 92% of a total estimated population in the PICs of 10,566,535 (2013). In contrast, the PIPIs 2011 represented about 14% population from 12 PICs.
- **More representative statistical tools used:** PIPIs 2015 used statistical tools that take account of all the population while the PIPIs 2011 simply presented the basic numbers. At the same time, there is an inherent problem in comparing data between countries with large versus small populations (as discussed above) and this needs caution in the PIPIs 2015 report.
- **Benchmarking data used to get 'single-sourced' data for indicators:** In addition to the above, the PIPIs for 2015 includes data from benchmarking projects undertaken through support from PRIF. This has increased the consistency of the data and largely reduced the use of various sources of data for one indicator. However, it is important to recognise that country level data is based on what is supplied by each utility in the country and this only reflects their customer base, not necessarily supply across urban and rural areas as a total.

These efforts mean that limitations have been significantly reduced in the PIPIs Report 2015, although there are still some issues (as already mentioned). These include use of secondary sources with varying methodologies for data collation, having data sets that are from different time periods, lack of disaggregation of data, lack of time series data, and missing data for many of the indicators. Consequently, although the report brings together data made available at the time of the study, it is not comprehensive and does not substitute for good primary data collection.

1.7 Structure of Report

In addition to this introductory information, there are three other sections in this report. Chapter 2 contains the analysed data (presented by sector), Chapter 3 contains Conclusions and there are also a number of Appendices. Appendix A lists the main sources of data; Appendix B contains information on how to obtain the raw data used in the report; Appendix C contains population data for the PICs used in calculating some of the indicators; Appendix D has a summary of limitations with the data; Appendix E has information about gaps in the data set; and Appendix F provides some illustrative port tariffs.

2. Performance Indicators: Data and Analysis

This section of the PIPIs Report provides performance results, mostly in the form of graphs. There is a brief explanation of each indicator with results in numbers and percentages, as well as tables and graphs. Most of the graphs contain a vertical bar for each of the countries and horizontal lines for the mean, median and any weighted data. Presentation follows the style of the 2011 PIPIs Report to aid comparison.

2.1 Energy

Key Findings:

- *In eight countries, more than 90% of households have access to electricity, though the percentage is lower in larger countries with geographical and other constraints.*
- *Most households with electricity are connected to the grid.*
- *All countries have reserve electricity capacity, though it varies between 13% and 71%.*
- *Power distribution losses can be as high as 29%, with a mean of 14%.*
- *While only five countries reported using renewable energy, it is known to be used in 14 PICs.*
- *Tariffs vary considerably according to country and category of customer – the lowest tariff is US12 cents per kWh in Pohnpei (FSM) for government, industrial and commercial customers and the highest tariff is US89 cents per kWh in Vanuatu for residential customers.*

Production and distribution of electricity is a serious logistical issue in Pacific countries comprised of many islands. In addition, a significant number of the PICs depend on imported fuel for electricity production but are unable to take advantage of economies of scale given their relatively small population base and the nature of their geography. Hence, costs are relatively high. In addition, the power supply is not reliable in some of the countries (or in areas within countries), power losses are high in some countries, and there are difficulties with implementing cost-recovery measures. The production and use of renewable and clean energy is not widespread so its impact across the region is not significant as yet, though its use expected to continue to expand.

The energy indicators for PIPIs 2015 consist of Access, Quality, Efficiency/Energy Use and Affordability. Each of them is elaborated in the following sub-sections.

2.1.1 Access

Access to energy is defined as access to electricity connection and electricity production. It is a critical component of economic development, supporting creation of businesses and job opportunities, as well as allowing existing businesses and small entrepreneurs to open their businesses earlier and stay open later. At the household level, one of the key impacts of introducing electricity is that women do not have to spend time fetching wood or other burnable materials for cooking and other household needs, thereby giving them time for economic and other pursuits.

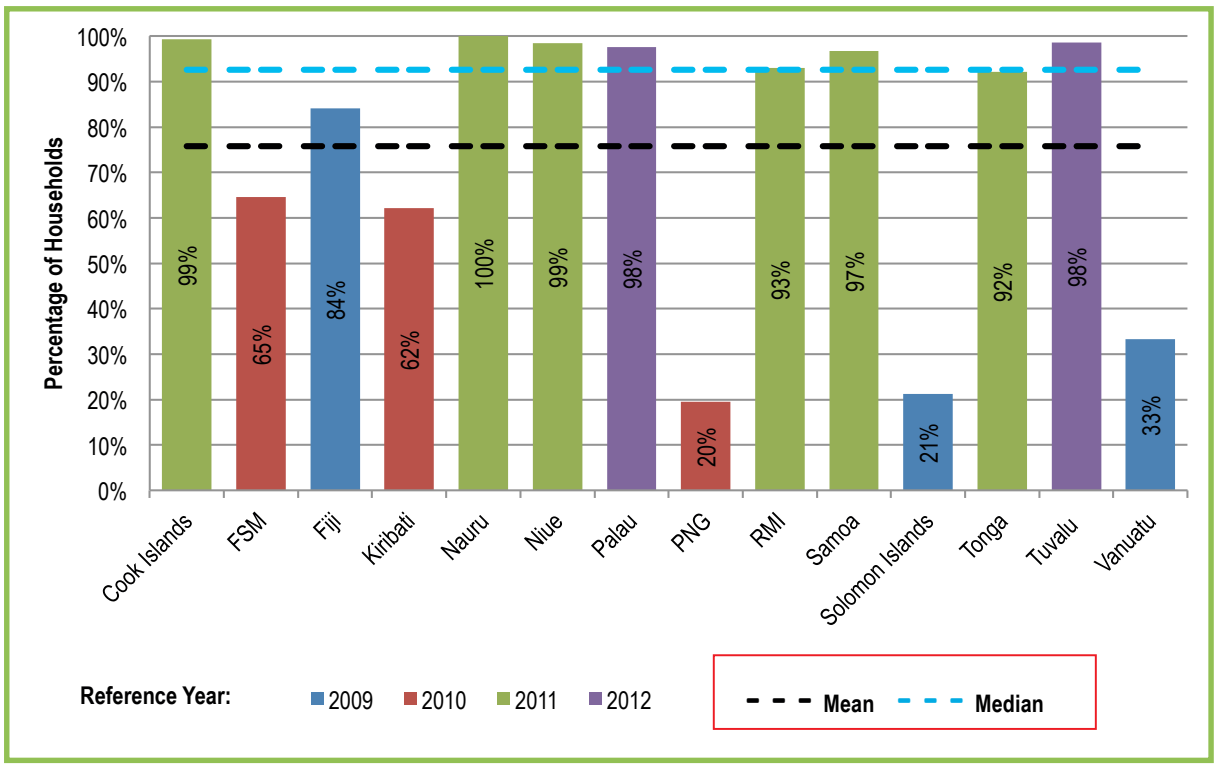
In this report, access to electricity connection is represented by the percentage of households connected to electricity, while electricity production includes both per capita installed electricity generation capacity and actual annual per capita electricity measured in kilo Watt hours (kWh).

The electricity connection can be either grid connected ('on-grid') or off-grid connected.

Access to Electricity Connection

The data shows that level of electrification across the PICs is not uniform – varying between 20% and 100% - though significant progress has been made and there are eight countries in which more than 90% of households have access to electricity (see Figure 1). Smaller PICs have greater coverage than larger PICs given they generally present fewer logistical barriers to installation and supply of power to more remote areas. In fact, the four smallest countries (Cook Islands, Nauru, Niue and Tuvalu) have electrification rates of 98% or more while two of the largest (and the most populous) countries - PNG and the Solomon Islands - have 20% and 21% electrification respectively – and would have a corresponding significant downward impact if the weighted percentage was included.

Figure 1. Access to Electricity as Percentage of Total Households by Country, 2009-2012



Source: Secretariat of Pacific Community (SPC), Economic Development Division (EDD) Database; Accessed August 2014[4]. Note: Includes both grid and off-grid connections. Referenced year refers to the latest Census or Household Income and Expenditure Survey.

Of households with electricity, most are connected to the grid and the rest have off-grid electrification. The percentage share of grid connection and off-grid electricity is 85% and 15% respectively.

Grid-Connected Access

The Polynesian sub-region has the highest overall grid-connection with Samoa at 96% of households connected, Niue and Tuvalu with 95%, Cook Islands with 94%, and Tonga with 89% (see Figure 2). The Melanesian sub-region has the least access to grid-connection given the impact of low connection rates in PNG, Solomon Islands and Vanuatu (17%, 12% and 28% respectively), though Fiji is an exception with a connection rate of 72%.

4 Updates on data in SPC's energy database can be obtained by contacting the Economic Development Division in Suva.

Figure 2. Access to Grid-Connected Electricity as Percentage of Total Households by Country, 2009-2012

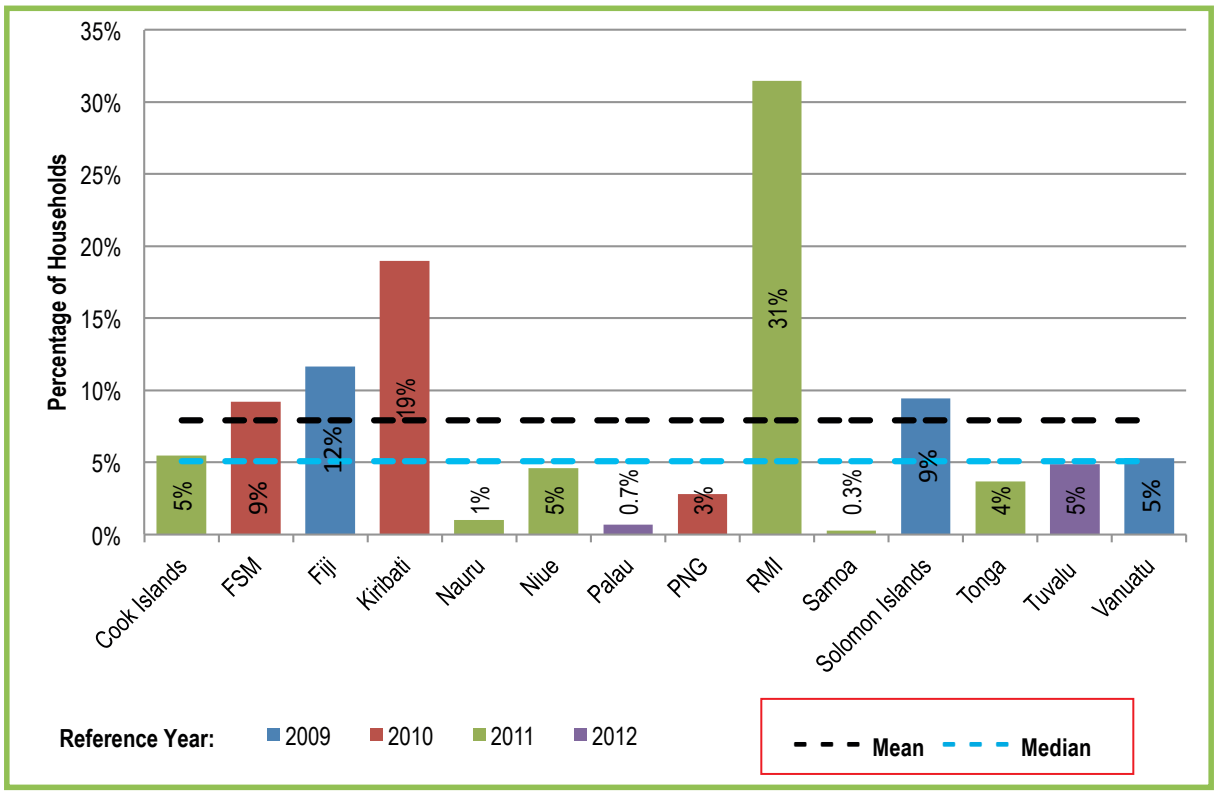
Source: SPC, EDD Database; Accessed August 2014. Referenced year refers to the latest Census or Household Income and Expenditure Survey.

Off-Grid Access

Off-grid power generally comprises solar energy, wind energy, batteries or generators (often used for back-up purposes) and it currently makes only a small contribution to total electrification. The available data shows that off-grid electrification is highest in RMI (31%)[5], followed by Kiribati (19%) and Fiji (12%), whilst there is very little reported off-grid electrification in Samoa, Nauru and Palau (see Figure 3), countries which all have high rates of access to the grid.

5 RMI installed solar home systems in all its Outer Islands, hence the high level of off-grid electrification.

Figure 3. Access to Off Grid-Connected Electricity as Percentage of Total Households by Country, 2009-2012



Source: SPC, EDD Database; Accessed August 2014.

Importantly, countries that have both low access to the grid and low access off-grid may not have adequate power to meet both household and business needs, with corresponding impact on level of overall social and economic development. This includes the three Melanesian countries of PNG, Solomon Islands and Vanuatu. In PNG 17% of households have access to the grid and 3% have off-grid access; in the Solomon Islands 12% of households have access to the grid and 9% have off-grid access; and in Vanuatu 28% of households have access to the grid and 5% have off-grid access (see Figures 2 and 3).

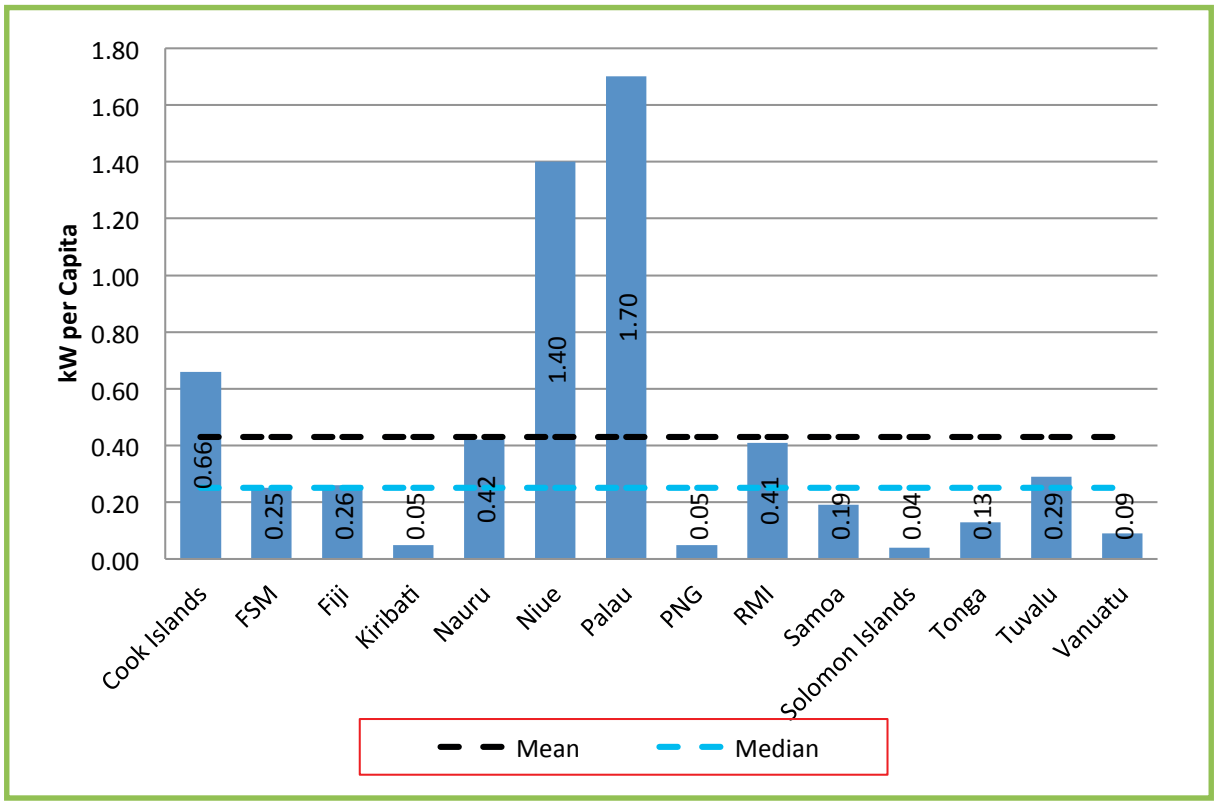
Electricity Production

Electricity production is measured in terms of both installed capacity (per capita) and actual production (per capita). These indicators are derived by dividing the total installed capacity and total annual actual electricity production[6] by the population of that year.

The data on per capita installed electricity production capacity in the PICs dates from 2012 (see Figure 4). Palau had the highest per capita installed electricity production capacity (1.70 kW per capita) followed by Niue (1.40 kW per capita). The three PICs with the lowest per capita installed electricity generation capacity were Solomon Islands (0.04 kW per capita), Kiribati (0.05 kW per capita) and PNG (0.05 kW per capita). This is consistent with the results in the PIPIs Report for 2011. The mean and median were 0.43 kW per capita and 0.25 kW per capita respectively, with 11 of the countries below the median and eight below the mean, indicating the statistical impact of the figures from Palau and Niue.

6 As reported in the *Pacific Power Utilities Benchmarking Report, 2012 Fiscal Year.*

Figure 4. Electricity Production – Installed Capacity – kW per Capita by Country, 2012



Sources: Electricity production data - Pacific Power Association. (2015, June). Pacific Power Utilities Benchmarking Report 2012 Fiscal Year[7]; Population data – SPC EDD Database, Accessed August 2014.

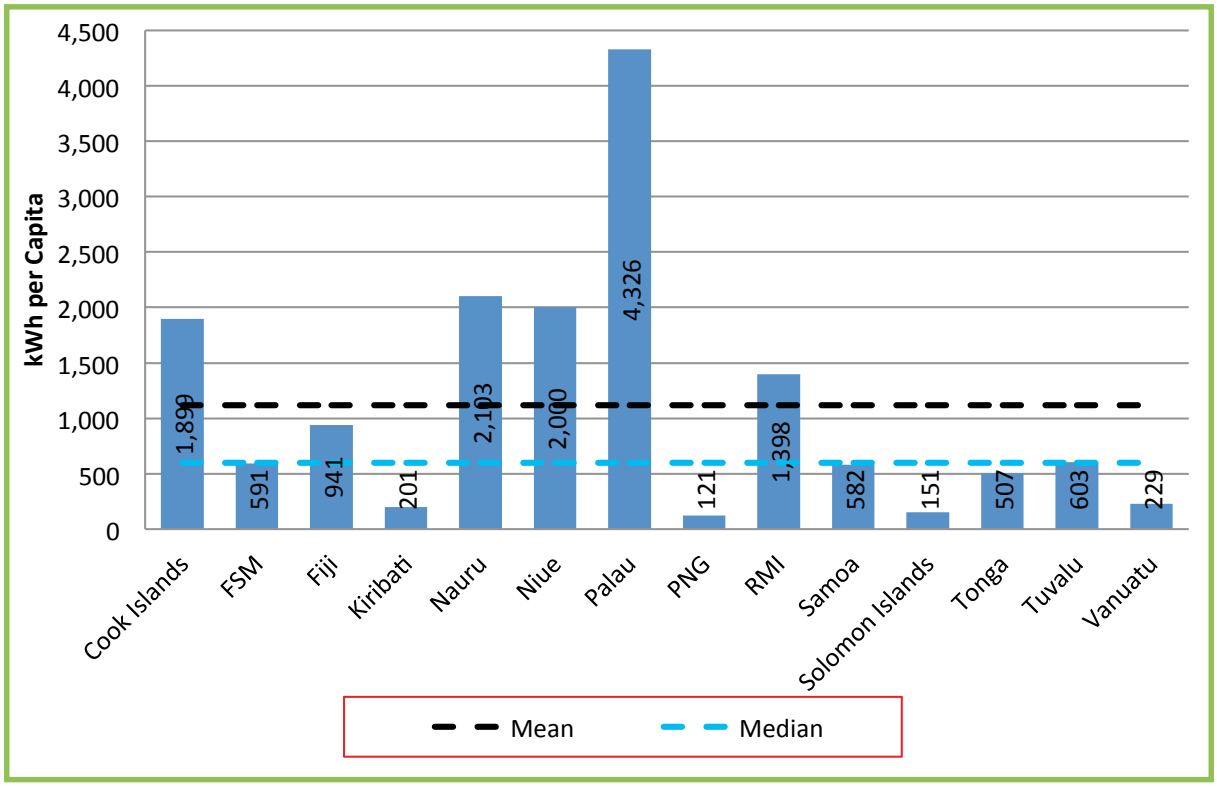
The data for actual production shows a mean of 1,118 kWh per capita and a median of 597kWh per capita, but this belies the significant spread in the data (as is characteristic of much of the infrastructure data across the Pacific). Per capita actual electricity production is highest in Palau (4,326 kWh per capita) and lowest in PNG (121 kWh per capita). Nine countries are below the average including FSM, Fiji, Kiribati, PNG, Samoa, Solomon Islands, Tonga, Tuvalu and Vanuatu (see Figure 5).

Power plant at Nauru Utilities Corporation (J. Overbeek)

Comparing installed capacity and actual production (Figures 4 and 5) is informative. For example, while Niue has a much higher installed capacity per capita than Nauru, actual production per capita is similar. This highlights the importance of ensuring grid stability and appropriate operational control strategies (e.g. frequency, voltage and power balance) are in place at power utilities for managing a significant share of renewable energy capacity. The integration of variable renewables into power grids requires transformation of existing networks including the need to consider energy storage capacity.

7 Data in the Power Benchmarking Report is collected at utility level. Therefore, in those cases where there is more than one utility in a country, the figures have been aggregated to provide country-level data.

Figure 5. Electricity Production – Actual Production - kWh per Capita by Country, 2012



Sources: Electricity production data - Pacific Power Association. (2015, June). Pacific Power Utilities Benchmarking Report 2012 Fiscal Year[8]; Population data – SPC EDD Database, Accessed August 2014.

It should be noted that access to the grid varies widely (see Figure 2) and hence using total population as the denominator for unit capacity and production may not be very instructive to compare the available and delivered services of electricity providers in PICs to grid- connected households. It may be more meaningful to use the number of households with access to the grid as the denominator to asses this parameter.

2.1.2 Quality

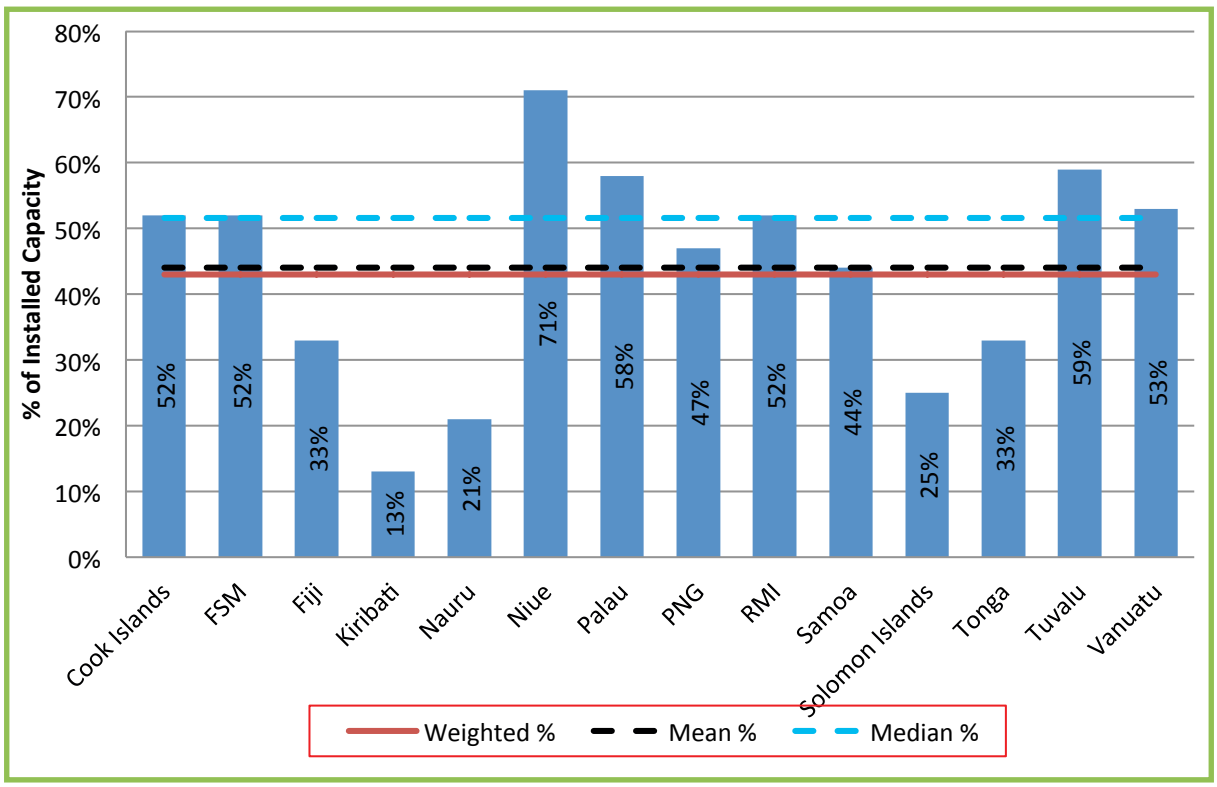
Quality of service delivery is assessed in terms of reserve capacity, System Average Interruption Frequency Index (SAIFI) and System Average Interruption Duration Index (SAIDI). Reserve capacity is the additional installed capacity above the maximum demand (i.e. whether there is additional generation capacity to meet increases in demand) and it is expressed as a percentage of total installed capacity. SAIFI is the average number of interruptions in electricity supply per customer per year and SAIDI is the average duration of interruptions in minutes per customer per year. Clearly, if there is access to electricity but that access is unreliable, it can have a significant impact on the ability to operate a business and compete in the marketplace, it can affect efficiency of government operations and also quality of life at household level.

Reserve Capacity

All the power utilities in the PICs have reserve capacity to some degree. Generally, having low reserve capacity is only an issue in the event of an increase in demand that cannot be met or during planned maintenance work. The overall weighted reserve capacity is 43% with a mean of 44% and a median of 52% (see Figure 6). Niue reported the highest reserve capacity with 71% while Fiji, Kiribati, Nauru, Solomon Islands and Tonga had less than the weighted average.

8 As above.

Figure 6. Energy Sector - Reserve Capacity as Percentage of Installed Capacity by Country, 2012

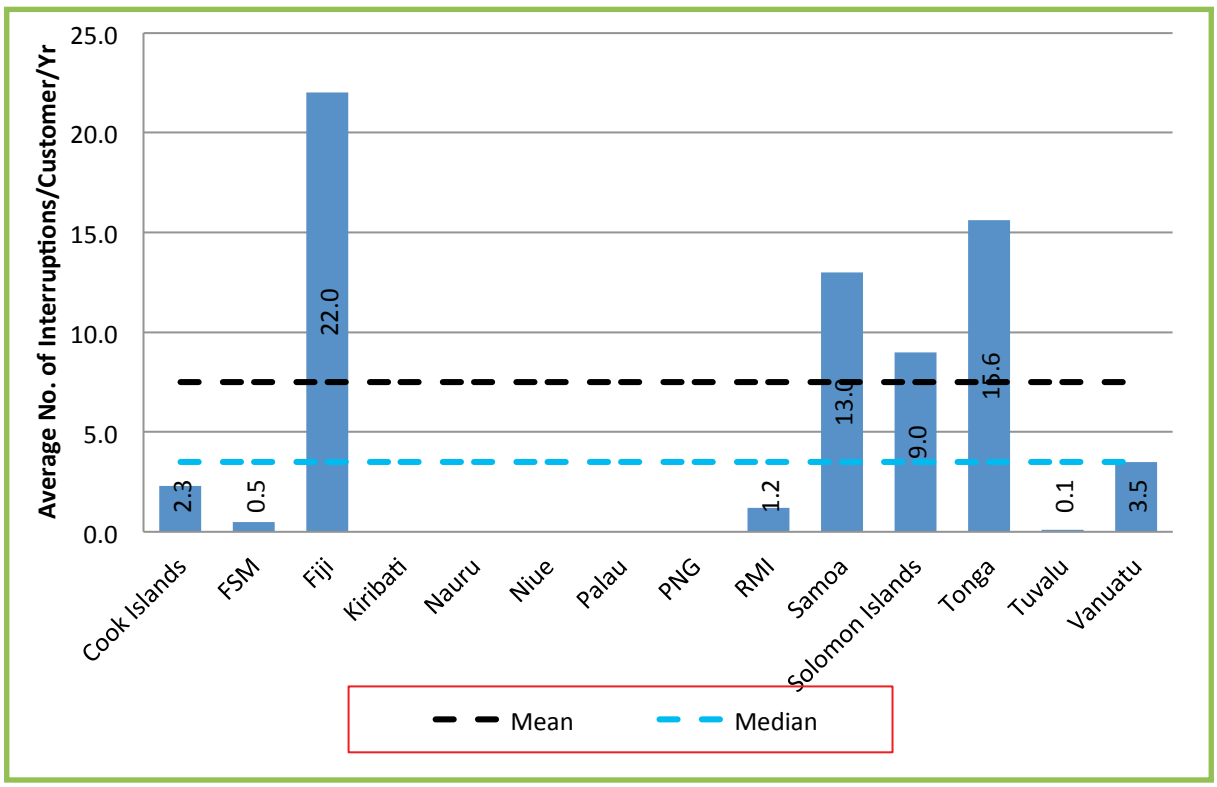


Source: Pacific Power Association. (2015, June). Taken from Raw Data Set for Pacific Power Utilities Benchmarking Report 2012 Fiscal Year.

System Average Interruption Frequency Index

The average number of system interruptions per year is a key indicator of the quality of service for customers. Data was only available for nine countries, with five of these having a relatively lower level of interruptions (see Figure 7): Tuvalu (0.1 interruptions per customer per year), FSM (0.5 interruptions per customer per year), RMI (1.2 interruptions per customer per year), Cook Islands (2.3 interruptions per customer per year), and Vanuatu (3.5 interruptions per customer per year). On the other hand, the level of interruptions in the Solomon Islands, Samoa, Tonga and Fiji are above average, being between 9.0 and 22.0 interruptions per customer per year.

Figure 7. Energy Sector - System Average Interruption Frequency Index (SAIFI), Number of Interruptions by Country, 2012

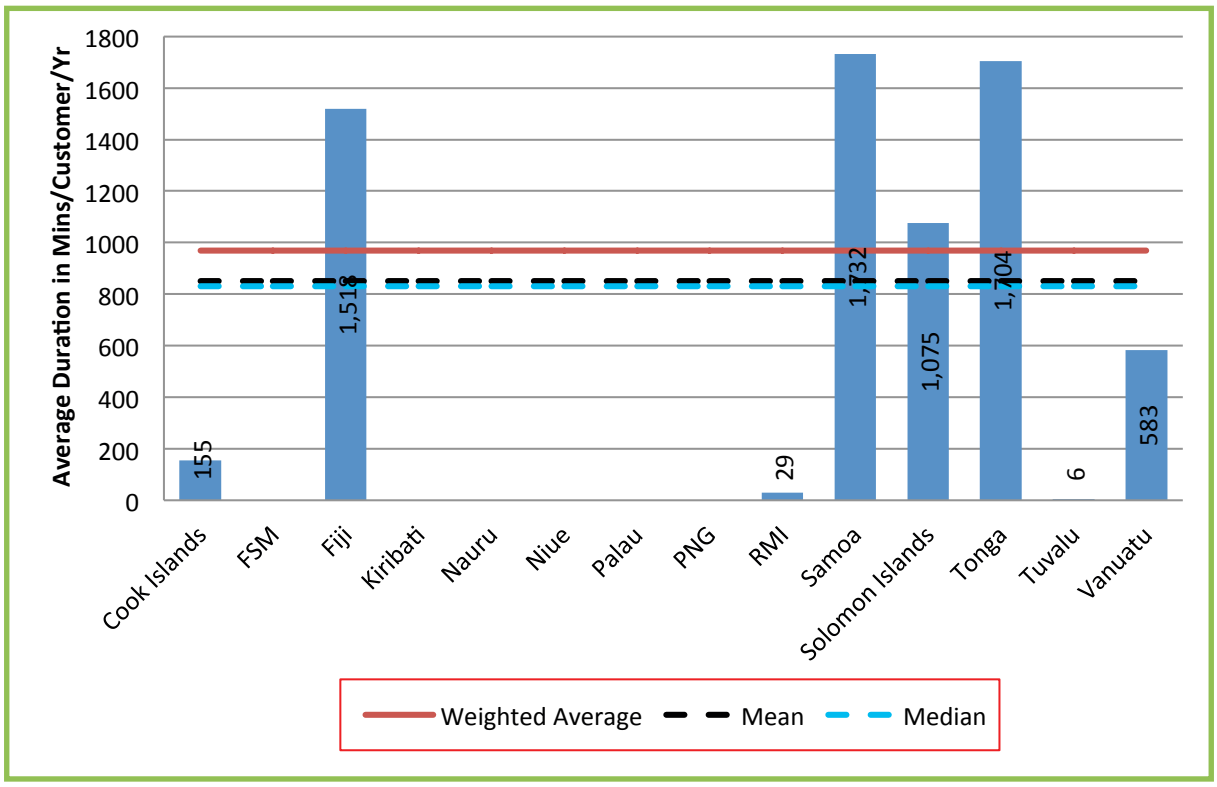


Source: Pacific Power Association. (2015, June). Pacific Power Utilities Benchmarking Report 2012 Fiscal Year.
Note: Data not available for Kiribati, Nauru, Niue, Palau and PNG.

System Average Interruption Duration Index

The *Pacific Power Utilities Report 2012 Fiscal Year* reported the weighted average SAIDI at 969 minutes per year per customer (across all the PICs). PICs reporting SAIDI above the weighted average were Fiji, Samoa, Tonga and Solomon Islands (see Figure 8) – the same countries facing challenges in managing the SAIFI levels. However, as previously discussed, it is important in using the weighted average to consider the variation between the two groups of countries with higher and lower SAIDI (and SAIFI) scores. Sub-regional patterns are difficult to determine given the incomplete information from Melanesia and Micronesia.

Figure 8. Energy Sector - System Average Interruption Duration Index (SAIDI), Minutes by Country, 2012



Source: Pacific Power Association. (2015, June). Pacific Power Utilities Benchmarking Report 2012. Note: Data not available for FSM, Kiribati, Nauru, Niue, Palau and PNG.

2.1.3 Efficiency/Energy Use

Indicators of efficiency per energy user are:

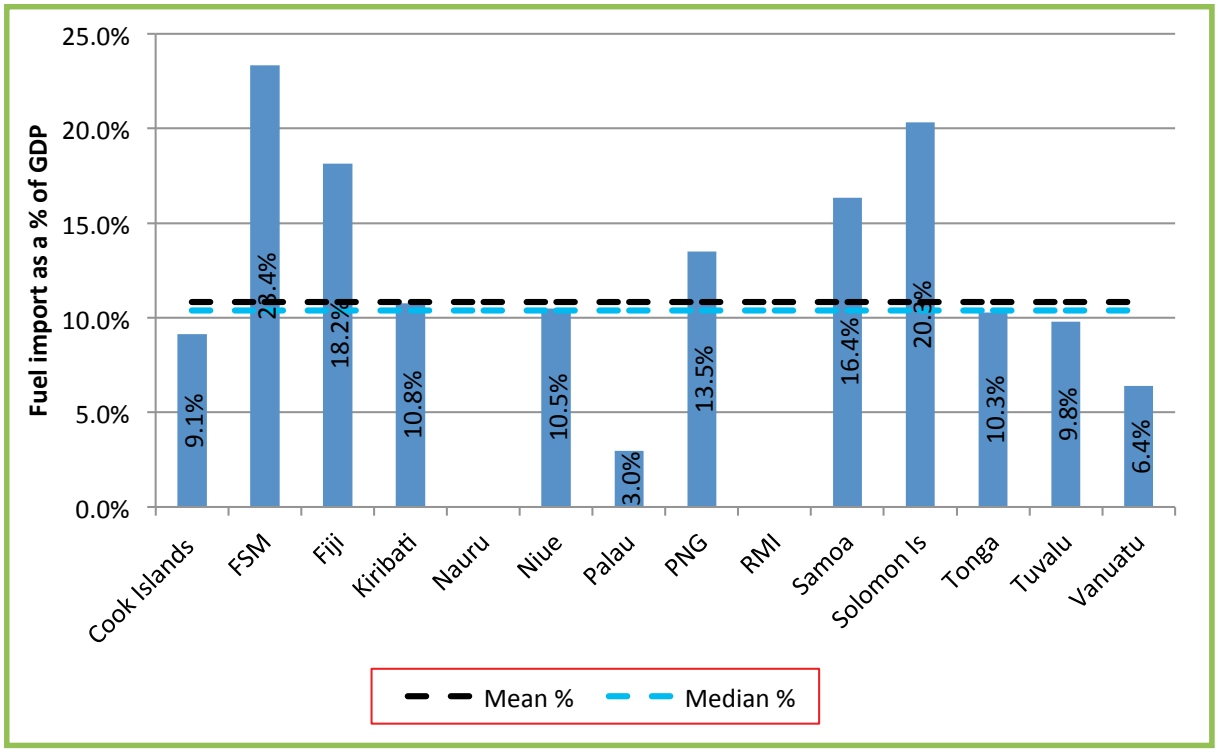
- total fuel imports (as a % of GDP)
- total fuel imports for power generation (as a % of GDP)
- energy intensity (fuel imports) – amount of petroleum fuel consumed in the country to produce USD1GDP (MJ[9]/USD)
- distribution losses as % of total output
- tonne of oil equivalent (TOE) per capita, and
- % share of renewable energy.

Fuel Imports

Expenditure on fuel imports as a percentage of GDP is used to assess dependence on fossil fuels. In general, the higher the percentage, the more vulnerable the country's economy is to world market price volatility, with improvements over time generally reflecting economic growth. The level of expenditure varies across the region, ranging from 3% of GDP in Palau to more than 23% FSM (see Figure 9).

9 MJ – Mega Joules. Joules is a derived unit of energy, work, or amount of heat in the International System of Units.

Figure 9. Energy Sector - Total Fuel Imports as Percentage of GDP by Country, 2012



Source: SPC, Fuel Price Monitoring Database/Bulletin; Accessed January 2016. Note: Data not available for Nauru and RMI.

As the Figure shows, the available data is based on 12 countries that import fuel and, on average, they spent 10.8% of GDP to do so. FSM and the Solomon Islands had a rate of spending higher than 20% of GDP (23.4% and 20.3% respectively). This indicates potential vulnerability to variation in world fuel prices. Fiji and Samoa are also high (18.2% and 16.4% respectively), both having tourism industries which are, by nature, energy intensive.

Given fuel import data is not disaggregated according to intended use in the individual PICs, it is not possible to report the proportion of imported fuel used for power generation.

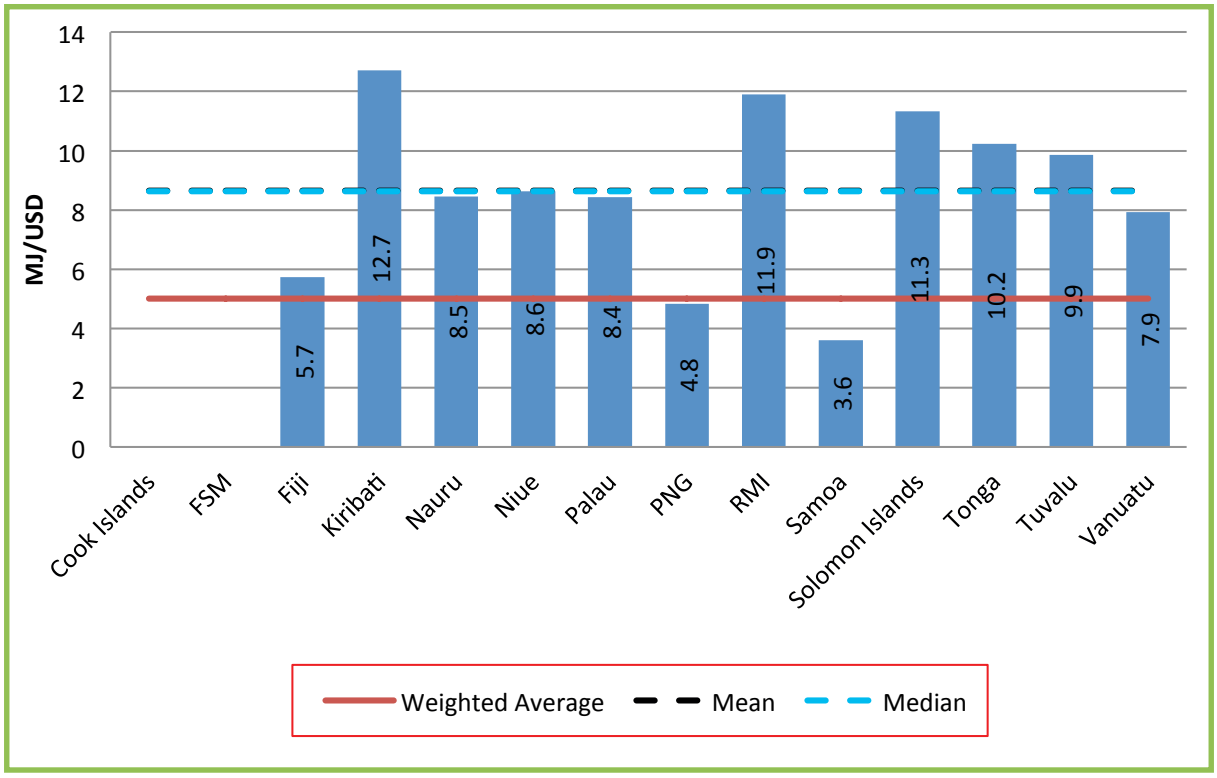
Energy Intensity

Energy intensity tracks the energy used per unit of GDP[10]. It is calculated by dividing the total final energy consumed (TFEC) in a country by the total GDP (reported in MJ per USD). Hence it is a broad measure of the energy efficiency in a nation's economy. High energy intensity indicates a high price or high cost of converting energy into GDP.

In 2010 the weighted energy intensity across the PICs was 5MJ per US dollar. However, it varied between 3.6 MJ per US dollar and 12.7 MJ per US dollar, with a calculated mean and median at 8.64 MJ and 8.63 MJ per US dollar respectively. The low energy intensity score in PNG and Samoa have a corresponding impact on the overall weighted average (see Figure 10).

10 Zieroth, G. (2011). *Indicators for the Framework for Action on Energy Security in the Pacific.* SPC and European Union Energy Initiative (EUEI). http://www.euei-pdf.org/sites/default/files/files/field_pblctn_file/EUEI_PDF_SPC_Energy%20Security%20Indicators_Mar%202011_EN.pdf. Access Date: 15th October 2015.

Figure 10. Energy Intensity - MJ/USD by Country, 2010



Source: SPC, Energy Database; Accessed August 2014. Note: Data not available for Cook Islands and FSM.

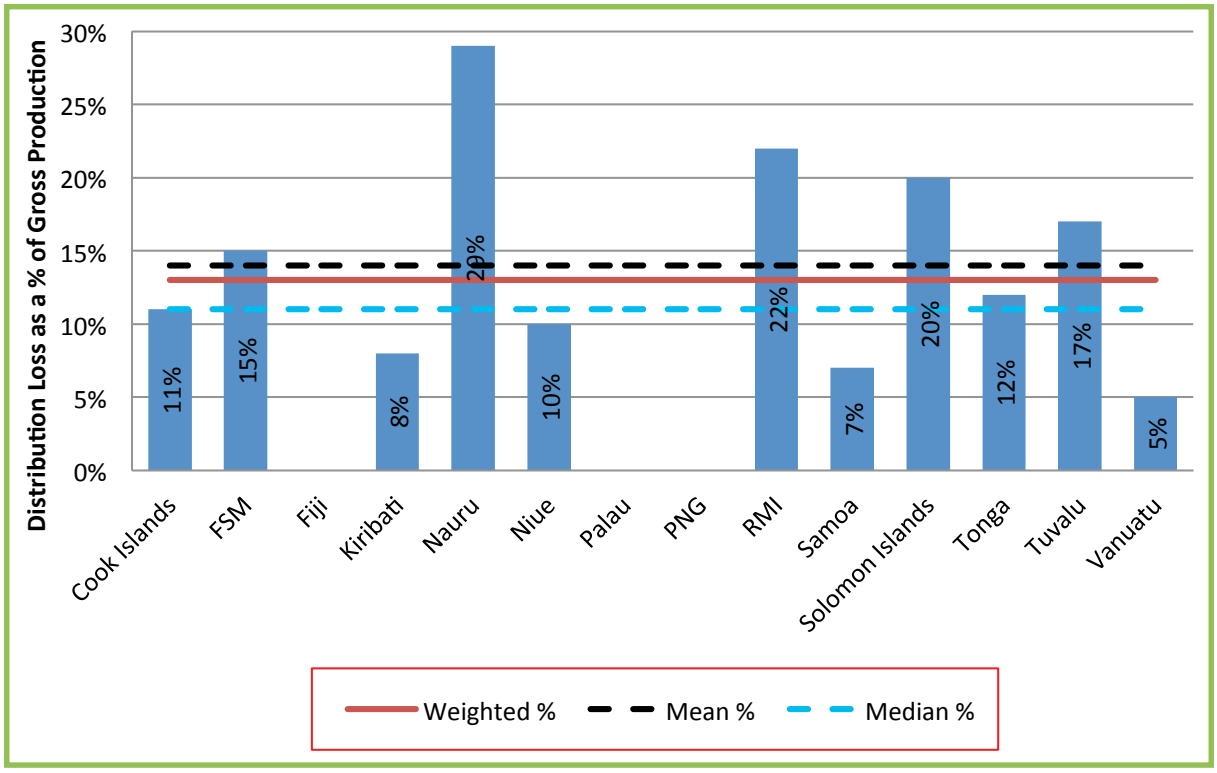
Distribution Losses

In 2012, the overall average distribution loss was reported at 13% of total gross production among PICs with a mean and median at 14% and 12% respectively (see Figure 11). The three PICs reporting the highest distribution losses were Nauru, RMI and Solomon Islands with reported losses at 29%, 22% and 20% respectively. A comparison to the data in the PIPIs Report 2011 shows that while RMI and the Solomon Islands remain among the group of countries with the highest levels of distribution losses, both have reduced the level over the last few years – RMI from 29% and the Solomon Islands from 28%.[11]

These distribution losses include both technical and non-technical losses. The technical losses result from inherent characteristics of the network, caused by factors such as the size of cables, load on the equipment, and condition of the network. These losses can be reduced by increasing the size of conductors, using equipment at the optimal level, and undertaking regular maintenance. The non-technical losses relate to issues such as inaccurate meters or incorrect meter readings, tampering of meters or illegal connections to the power supply. These losses are addressed through the monitoring work of utility staff and contractors. The benchmarking exercises undertaken over the last few years among the utilities in the Pacific Power Association have helped utilities to understand whether their level of distribution losses is similar to other utilities or greater than average.

11 PIPIs Report 2011, p.14. Note that data was not available for Nauru in the PIPIs Report for 2011.

Figure 11. Energy Sector - Distribution Losses as Percentage of Gross Production by Country, 2012



Source: Pacific Power Association. (2015, June). Pacific Power Utilities Benchmarking Report 2012 Fiscal Year.
Note: Data not available for Fiji, Palau and PNG.

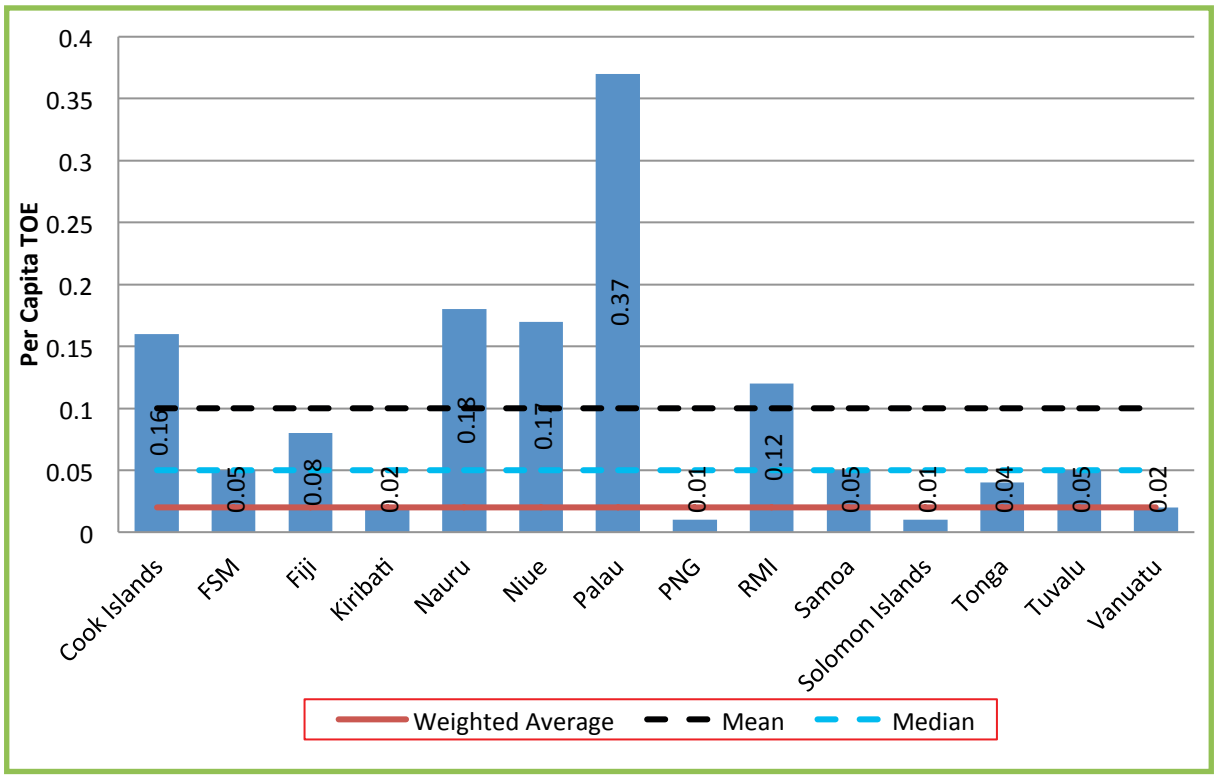
Power lines in rural Fiji (World Bank - A. Nacola)

Tonne of Oil Equivalent Used

Tonne of Oil Equivalent (TOE) is a unit of energy defined as the amount of energy released by burning one tonne of crude oil (approximately 42 gigajoules of energy). It is a gauge of total energy use in countries and reflects on industrial activity, tourism and social development. In general, the higher the energy use, the higher the level of combined industrial activity, tourism and social development. Importantly, a per capita element has been added to aid comparison between the countries.

In 2012, the PICs used 0.02 TOE of weighted energy per capita from non-renewable sources (see Figure 12). The mean and median TOE per capita were 0.10 and 0.05 respectively. It was highest in Palau (0.37 TOE) and lowest in PNG and the Solomon Islands (0.01 TOE each). Palau also had the highest TOE in the PIPIs Report 2011[12]. It has a relatively low population and level of industry, but a relatively developed tourist industry and electricity in most homes, vehicles, boats and other facilities that use a lot of energy. In contrast, while PNG has some large oil and mining projects, the level of development for most people in the country is not as advanced as it is in Palau. There is low electricity penetration, the tourist industry is somewhat fledging, the transport network has significant issues, and so on.

Figure 12. Energy Sector - Tonne of Oil Equivalent (TOE) per Capita by Country, 2012



Source: Pacific Power Association. (2015, June). Pacific Power Utilities Benchmarking Report 2012 Fiscal Year.

Renewable Energy

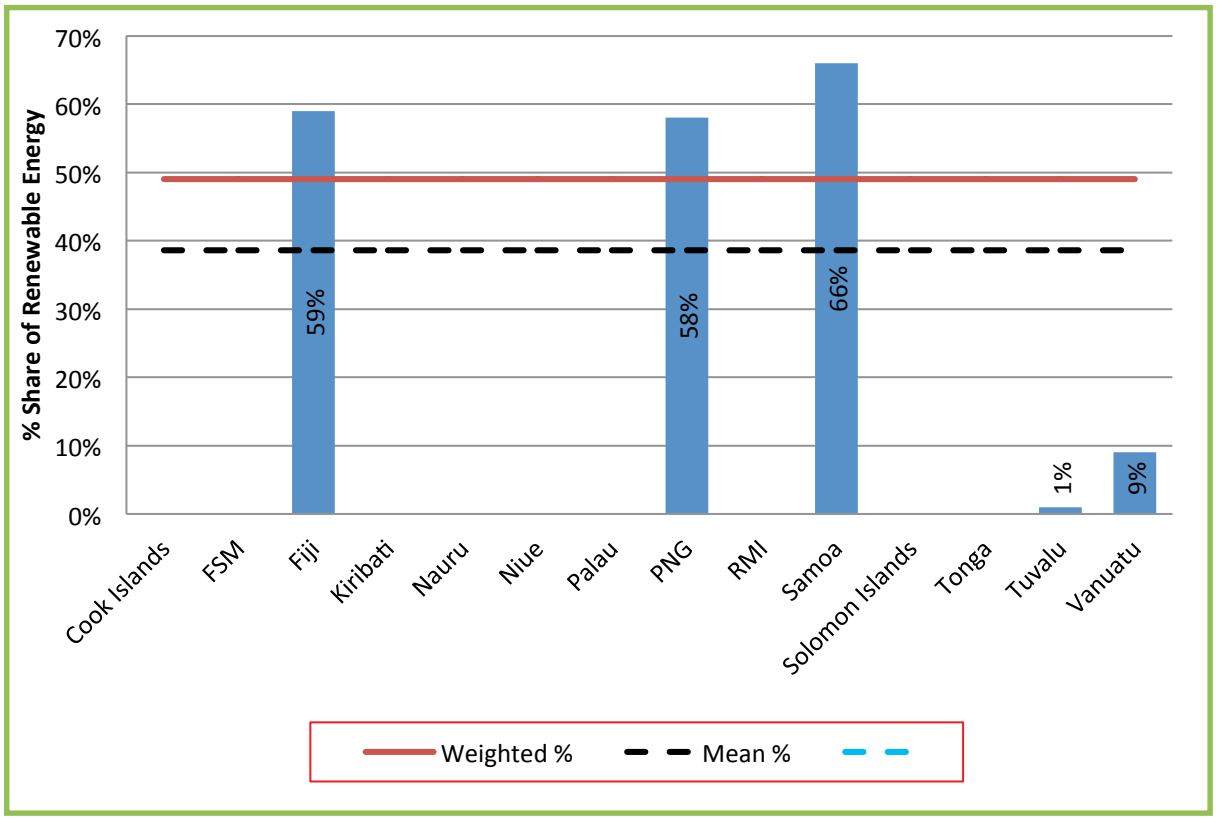
Renewable energy data for the PIPIs is taken from the *Pacific Power Utilities Report 2012 Fiscal Year* and therefore reflects what was reported by the utilities. This shows that while renewable energy contributed 49% of the total electricity consumed in PICs, only five countries (Fiji, PNG, Samoa, Tuvalu and Vanuatu) reported using renewable sources of energy (e.g. hydro-generation and solar power). There is also some renewable energy technology in the Cook Islands, FSM, Kiribati, Nauru, Niue, Palau, RMI, Solomon Islands and Tonga but data was not submitted on this in the benchmarking exercise and so those countries are counted in missing data for this report.

Among the utilities for which data was supplied, the percentage share of renewable sources of energy was highest in Samoa (66%) followed by Fiji (59%), PNG (58%), Vanuatu (9%) and Tuvalu (1%) – see Figure 13. The weighted percentage is reported as 49%, with a mean percentage of 38.6%. In addition to exercising caution with the use of averaged data given the significant variation in the data set, the figures may need further verification in future rounds of benchmarking. For example, in regard to Vanuatu, the data in the PIPIs Report for 2011 showed renewable energy at 19% whereas it is now 9%, a result of only one utility being involved in the benchmarking exercise for 2012 data.

12 PIPIs Report 2011, p.13.

A further issue is that some renewable energy sources are off-grid (e.g. small rooftop solar photovoltaic/PV systems) and therefore they are not reported in the power utility data for the benchmarking exercise. More accurate data would, therefore, require a primary data collection exercise focused on all sources of renewable energy.

Figure 13. Share of Renewable Energy as Percentage of Total Energy (Electricity) by Country, 2012



Source: Pacific Power Association. (2015, June). Pacific Power Utilities Benchmarking Report 2012 Fiscal Year.
Note: Data not available for the Cook Islands, FSM, Kiribati, Nauru, Niue, Palau, RMI, Solomon Islands and Tonga.

2.1.4 Affordability

Overall, the cost of electricity in the Pacific is high. As already noted, this is largely due to having to import fuel, which is transported across large distances, and then having dispersed communities with difficult terrain in many places and challenges associated with cost recovery from consumers.

Indicators used to measure affordability are:

- fuel imports as a percentage of total imports
- average end-user electricity tariff
- average annual wholesale fuel prices, and
- average annual retail fuel prices.

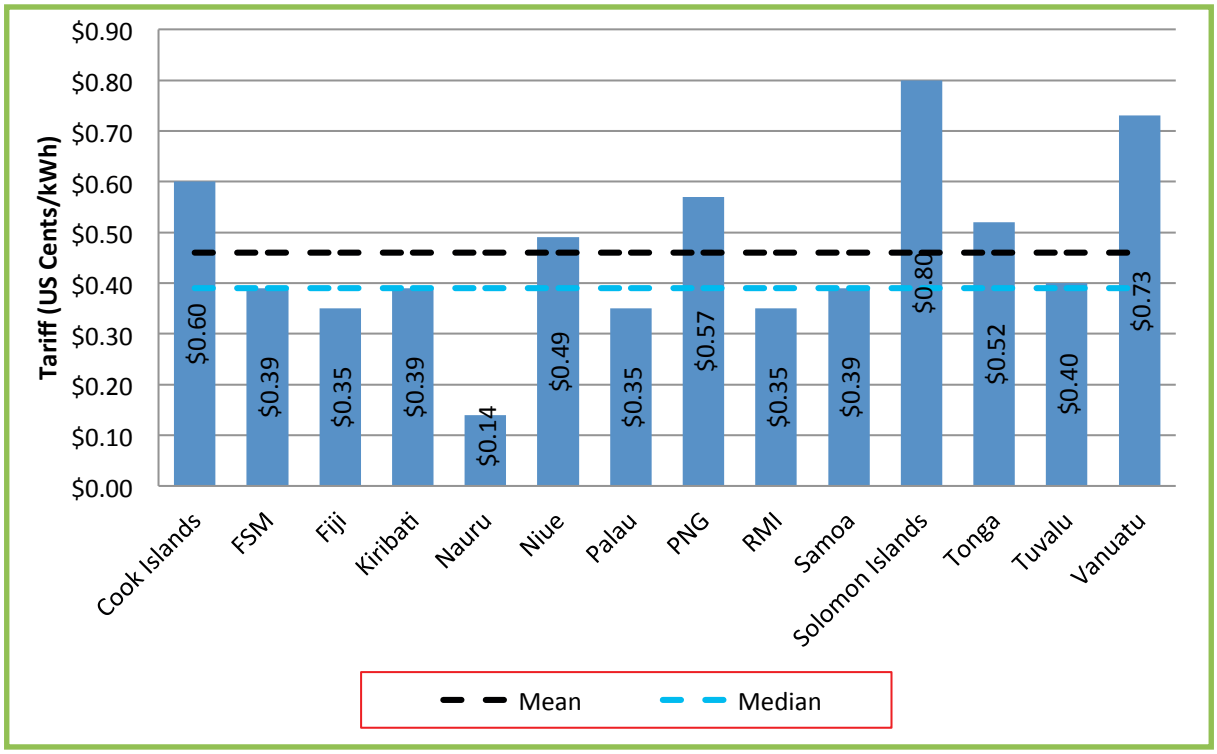
Data on fuel imports as a percentage of total imports and average wholesale fuel price was not available and therefore cannot be reported.

Electricity Tariffs

In the PICs, different electricity tariffs are used are applied to different customer groups. Hence, there are residential, commercial, industrial and government tariff rates.[13]

Across the PICs, the mean residential electricity tariff in 2012 was US46 cents per kilowatt hour (kWh) and the median was US39 cents per kWh (see Figure 14). The residential electricity tariff was highest in the Solomon Islands (US80 cents per kWh), Vanuatu (US73 cents per kWh) and Cook Islands (US60 cents per kWh). The PICs offering the cheapest residential electricity tariff were Nauru (US14 cents per kWh), Fiji (US35 cents per kWh), Palau (US35 cents per kWh) and RMI (US35 cents per kWh).

Figure 14. Electricity Tariff for Residential Users (US Cents per KWh) by Country, 2012

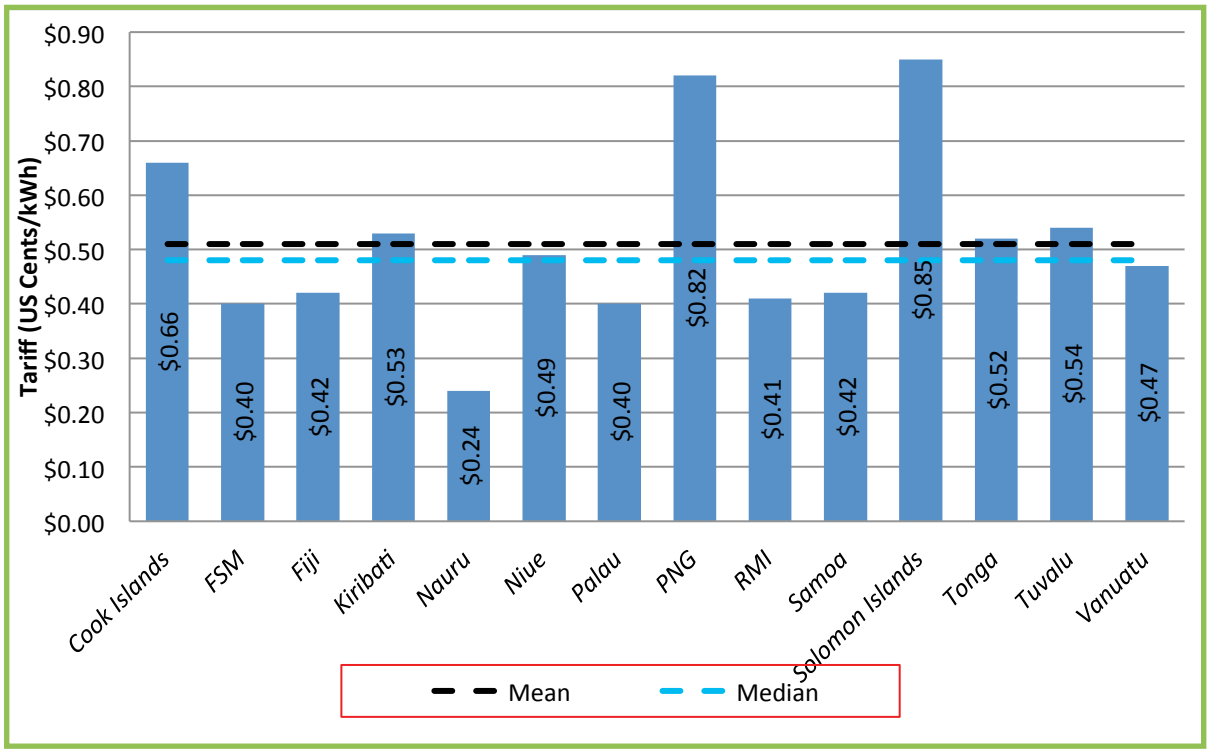


Source: SPC, Energy Database; Accessed August 2014.

In 2012, the median commercial electricity tariff was US51 cents per kWh with a median price of US48 cents per kWh (see Figure 15). The price was lowest in Nauru (US24 cents per kWh) and highest in the Solomon Islands (US85 cents per kWh) and PNG (US82 cents per kWh).

13 SPC was in the process of updating tariff data at the time of the completion of data collection for this report.

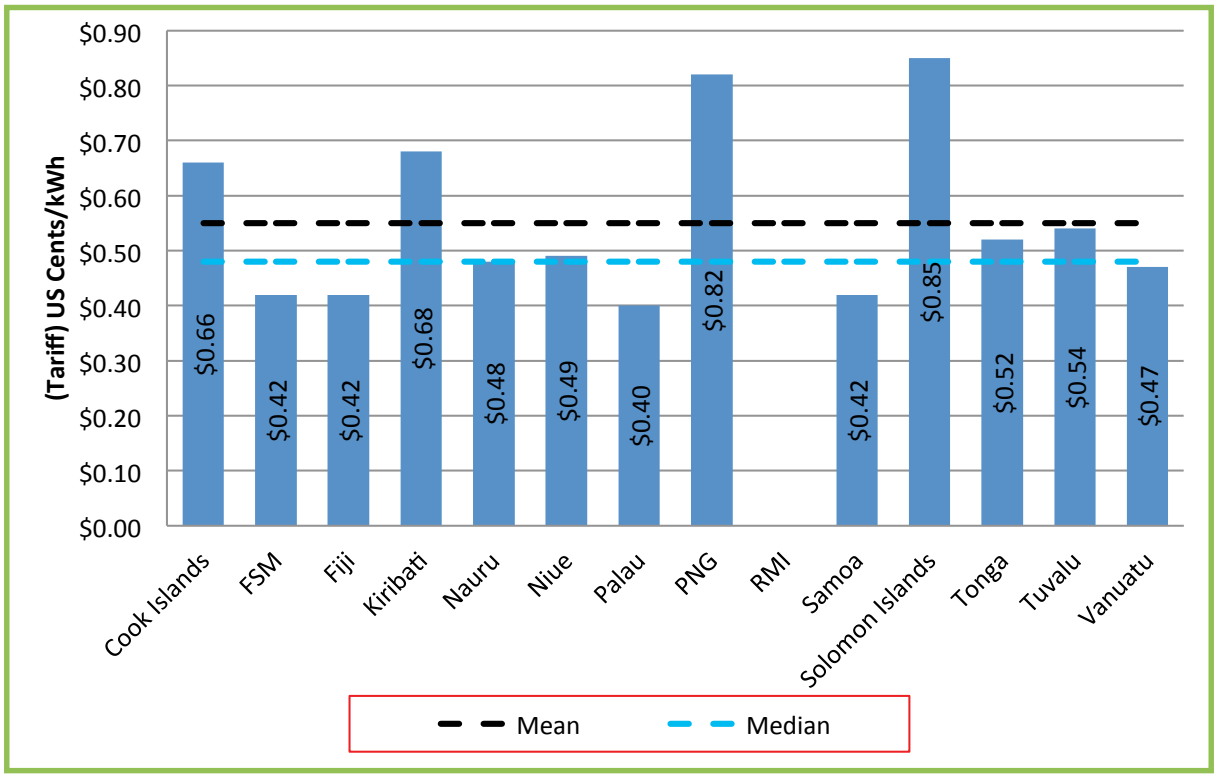
Figure 15. Electricity Tariff for Commercial Users (US Cents per KWh) by Country, 2012



Source: SPC, Fuel Price Monitoring Database/Bulletin, August 2014.

The mean industrial electricity tariff in 2010 was US55 cents per kWh and the median was US48 cents per KWh (see Figure 16). The most expensive industrial tariffs were in the Solomon Islands (US85 cents per kWh) and PNG (US82 cents per kWh) while the lowest tariffs were in Palau (US40 cents per kWh), FSM (US42 cents per kWh), Fiji (US42 cents per kWh) and Samoa (US42 cents per kWh).

Figure 16. Electricity Tariff for Industrial Users (US Cents per KWh) by Country, 2010



Source: SPC, Fuel Price Monitoring Database/Bulletin, August 2014. Note: Data not available for RMI.

A useful comparison can be made between the tariffs paid by different types of customers (see Table 2). In almost all countries, residential tariffs are less than the tariffs for commercial, industrial and government customers. Exceptions are Niue and Tonga which have a flat rate for all customers and Vanuatu where residential customers pay the highest tariff. In Nauru, the Government pays a relatively low tariff compared to industry and commercial businesses, while in Kiribati both the Government and commercial businesses pay a lower tariff than industry.

Table 2. Energy Sector – Tariffs by User Group by Currency, 2012-2013

	Tariff	Government	Industrial	Commercial	High Demand /Voltage Customers	Institutions	Residential	Year of Data
Cook Islands (TAU)	NZD/kWh	0.8100	0.8100	0.8100	0.7200		0.7367	2012
	USD/kWh	0.6488	0.6488	0.6488	0.5767		0.5900	
Fiji (FEA)	FJD/kWh	0.4300	0.4300	0.4300	0.3100	0.3484	0.3484	2012
	USD/kWh	0.2353	0.2353	0.2353	0.1696	0.1906		
FSM (Pohnpei)	USD/kWh	0.1200	0.1200	0.1200			0.1400	2013
FSM (Chuuk)	USD/kWh	0.5526	0.5326	0.5326			0.5026	2013
FSM (KUA)	USD/kWh	0.5228	0.5120	0.4700			0.4512	2013
FSM (YSPSC)	USD/kWh	0.7683	0.4905	0.4905			0.4154	2013
Kiribati	AUD/kWh	0.5500	0.7000	0.5500			0.4000	2012
	USD/kWh	0.5629	0.7164	0.5629			0.4093	
RMI (MEC)	USD/kWh	0.4970	0.4830	0.4830			0.4170	2012
Nauru	AUD/kWh	0.2000	0.5000	0.2500			0.1500	2012
	USD/kWh	0.2047	0.5117	0.2558			0.1535	
Niue	NZD/kWh	0.6000	0.6000	0.6000			0.6000	2012
	USD/kWh	0.4806	0.4806	0.4806			0.4806	
Palau	USD/kWh	0.4050	0.4050	0.4050			0.3477	2013
PNG (PPL)	Kina/kWh	93.7200	93.7200	93.7200	60.8600		65.4667	2012
	USD/kWh	45.4746	45.4746	45.4746	29.5304		31.7656	
Samoa	Tala/kWh	1.0200	1.0200	1.0200		0.9355	0.9355	2012
	USD/kWh	0.4297	0.4297	0.4297		0.3941	0.3941	
Solomon Islands	SBD/kWh	6.3332	6.3332	6.3332	6.1709		5.8991	2012
	USD/kWh	0.8626	0.8626	0.8626	0.8405		0.8035	
Tonga	TOP/kWh	0.8966	0.8966	0.8966			0.8966	2012
	USD/kWh	0.4988	0.4988	0.4988			0.4988	
Tuvalu	AUD/kWh	0.5600	0.5600	0.5600			0.4133	2012
	USD/kWh	0.5731	0.5731	0.5731			0.4230	
Vanuatu (UNELCO)	Vatu/kWh	48.2343	48.2343	48.2343	38.8092	67.0844	84.0865	2012
	USD/kWh	0.5131	0.5131	0.5131	0.4129	0.7137	0.8945	

Source: Data collected from utilities by SPC during in-country missions, 2013-2015.

Notes: Tariffs are based on the country currency. Conversion to USD is shown to aid comparisons and is as at 1st July on the year of data collection. Empty cells are missing data. High demand/high voltage customers may be government, industrial or commercial customers. Given the high demand, they may be charged a different rate and may also be charged by the voltage demand they draw over a certain KV (depending on the country).

Utilities: TAU = Te Aponga Uira O Tumu-Te-Varovaro; FEA = Fiji Electricity Authority; KUA = Kosrae Utilities Authority; YSPSC = Yap State Public Service Corporation; MEC = Marshall Energy Company; PPL = PNG Power Ltd.; UNELCO = UNELCO Vanuatu Ltd.

Average Annual Retail Fuel Prices

At the time of data collection, wholesale prices were not available. The average retail price for automotive fuel oil (ADO) averaged at USD1.36 per litre (with a median of USD1.45), unleaded motor vehicle gasoline (mogas) was USD1.27 per litre (with a median of USD1.39), and kerosene had an average price of USD1.07 per litre (with a median price of USD1.26 per litre). Pricing generally reflects the fact that the Pacific region is at the end of the supply chain and there are high costs associated with shipping into the region, with some variations related to volume and method of shipment.

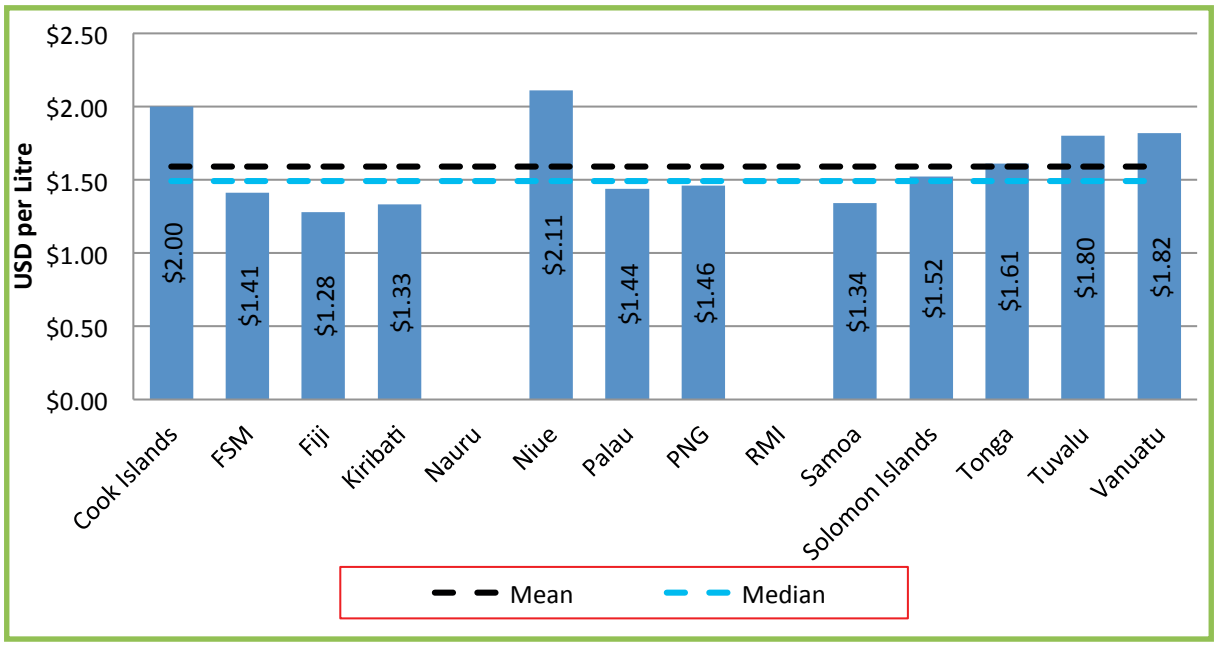
The countries that had among the highest prices included the Cook Islands (for both ADO and mogas), Palau (for kerosene), Niue (for both ADO and kerosene), and Tuvalu (for mogas and kerosene). Countries that had among the cheapest prices included Kiribati (for ADO, mogas and kerosense), Fiji (for ADO and kerosene), Niue (for mogas), and Samoa (also for all three – ADO, mogas and kerosene). Specific details for each of the individual fuels follows.

Fuel station supplying mogas, RMI (C. McMahon)

a) Average Annual ADO Retail Price

Based on the available data, the three PICs with the highest average annual ADO retail price were Niue, the Cook Islands and Vanuatu at USD2.11/litre, USD2.00/litre and USD1.82/litre respectively (see Figure 17). The lowest prices for ADO were recorded for Fiji (USD1.28/litre), Kiribati (USD1.33/litre) and Samoa (USD1.34/litre). The mean and median were USD1.59/litre and USD1.49/litre respectively, but half the countries fall below those prices so the spread of pricing should be noted.

Figure 17. Automated Diesel Fuel – Average Retail Price (USD) by Country, 2014

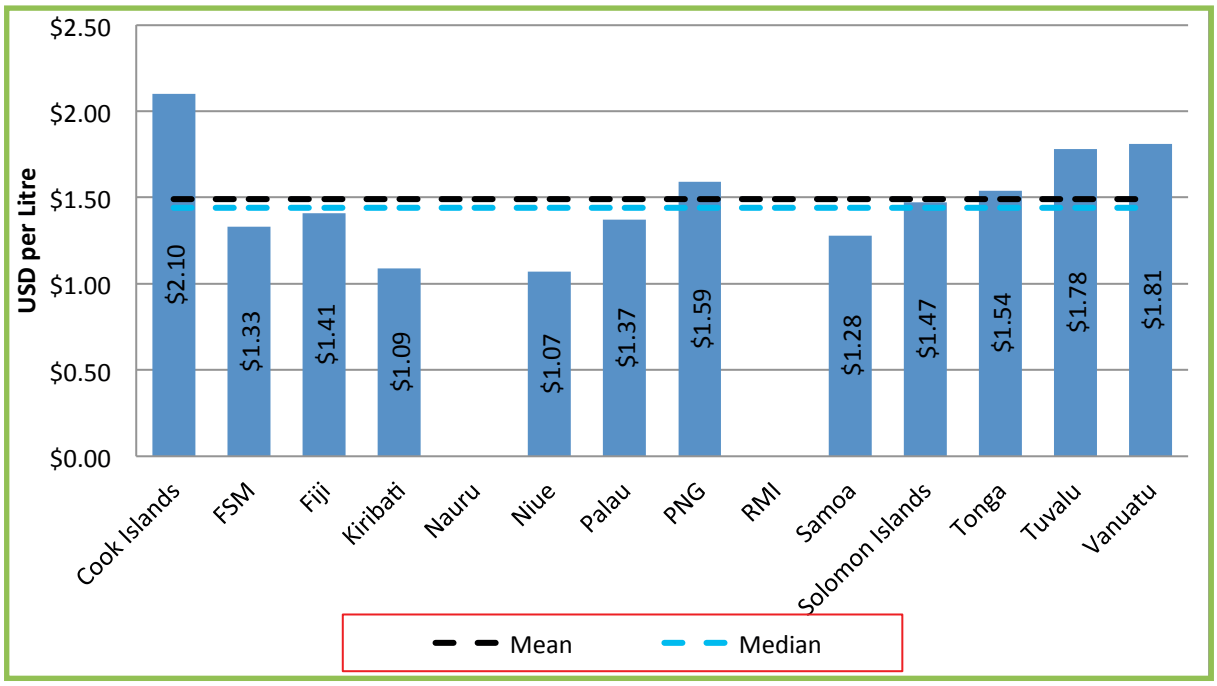


Source: SPC, Fuel Price Monitoring Database/Bulletin; Accessed August 2014. Note: Data not available for Nauru and RMI.

b) Average Annual Mogas Retail Price

In 2014, the average annual mogas retail price was highest in the Cook Islands at USD2.10 per litre followed by Vanuatu (USD1.81/litre) and Tuvalu (USD1.78/litre). The three PICs with the lowest average annual mogas retail price were Niue (USD1.07/litre), Kiribati (USD1.09/litre) and Samoa (USD1.28/litre). The mogas price for Nauru and RMI was not available (see Figure 18). The mean and median prices across the PICs were USD1.49/litre and USD1.44/litre respectively.

Figure 18. Average Mogas Retail Price (USD) by Country, 2014

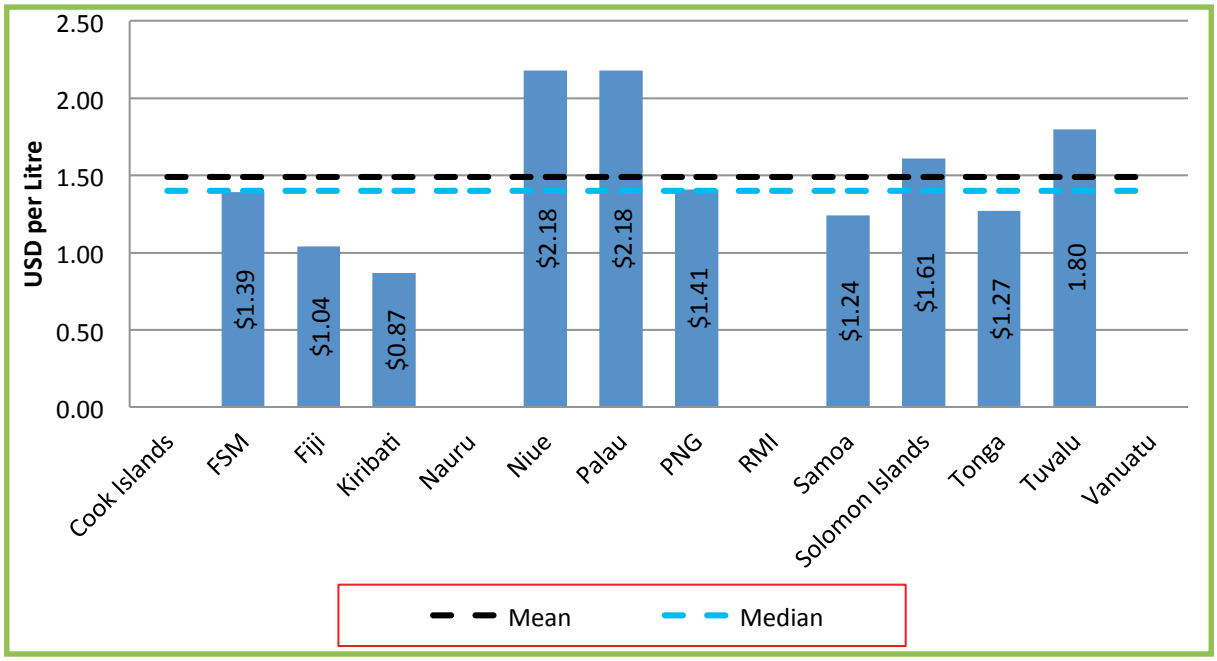


Source: SPC, Fuel Price Monitoring Database/Bulletin, August 2014. Note: Data not available for Nauru and RMI.

c) Average Annual Kerosene Retail Price

Data on kerosene prices was available for only 10 PICs (see Figure 19). This data shows that in 2014 the kerosene price was highest in Niue and Palau (USD2.18/litre) and lowest in Kiribati (USD0.87/litre). Prices in other countries were: Tuvalu (USD1.80/litre), Solomon Islands (USD1.61/litre), PNG (USD1.41/litre), FSM (USD1.39/litre), Tonga (USD1.27/litre), Samoa (USD1.24/litre) and Fiji (USD1.04/litre). Kerosene prices were not available for the Cook Islands, Nauru, RMI and Vanuatu. The mean and median prices were USD1.49/litre and USD1.41/litre but the prices for five countries fall below those figures, so they need to be applied with reference to the spread of results in the data set.

Figure 19. Average Kerosene Retail Price (USD) by Country, 2014



Source: SPC, Fuel Price Monitoring Database/Bulletin, August 2014. Note: Data not available for Cook Islands, Nauru, RMI and Vanuatu.

2.2 Information and Communication Technology

Key Findings:

- *There has been exponential growth in mobile cellular network coverage with a weighted coverage of 92% across the PICs.*
- *In half of the PICs, undersea fibre optic cable systems has replaced satellites, providing better quality service in terms of international bandwidth.*
- *The cost of local mobile phone services varies between US9 cents per minute and US32 cents per minute across the region. The cost of international phone calls depends on a range of factors including domestic strategies and the cost for international operators to terminate calls.*

A key priority for many Pacific governments is to improve accessibility and affordability of both domestic and international communications. This is in recognition of its importance to commercial activity, education, health, social development and cohesion. In particular, the introduction of undersea fibre optic cable is significant because it has a high reliability and a much greater carrying capacity than satellite transmission.

The PIPIs used in this report were revised from those used in the PIPIs Report for 2011, so few comparisons can be made in the data. However, the current indicators are likely to prove a good basis for comparison over the coming years. The data is derived from a PRIF research study on the *Economic and Social Impact of ICT in the Pacific*[14].

2.2.1 Access

Measures of ICT access include coverage of 2G and 3G mobile networks and fixed broadband Internet subscriptions.

Mobile Cellular Network Coverage

The PIPIs 2015 includes *mobile cellular coverage* as an indicator of ICT access replacing the PIPIs 2011 indicator *mobile cellular subscribers per 100 population*. Mobile network coverage is defined as the percentage of the population who live in an area where a mobile signal is available[15]. It is a preferred indicator of access (rather than mobile subscriptions) since subscriptions can be misleading due to multiple SIM cards (i.e. users with more than one subscription), lapsed subscriptions (i.e. people who no longer use the network but are still counted as subscribers) and machine-machine subscriptions (e.g. automatic teller machines using the mobile network to transmit transaction data).

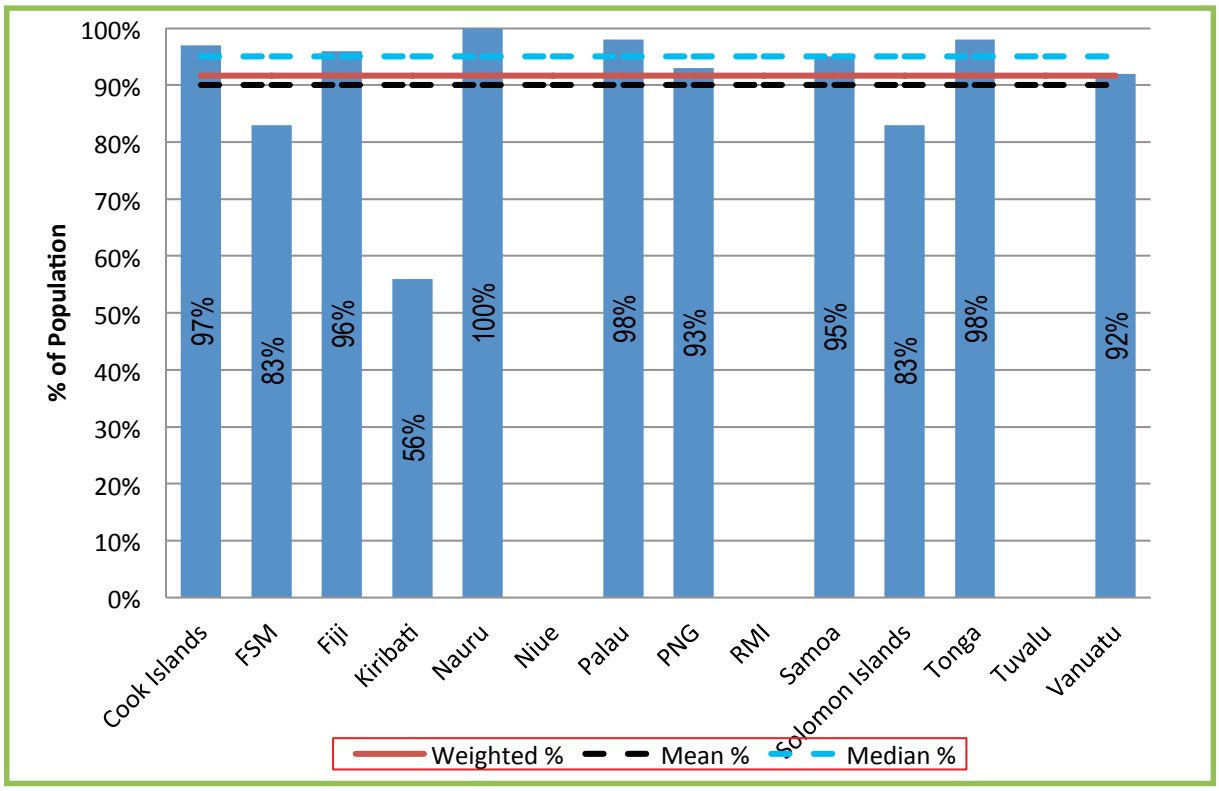
Using a mobile phone in the Solomon Islands (World Bank – R. Skeates)

Based on the available data, second generation (2G) mobile cellular network coverage is highest in Nauru where the entire island is covered and least in Kiribati where an estimated 56% of the population had at least 2G access in 2014 (see Figure 20). The overall weighted coverage of mobile cellular networks across the countries was 92% with mean and median percentages of 90% and 95% respectively.

14 Minges, M, and Stork, C. (2015). *Economic and Social Impact of ICT in the Pacific*. Pacific Region Infrastructure Facility: Sydney, Australia. http://www.theprif.org/components/com_jomcomdev/files/2015/10/40/124-PRIF%20Pacific%20ICT%20Report%202015.pdf. Access Date: 12th November 2015.

15 Population data in this chapter of the PIPIs Report is based on World Bank population data for 2013 (http://data.worldbank.org/indicator/SP.POP.TOTL).

Figure 20. Percentage of the Population Covered by 2G Mobile Network, by Country



Source: Adapted from regulators and operators. Note: Data is for 2014 or latest available data. Data not available for Niue, RMI and Tuvalu.

Availability of Mobile Broadband Services

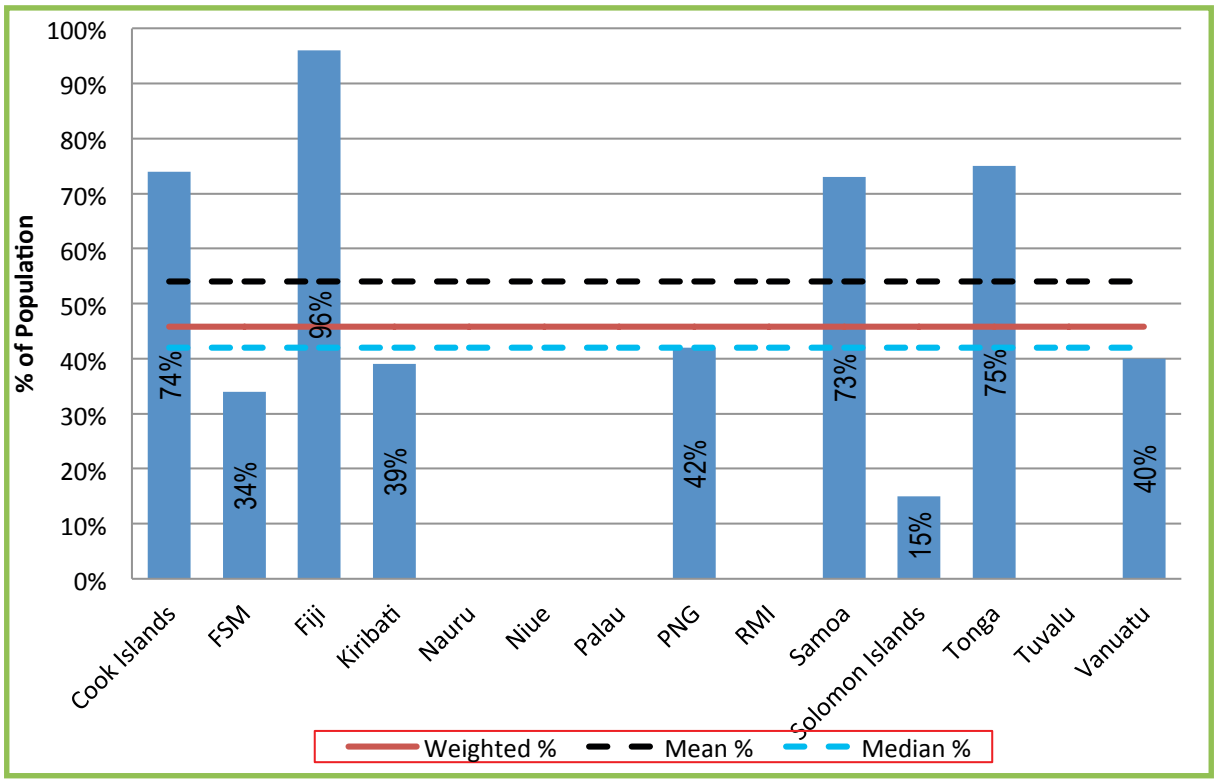
Third (3G) and fourth (4G) generation mobile technologies hold great promise to increase high-speed access to the internet in the region.

There are 3G networks in nine of the PRIF PICs so coverage is well below 2G networks, with the exception of Fiji where one supplier's entire network is 3G-enabled. The mean and median coverage of 3G in the PICs was 54% and 42%, with a range from 15% (in the Solomon Islands) up to 96% (in Fiji). The Polynesian countries of the Cook Islands, Samoa and Tonga also have above average coverage, in contrast to the Melanesian countries of PNG, Vanuatu and Solomon Islands.

In the Cook Islands, the deployment of 3G has been in parallel with connection to a new satellite network installed in Rarotonga, home to almost three-quarters of the population. In Samoa, there is 3G competition and deployment is easier given most of the population lives on only two islands.

The overall weighted 3G coverage was estimated to be 46% in 2014 (see Figure 21).

Figure 21. Percentage of Population Covered by 3G Mobile Network by Country, 2014



Source: Adapted from regulators and operators. Note: Data for PNG refers to proportion of mobile base stations. At the time of data collection there was no 3G network in Nauru, Niue, Palau, RMI or Tuvalu.

The fourth generation (4G) technology – also known as Long Term Evolution (LTE) – can provide speeds equivalent to or even higher than many fixed broadband technologies. Only Fiji[16], Kiribati[17] and PNG[18] have commercially-launched mobile LTE services and one supplier in Vanuatu has a deployed a fixed 4G service in Port Vila[19]. However, detailed data on 4G access was not available for this report.

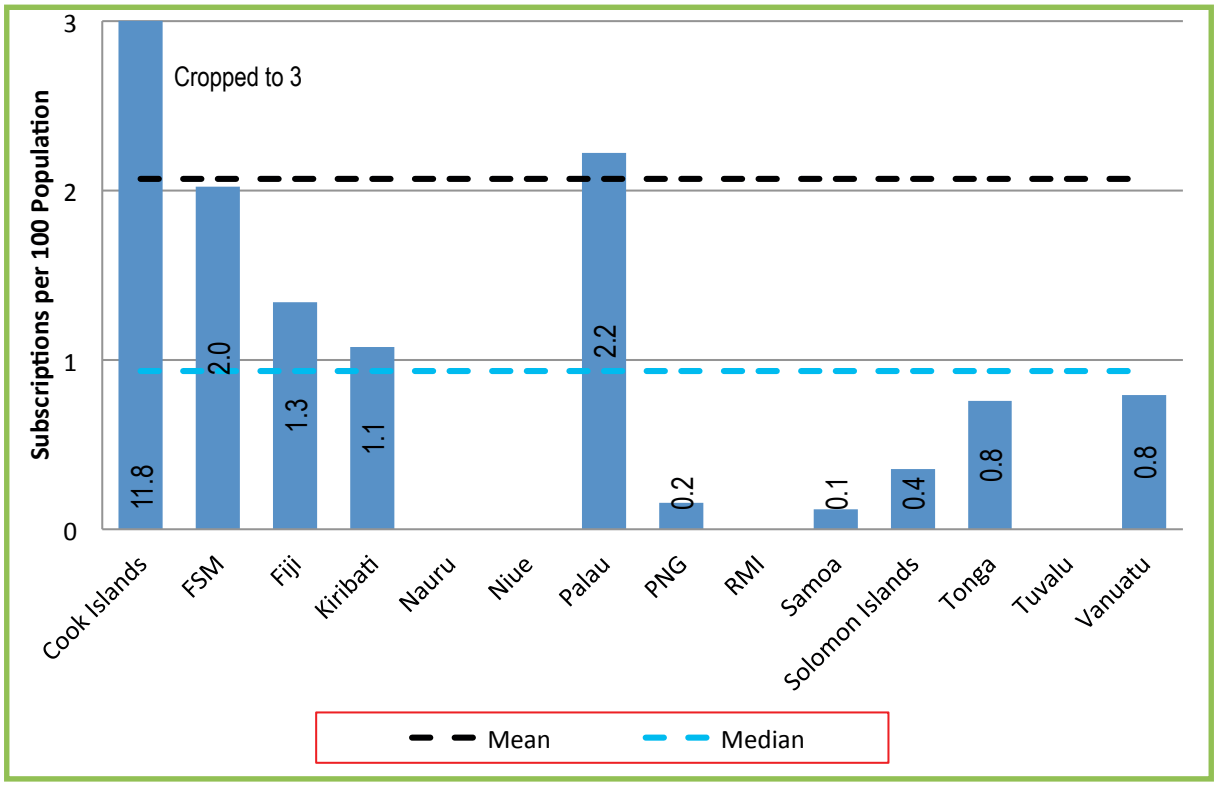
Fixed Broadband Internet Subscriptions

Fixed broadband internet is defined as cabled connections offering download speeds of at least 256 kbps.[20] The main fixed broadband technology used in the region is Asymmetric Digital Subscriber Line (ADSL). This service is commercially available in all the countries covered in the report except Nauru, Niue and Tuvalu. Fixed broadband subscription penetration is highest in the Cook Islands at 11.8 subscriptions per 100 people and least in Samoa at 0.1 subscriptions per 100 people (see Figure 22). The mean is 2.1 subscriptions per 100 people and the median is 0.9 subscriptions per 100 people, a divergence that reflects the relatively high level of access in the Cook Islands.

Comparison with the data in the PIPIs Report 2011 is useful in understanding the growth over the last few years[21]. Most notable is the growth in the Cook Islands – from 7.4 subscribers per 100 people to 11.8; in FSM – from 0.10 subscribers per 100 people to 2.0; and in Palau – from 0.48 subscribers per 100 people to 2.2. In contrast, Samoa remained at 0.1 subscribers per 100 people across the same time period.

16 http://www.fiji.gov.fj/Media-Center/Speeches/LAUNCHING-OF-VODAFONE'S-4G-LTE-NETWORK--PM-Bainim.aspx.
17 TeleGeography. 2013. "3G and LTE launched commercially in Kiribati." COMMSUPDATE, November 12. https://www.telegeography.com/products/commsupdate/articles/2013/11/12/3g-and-lte-launched-commercially-in-kiribati/.
18 https://www.facebook.com/notes/digicel-papua-new-guinea/digicel-set-to-pioneer-lte-wireless-broadband-in-png-first-10-sites-for-post-pay/10152064550787655.
19 http://wantok.vu/4g/.
20 http://www.oecd.org/sti/broadband/broadband-methodology.htm.
21 PIPIs Report, p.16.

Figure 22. Fixed Broadband Internet Subscribers per 100 Population by Country



Source: Adapted from regulators, operators and International Telecommunication Union (ITU). Note: Data is for 2014 or latest available data. Data not available for Nauru, Niue, RMI and Tuvalu.

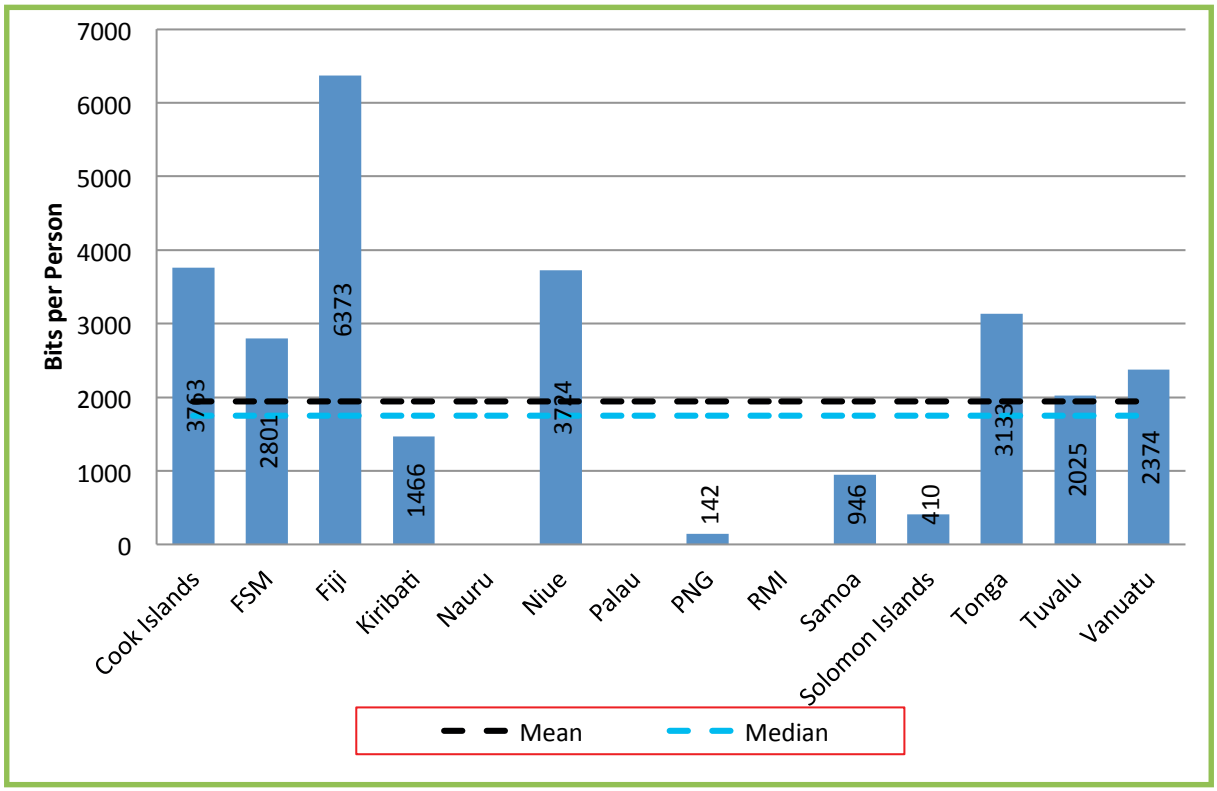
2.2.2 Quality

The capacity of international internet connections determines accessibility to overseas content. Hence, the indicator for quality of ICT is international internet bandwidth (bits per person).

The region has traditionally relied on satellite for international connectivity but, over the last few years, a number of PICs have connected to undersea fibre optic cable systems which generally provide considerably more capacity at a lower marginal cost. By the end of 2014, half of the PICs had submarine cable connectivity (Fiji, FSM, PNG, RMI, Samoa, Tonga and Vanuatu).

The overall weighted average international bandwidth in the region is 893 bits per person (see Figure 23). Fiji, the landing hub for three undersea fibre optic cables, has the highest bits/person. The Cook Islands, Niue and Tonga also have above average international bandwidth penetration.

Figure 23. International Internet Bandwidth (bits per person) by Country



Source: Adapted from regulators and operators. Note: Data is for 2014 or latest available data. Data not available for Nauru, Palau and RMI.

2.2.3 Affordability

The affordability of ICT services in the PICs is measured in terms of mobile phone call tariffs per minute and internet charges for mobile and fixed broadband use. The 'per minute' mobile phone call tariff used includes both local (in-country) and international use (calculated for calls to Sydney and San Francisco).

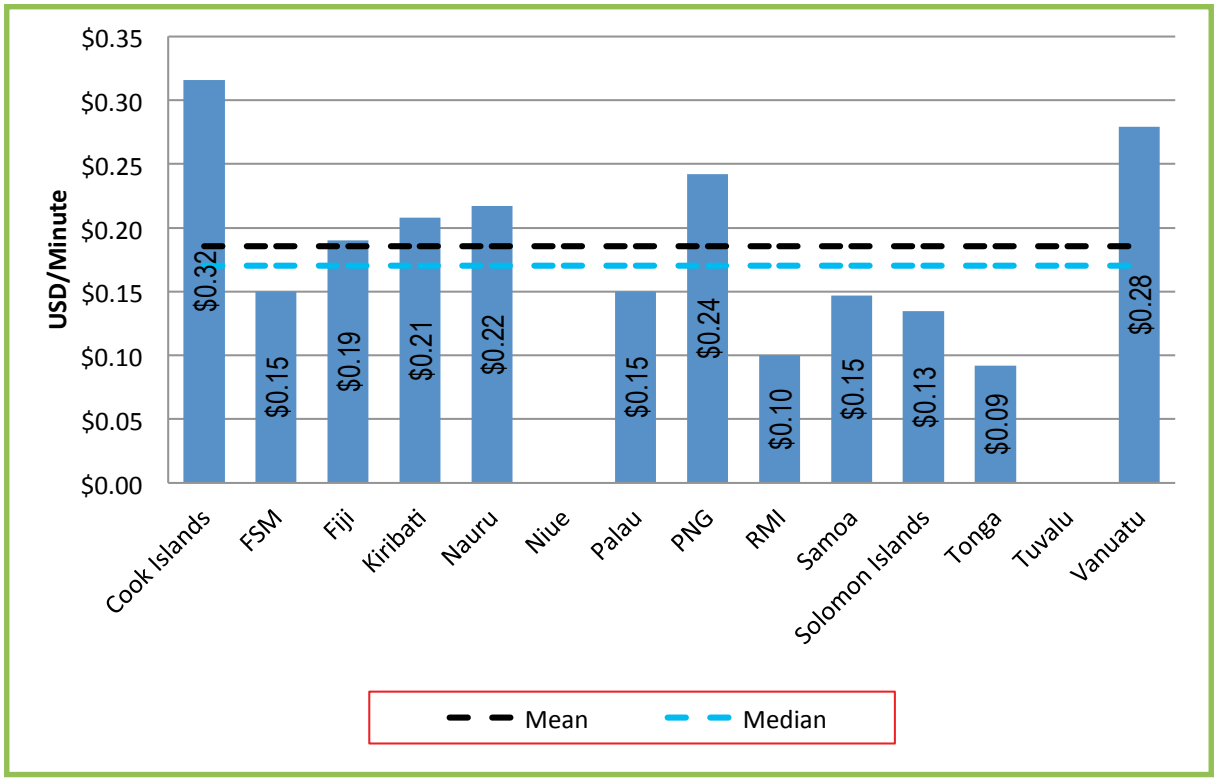
Tariffs were collected from the web sites of telecommunication service operators between the second half of 2014 and early 2015. Data is not available for Niue and Tuvalu as web sites were not located for telecom operators in those countries. In the six PICS that have mobile competition, tariffs of the leading telecommunication operator (in terms of subscription market share) are used. Prices have been converted to United States dollars for comparability based on 2014 annual average exchange rates.

Local Mobile Phone On Net Call Tariff - Off Peak Time

Tariffs are compared for the price of a local one-minute, on net (i.e. within the same network) off-peak call using prepaid mobile service. In most of the countries, there is a uniform nationwide price for local mobile calls (i.e. a call can be made for the same price regardless of the destination within the country). In a few countries, there is a distinction between local (within the same exchange area) and national calls (from one exchange area to another and/or inter-island) with the latter more expensive. This analysis compares just local calls.

The price per minute for on net, off-peak local mobile phone calls is presented in Figure 24. The average price is US19 cents, with a median of US17 cents. However, there is considerable variance across the region. The Cook Islands is the most expensive with a one minute local mobile phone call costing US32 cents and Tonga is the cheapest, offering one-minute mobile phone calls for US9 cents. Four of the countries with mobile competition have prices equal to or below the average (Fiji, Samoa, Solomon Islands and Tonga) whereas the two others with mobile competition have significantly above average pricing (PNG and Vanuatu). FSM, Palau and RMI have prices less than the average, but FSM and RMI charge more for national long distance mobile calls.

Figure 24. Mobile-Cellular Prepaid Price of One Minute Local Call (off-peak, on-net in USD/Minute) by Country, 2014

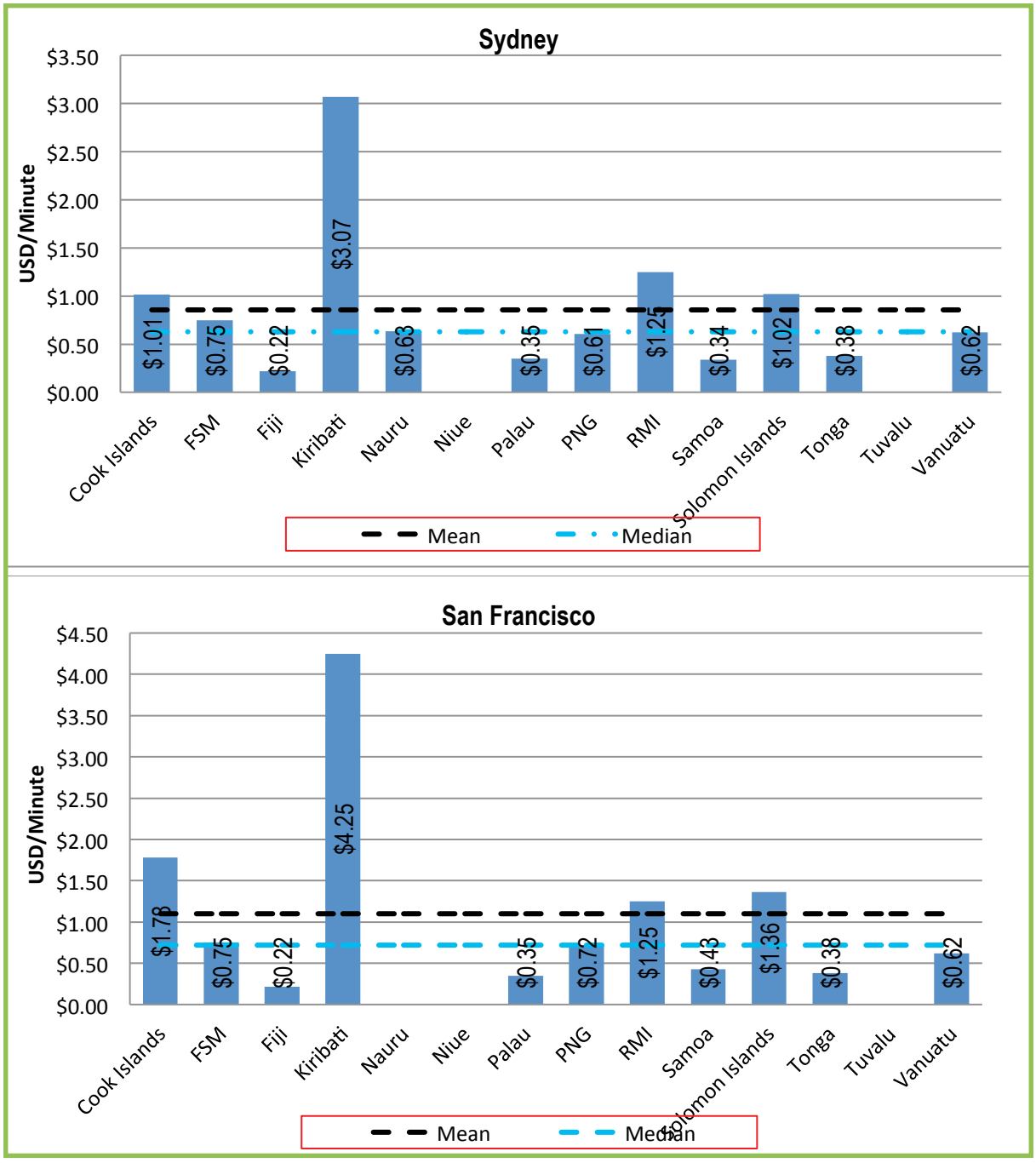


Source: Adapted from tariff information on mobile operator web sites. Note: Including tax. Converted to USD using annual average exchange rate. Tariffs refer to mobile operator with largest subscriber market share. Data not available for Niue and Tuvalu.

International Mobile Phone Call Tariff – Peak Time

The cost of international calls varies across the region and depends on a number of factors including domestic strategies and the cost for international operators to terminate calls, if that is needed. The average price of peak time one-minute mobile phone calls to Sydney and San Francisco are USD85 cents and USD1.10 respectively (with medians of US63 cents and US72 cents respectively). Peak time mobile calls to Sydney are cheapest from Fiji at USD22 cents per minute and they are most expensive in Kiribati where they cost USD3.07 per minute (Figure 25 on left). Similarly, the peak time mobile call tariff to San Francisco is least from Fiji at USD0.22 per minute and highest in Kiribati at USD4.25 per minute (see Figure 25 on right). In general, countries with mobile competition and undersea fibre optic connectivity have lower prices compared to the median. Palau also has relatively inexpensive prices even though it did not have undersea fibre optic cable at the time of data collection at the end of 2014. It is interesting that calls to the United States are somewhat more expensive given that there is little technical reason for this being the case. Operators with above average prices may find them difficult to sustain as the internet becomes more prevalent and users turn to alternatives such as Skype for making international calls.

Figure 25. Peak One-Minute Phone Call Tariff to Sydney and San Francisco (USD/Minute) by Country, 2014



Source: Adapted from tariff information on mobile operator web sites. Note: Including tax. Converted to USD using annual average exchange rate. Tariffs refer to mobile operator with largest subscriber market share. Some data not available for Nauru, Niue and Tuvalu.

Price of 3G

At the time of data collection for this report, operators offered mobile data bundles in all of the PICs that had launched 3G except for Kiribati (which has since made this service available). The prices of the bundles vary depending upon the time period and amount of data usage included (see Table 3). For example the time period can vary from one hour to four months and data usage from 5Mb to 9.5Gb.

Table 3. Types of Pre-Paid 3G Data Bundles by Country, 2014

	Number of Bundles	Minimum Mb	Maximum Mb	Minimum Days	Maximum Days
Cook Islands	3	100	1,000	30	30
FSM	3	100	5,000	1	30
Fiji	3	300	1,500	1	30
Kiribati	Not available at time of data collection				
PNG	9	10	9,500	1 hour	30
Samoa	4	40	4,000	1	30
Solomon Islands	4	75	1,000		
Tonga	4	30	1,024	1	60
Vanuatu	6	5	2,000	1	60

Source: Adapted from tariff information on mobile operator web sites.

While the variety of data bundles offers flexibility for users, it makes comparisons difficult. According to mobile equipment manufacturer Ericsson, the average smartphone user in the Asia Pacific region consumed 700Mb per month of data in 2014[22]. This is used as the benchmark based on the cheapest bundle offering at least 700Mb over a one-month period. Results are shown in the Table 4. In some countries, the price of at least 700Mb is the same for two different bundles. For example, in PNG one can either purchase two 14 day bundles of 700Mb or a one month bundle of 1.5Gb. The latter option is preferred since it technically provides two extra days and 100 extra Mb. The cheapest price is in Fiji where USD7.93 provides 1.5Gb of data per month, while the most expensive price is in the Solomon Islands where 1Gb is USD67.98. The average price in the region for at least 700Mb per month of mobile broadband is USD33.30 or 4 US cents per Mb. The monthly price as a percentage of per capita income is less than 5% in only three PICs (Cook Islands, Fiji and Tonga).

Mobile banking has had a significant impact on rural businesses and access to financial services for both men and women, Solomon Islands (World Bank – R. Skeates)

22 http://www.ericsson.com/res/docs/2015/ericsson-mobility-report-feb-2015-interim.pdf.

Table 4. 3G Price for 700MB Data Usage per Month by Country, 2014

	Price of Bundle USD	Amount (Mb)	Days	Total Mb	Total Price USD	Price per Mb (USD)	Total Monthly Price as % of Per Capita Income
Cook Islands	$41.57	1,000	30	1,000	$41.57	$0.04	2.3%
FSM	$30.00	2,000	30	2,000	$30.00	$0.02	11.8%
Fiji	$7.93	1,500	30	1,500	$7.93	$0.01	2.2%
Kiribati	$34.78	700	30	700	$34.78	$0.05	25.3%
PNG	$12.31	700	14	1,400	$24.63	$0.02	14.2%
PNG	$24.63	1,500	30	1,500	$24.63	$0.02	14.2%
Samoa	$8.19	675	14	1,350	$32.77	$0.02	9.3%
Solomon Islands	$33.99	500	30	1,000	$67.98	$0.07	41.8%
Solomon Islands	$67.98	1,000	30	1,000	$67.98	$0.07	41.8%
Tonga	$6.49	400	30	800	$12.98	$0.02	3.5%
Tonga	$12.98	1,024	60	1,024	$12.98	$0.01	3.5%
Vanuatu	$41.38	750	30	750	$41.38	$0.06	15.2%
Mean				**1,169**	**$33.30**	**$0.04**	**15.4%**

Source: Adapted from tariff information on mobile operator web sites. Note: In PNG, Solomon Islands and Tonga, two different plans result in the same price for at least 700Mb.

Price of Monthly ADSL – Post-paid

Eleven of the countries included in the PIPIs offer post-paid ADSL internet service to the general public. Price structures differ based on speed and the amount of data included. Some operators charge different prices depending on the speed, while others offer the maximum speed possible with actual speeds depending on technical factors such as how far the subscriber is from the telephone exchange. Some operators include unlimited data usage in the subscription, while others have a cap and charge for excess data usage.

A common benchmark is used to compare ADSL pricing consisting of the lowest monthly price for a package of at least 256 kbps advertised download speed and 1Gb of data usage included.[23] There is a wide difference in monthly entry-level prices ranging from USD11 to over USD200 (see Table 5). The median price in the region is USD43 per month, with eight of the PICs having a price less than USD50 per month.

On a speed-adjusted basis, the monthly price per mbps[24] ranges from USD1 to over USD2,500 with a median of USD129. In general, countries with submarine cable connection and competitive mobile operators tend to have the lowest prices. International connectivity is typically one of the main wholesale cost elements and such costs tend to be lower with undersea fibre optic cables. The existence of mobile competition (particularly where competitors provide mobile broadband) puts pressure on fixed broadband pricing. Hence PICs such as Fiji and Tonga, with undersea cable and mobile broadband competition, have the lowest prices.

It is interesting that the Cook Islands has relatively low fixed broadband prices, even though it has neither undersea cable nor mobile broadband competition. One factor is its recent connection to a new satellite network offering 'fibre-like internet speeds'[25]. The Cook Islands, Fiji and Tonga are the only three PICs that meet the UNESCO/ITU Broadband Commission's affordability target (monthly broadband price less than 5% of per capita income)[26].

23 This is the same methodology used by the International Telecommunication Union (ITU) for its fixed broadband price basket. See: http://www.itu.int/en/ITU-D/Statistics/Documents/publications/mis2014/MIS2014_without_Annex_4.pdf.
24 mbps = mega bits per second.
25 http://www.o3bnetworks.com/additional-pages/blog/guest-blog-telecom-cook-islands,-jules-maher.
26 http://www.broadbandcommission.org/Documents/Broadband_Targets.pdf.

Table 5. Price of Monthly ADSL – Post-Paid by Country, 2014

	Price per Month (USD)	Data Cap (GB)	Advertised Download Speed (Mbps)	USD per Mbps	Monthly price as % of GDP per Capita
Cook Islands	$20.78	1.5	2	$10	1%
FSM	$33.00	No cap	0.256	$129	13%
Fiji	$10.57	30	10	$1	3%
Kiribati	$225.86	No cap	0.256	$882	164%
Nauru	$40.65	5	0.512	$79	4%
Palau	$659.95	No cap	0.256	$2,578	67%
PNG	$18.96	No cap	0.256	$74	11%
RMI	$49.95	No cap	0.256	$195	17%
Samoa	$42.69	3	2	$21	12%
Solomon Islands	$269.24	No cap	0.256	$1,052	165%
Tonga	$18.03	2	21	$1	5%
Vanuatu	$61.55	No cap	0.256	$240	23%
Mean	**$120.94**			**$438.50**	**40.4%**
Median	**$41.67**			**$104**	**13%**

Source: Adapted from tariff information on mobile operator web sites. Note: Lowest price based on a minimum advertised download speed of 256 kbps and 1 GB of data per month. Taxes included. Converted to USD using annual average exchange rates. ADSL service is not commercially available in Niue or Tuvalu.

2.3 Solid Waste Management

Key Findings:

- *Overall coverage of solid waste collection in urban areas was 94.8% in 2013, but it varied between 50% (in Kiribati and Solomon Islands) and 100% (in six of the PICs). Data is difficult to obtain for rural areas and there are many temporary, unauthorised and open dumps.*
- *There has been progress since the 2011 PIPIs Report. For example, Kiribati expanded service provision from 35% of the urban population to 50% and FSM expanded from 60% to over 70%.*
- *There are a range of SWM facilities in use including semi-aerobic 'Fukuoka method' landfills, anaerobic landfills, and open dumps.*
- *There is some recycling and other efforts at sustainability, with four countries involved in container deposit schemes. Extended Producer Responsibility programs are yet to be introduced.*

Sustainable solid waste management is a challenge for all or most of the PICs. While waste collection and disposal services are provided in many urban areas of PICs, the services can be irregular and inadequate and there may not be any services provided in the rural areas. This has resulted in many temporary, unauthorised and open dumps where waste is not buried and there is open burning and unauthorised 'waste picking' activities by community members (including children). At other disposal sites, waste is bulldozed and covered at least occasionally though there is limited information on how often this is done. Additionally, there are challenges in terms of availability of land for effective disposal and the need to manage waste near or within residential areas and sensitive environmental areas (including the potential for pollution of surface water or groundwater catchments through leachate[27]).

27 i.e. liquids passing through the landfill and contaminating the underlying and adjacent groundwater resources.

2.3.1 Access

In this report, the proportion of the population served by solid waste collection and disposal is used as the measure of access to solid waste management services. The data is from the ADB-funded *45146-001: Solid Waste Management Sector Project*[28]. It is based on selected urban areas and therefore has some inherent uncertainty. The data does not present complete information for a country, as rural data is not included. In addition, given that the boundary of urban service areas is determined differently across the region (including peri-urban areas and informal settlements for some municipalities but not others), caution is needed in interpretation and making comparisons between different countries.

Access and Frequency of Service

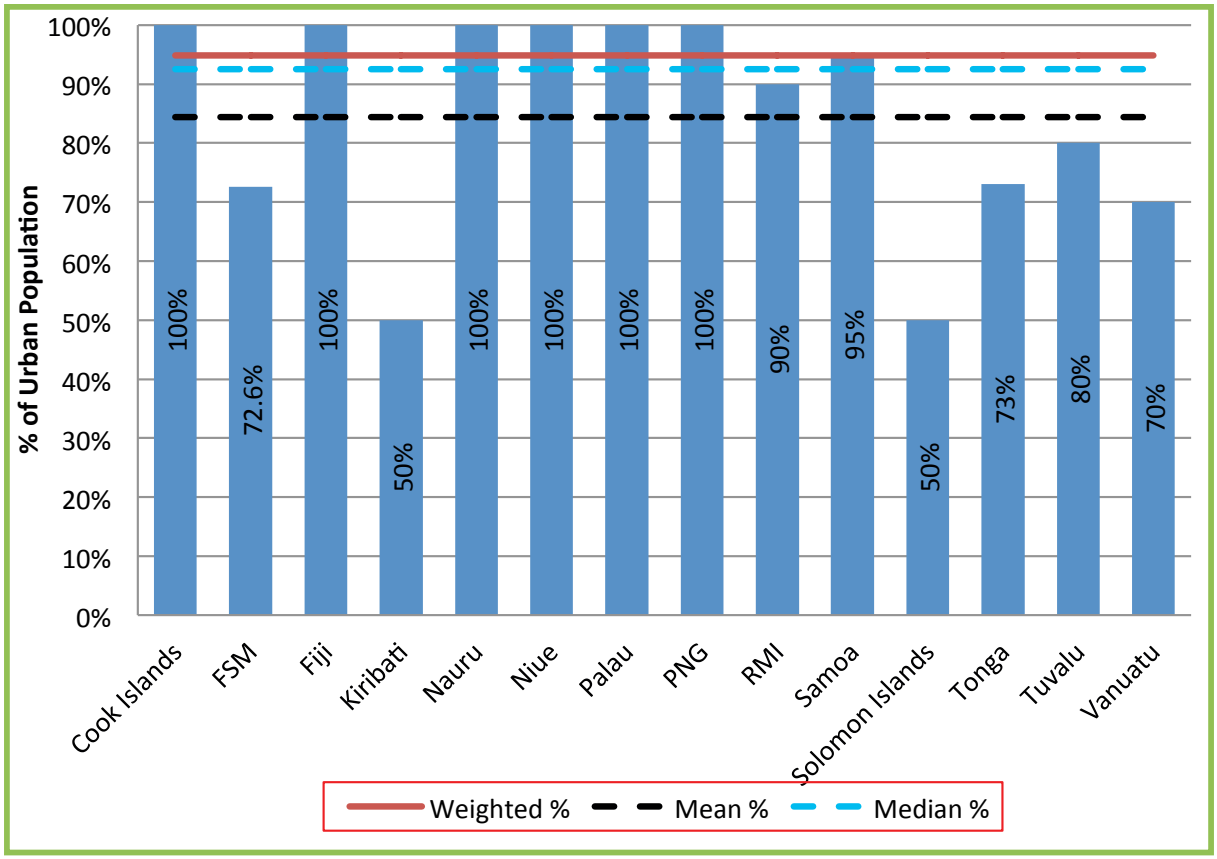
Solid waste collection and disposal services are available in most of the urban areas of the PICs. The service is generally provided free to households, while businesses and institutions are responsible for transporting their own waste to the landfill or they can pay for waste collection services. In the Cook Islands, Nauru, Niue and Palau there is 100% coverage for solid waste management services in the urban service areas while the Solomon Islands and Kiribati have the lowest coverage at about 50% of the population. In rural areas, there may not be a service and community members may have to bring their waste to a central location/s or otherwise dispose of it themselves.

Rubbish collection service provided by Port Vila Municipal Council, Vanuatu (J-PRISM Expert Team, SPREP)

Figure 26 presents coverage of solid waste collection in urban areas in the PICs in 2013. The overall coverage was 94.8% of the population (expressed as a weighted percentage), with a mean coverage of 84.4% and a median coverage of 92.5%. However, these high figures result from the six countries that report 100% coverage (i.e. Cook Islands, Fiji, Nauru, Niue, Palau, and PNG). In other PICs it is as low as 50% (i.e. in Kiribati and the Solomon Islands.

28 Asian Development Bank Publication Stock No. ARM146614-2 June 2014 – Individual solid management country reports for: Cook Islands, FSM, Fiji, Kiribati, Nauru, Palau, PNG, RMI, Samoa, Solomon Islands, Tonga, Tuvalu and Vanuatu.

Figure 26. Access to Regular Solid Waste Collection Service in Urban Areas as a Percentage of Urban Population by Country, 2013

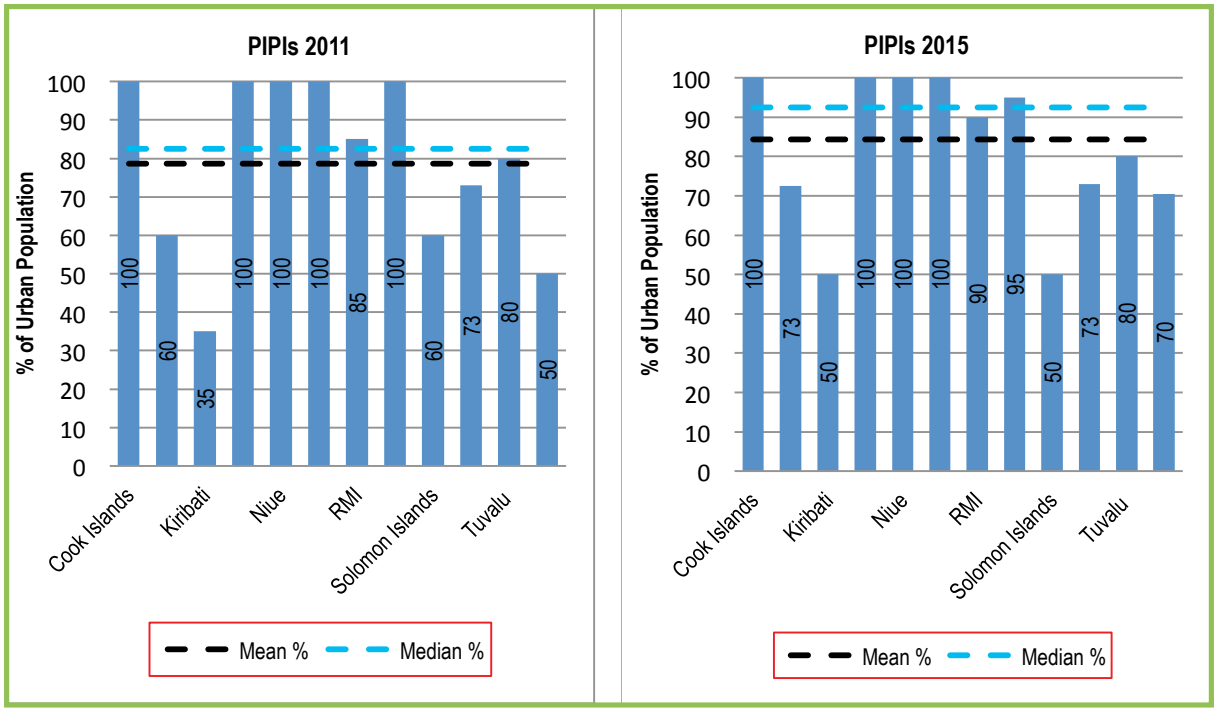


Source: Asian Development Bank Publication Stock No. ARM146614-2 June 2014.

Changes in Solid Waste Management Services between PIPIs 2011 and 2014

Comparing data from the PIPIs 2011 Report with current data is informative, despite limitations in the data sets. Those that were providing waste disposal services to all urban households continue to report this same level of service (see Figure 27). In addition, service levels have increased in a number of countries, for example: in Vanuatu the coverage has increased by 20%, in Kiribati the coverage has increased by 15%, in FSM by 13% and in RMI by 5%. There were also some minor variations and data corrections for some countries, for example, in the Solomon Islands.

Figure 27. Access to Regular Solid Waste Collection Service in Urban Areas as Percentage of Urban Population by Country – Comparison of 2011 and 2015 PIPIs

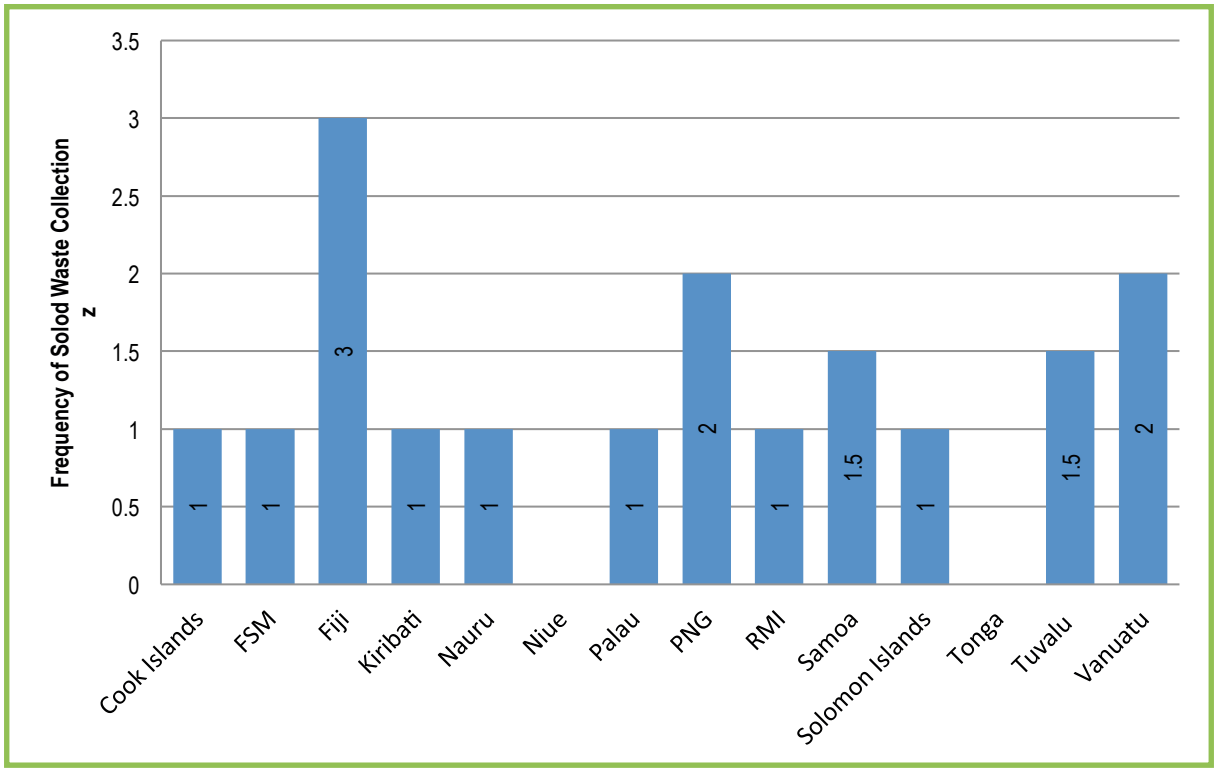


Source: Asian Development Bank Publication Stock No. ARM146614-2 June 2014. Note: Fiji and PNG were not included in the PIPIs Report 2011 and are therefore not in these comparative tables.

Frequency of Solid Waste Collection Services

The data on frequency of services is difficult to interpret (see Figure 28). On average, it appears that solid waste is collected once or twice per week in most of the PICs. An exception to this is in Fiji where solid waste is collected three times a week in Suva. Waste collection is predominantly done by the public sector although there are examples of private sector operators in some countries (e.g. Cook Islands, FSM and PNG). Anecdotal information suggests that contracting-out of services sometimes works well and sometimes not, particularly if the arrangements for paying or monitoring the contractor are not consistent. In Kiribati, the Government has introduced waste collection 'green bags' that can be purchased by households at US18 cents per bag, though they are only intended for non-organic waste.

Figure 28. Frequency of Solid Waste Collection per Week by Country, 2014



Source: Asian Development Bank Publication Stock No. ARM146614-2 June 2014; plus anecdotal confirmation in Cook Islands and Fiji. Note: Data not available for Niue and Tonga.

2.3.2 Quality

The PIPIs for measuring the quality of solid waste management facilities are:

- number of each type of waste management facility in urban areas
- % of facilities that meet environmental best practice standards, and
- % of facilities with up-to-date environmental monitoring reports readily available.

Available data shows that there are more than 330 temporary dumps, more than 96 authorised open dumps, at least 34 controlled dumps and at least 15 sanitary landfills across the PICs[29]. Most of the disposal sites in urban areas are either controlled dumps or sanitary landfills. A number of the PICs (including FSM, Palau, PNG, Samoa, Solomon Islands, Tonga and Vanuatu) have semi-aerobic 'Fukuoka method' landfills built under a project funded by Japan International Cooperation Agency (JICA) and one of the sites in Fiji has an anaerobic landfill (see Table 6). However, many disposal sites are temporary, unauthorised and open dumps where open burning occurs and 'waste picking' activities are carried out by community members (including children) without authorisation or use of personal protective equipment (PPE). This is potentially dangerous as heavy machinery may be operating in the vicinity and there may be hazardous waste at the site.

29 Secretariat of the Pacific Regional Environment Programme (November 2015). *Cleaner Pacific 2025: Pacific Regional Waste and Pollution Management Strategy 2016-2025.* SPREP: Apia, Samoa, p.25. Received from SPREP, 13th November 2015.

Table 6. Type of Solid Waste Management Facility in Urban Areas by Country

Performance Indicators		*Year*	*Cook Islands*	*FSM*	*Fiji*	*Kiribati*	*Nauru*	*Niue*	*Palau*	*PNG*	*RMI*	*Samoa*	*Solomon Islands*	*Tonga*	*Tuvalu*	*Vanuatu*
No. of each type of waste management facility in urban areas	Open Dump	2013	1	1		2	1	1		1	1		1		1	
	Semi-aerobic "Fukuoka-method"	2015		3					1	under construction		2	under construction	1		1 – currently developing an additional cell
	Anaerobic landfill	2013			1											
	Incineration	2013														

Source: Asian Development Bank Publication Stock No. ARM146614-2 June 2014; SPREP records 2015. Note: Table shows all available data with empty cells indicating 'none' or 'nil'. Open dumps and incineration can be established at any time and present challenges to accurate record-keeping.

Data is not currently available on the two indicators on environment best practice standards and having up-to date environmental monitoring reports readily available.

Landfill in Baruni, PNG following rehabilitation through JICA (J-PRISM Expert Team, SPREP)

2.3.3 Efficiency

The PIPI for efficiency of solid waste management facilities and services is the per capita cost of waste disposal. This indicator can also be strengthened by taking account of the relative level of development in different countries of the Pacific and calculating the per capita cost as a percentage of the GDP, thereby highlighting relative costs in each country. However, the total costs and revenues in each country are unclear (particularly because private sector costs are unavailable), so neither the per capita cost nor the per capita cost as a percentage of GDP are reliable. A further complication is that service levels vary greatly between the countries across the entire waste management supply chain and the available data is currently inadequate in reflecting this.

Even so, there is some data available on costs and charges to households. In general, costs for rubbish collection may either be fully covered through government budgets (e.g. in the Cook Islands, Nauru, Palau, RMI and Samoa) or they may be initially covered by government with levies then charged to households, businesses and institutions (e.g. in Kiribati, Solomon Islands, Tonga, Tuvalu and Vanuatu). Governments usually allocate a fixed amount of budget each year for this which is managed through local governmental bodies, mostly municipalities. Data on these government budget allocations is available for seven of the 14 PICs, as follows:

- Cook Islands - USD346,000
- FSM - USD100,000
- Fiji – USD1,800,000
- Kiribati - USD284,580
- PNG - USD4,050,000
- RMI - USD32,500, and
- Samoa - USD970,000[30].

There are various systems across the region for recovering costs from customers. Charges for waste collection and disposal are generally set at different rates for households, businesses and institutions. Some of the governments charge periodically (i.e. weekly or monthly, half yearly and annually) and some charge on the basis of volume and the frequency of collection service provided. Some countries have private operators as well as government, generally servicing different areas. Most of the landfill sites have a tipping charge for vehicles entering the land fill sites for dumping waste.

Where there is cost recovery, the amount levied varies significantly between countries. For example, at the time of data collection, the charge in Kiribati was AUD29 per year and in Tuvalu it was AUD40 per year, whereas in Vanuatu it was USD163 per year. Recovery rates may be 25% or less and, in some countries, fees may only be recovered when properties change ownership and the government can collect all outstanding debts against the property. In addition, revenue that is collected may be used as part of general government revenue and not necessarily for solid waste management. The issue of cost recovery was also raised in the 2011 PIPIs Report. As was the case then, many governments do not appear to have a current strategy for cost recovery and/or the level of recovery is unknown.

2.3.4 Sustainability

The PIPIs 2015 include measures for sustainability based on:

- number of systems for sorting solid and/or hazardous waste
- number of shipping containers exported that contain recyclable commodities or waste, and
- number of Extended Producer Responsibility (EPR) programs (explained further below).

Sorting of rubbish at dump, Majuro, RMI (C. McMahon)

30 *Asian Development Bank Publication Stock No. ARM146614-2 June 2014.*

As Table 7 shows, almost all PICs have some sort of system for sorting solid waste, some sort hazardous waste and some are involved in recycling. Items removed before waste is bulldozed/ buried include polyethylene terephthalate (PET) drink bottles, aluminium cans, cardboard and paper, glass, ferrous and non-ferrous scrap metals, white goods, lead acid batteries and end-of-life vehicles. Glass is generally reused locally. Recycling plants exist in Fiji (for paper and lead-acid batteries) and Palau (for converting plastics to oil) and recyclable material is also collected and consolidated for export, with the private sector taking a lead role in this effort (incentivised by prices in international recycling commodity markets)[31]. The main markets are in New Zealand, Australia, Korea, and China and the materials exported include aluminium cans, ferrous and non-ferrous metals and lead acid batteries.

Table 7. Approach to Sustainability in Solid Waste Management by Country

Performance Indicators	*Year*	*Cook Islands*	*FSM*	*Fiji*	*Kiribati*	*Nauru*	*Niue*	*Palau*	*PNG*	*RMI*	*Samoa*	*Solomon Islands*	*Tonga*	*Tuvalu*	*Vanuatu*
Systems for sorting solid waste[32]	2013	Yes	Yes	Yes	Yes	Yes		Yes	Yes	Yes	Yes		Yes	Yes	Yes
Systems for sorting hazardous waste	2014		Yes	Yes					Yes	Yes	Yes		Yes	-	Yes
Export of shipping containers holding recyclable commodities or waste[33]	2013	Yes	Yes	Yes	Yes			Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Extended Producer Responsibility programs	2013														
Container Deposit Schemes	2015	Yes[34]	Yes[35]		Yes[36]			Yes[37]							

Source: Asian Development Bank Publication Stock No. ARM146614-2 June 2014; J-PRISM Survey on Disposal Sites in the Pacific, JICA, 2014: http://www.sprep.org/j-prism, Table 2.2, p.8[38].

Note: Table shows all available data, with empty cells indicating 'no' or absence of the program at the time of data collection.

31 SPREP, op cit, p.21.
32 Numbers are not available but the table indicates where there is a practice of sorting.
33 Number of shipping containers exported was not available for most of the PICs but they do export recyclable commodities or waste.
34 Being established for recyclable imports.
35 US6 cents on imported cans and bottles ;$4.00 on lead-acid batteries.
36 AUD5 cents on imported cans and bottles, with AUD4 cents redeemed.
37 US10 cents charged on cans and bottles, with US5 cents redeemed.
38 This study highlights that even though a system of waste disposal may exist in a country, there can be varying coverage across the country and systems may have minor to severe problems.

EPR is a new concept for the Pacific. It promotes the integration of environmental factors and costs into the management of products throughout their lifecycle, particularly involving holding manufacturers responsible for the costs of managing/disposing of their products at the end of their productive life. This shifts responsibility for waste disposal from the government to the private sector. Hence, it is the producer/supplier that takes responsibility for collection and disposal of the waste/recyclable product and it often involves financial incentives to encourage manufacturing of environmentally-friendly products. Examples include 'take back' programs for computers or cartridge return schemes.

However, as Table 7 shows, at the time of data collection none of the countries had introduced EPR. In addition, most did not have a Container Deposit Legislation (CDL) program and they also do not have a system of Green Fees[39]. FSM and Palau have recently introduced CDL programs and the Cook Islands is in the process of introducing it. As an example, in FSM the CDL program was launched with support from the United Nations Development Programme (UNDP). Under the scheme, a deposit fee of USD6 cents is levied on each imported aluminium, plastic or glass beverage container. Consumers are able to redeem US5 cents when the container is returned to designated collection points for recycling. The remaining US1 cent covers handling charges. Similarly, a levy of USD4 is charged on imported lead-acid batteries to assist with the cost of disposal. Remaining monies go into a recycling fund which is used solely to finance the country's recycling program.

Informal, household, and community recycling is also practised, including the use of food waste as animal feed and reuse of materials of perceived value, such as plastics. In some PICs, restaurants barter the food waste as part payment for pork from pig farmers.

In total, it is estimated that up to 60% of potentially recyclable waste is being exported or reused/recycled locally in some countries. In 2011, this was estimated to involve 10% of recyclables in Tonga (598 tonnes per year), 15% in Tuvalu (103 tonnes per year), 36% in Samoa (4,741 tonnes per year), 37% in Vanuatu (4,642 tonnes per year) and 57% in Fiji (38,081 tonnes per year)[40].

Information was not available on the total number of shipping containers carrying recyclables for export markers. However, as an example, Samoa ships approximately 12 containers of recyclables and waste every month to New Zealand[41].

Collecting cars for recycling – Nuku'alofa, Tonga (P. Dutton)

39 Also known as a 'visitor levy' charged to tourists for the purpose of supporting environmental protection in the islands.

40 Japan International Cooperation Agency (JICA), the Overseas Coastal Area Development Institute of Japan & Yachiyo Engineering Co. Ltd. (2013). *Data collection survey on reverse logistics in the Pacific Islands – Final* Report. http://www.sprep.org/attachments/VirLib/Regional/16.pdf, p.ix, JICA. Access Date: 16 November 2015.

41 Asian Development Bank Publication Stock No. ARM146614-2 June 2014, solid-waste-management-samoa.pdf.

2.4 Transport

Key Findings:

Aviation

- *There are 722 airports in the 14 PICs, with at least one international airport in each country.*
- *Only 7% of airports are paved, including all international airports.*
- *There are 16,678 international passenger seats per week of which 65% are on flights from Australia and New Zealand.*
- *Since 2010, there have been two airplane crashes (both in PNG) with 28 fatalities.*

Maritime

- *There are 31 international shipping ports.*
- *International cargo and commercial vessels range from 295 per year in Vanuatu to 20 per year in Tuvalu.*
- *The composition of port charges caries considerably, making comparisons difficult.*

Roads

- *There are 21,862 kilometres of road in the PICs, with only 33% paved.*
- *60% of paved road is in PNG but it also has very low road density due to the amount of inaccessible land.*
- *There is a lack of data on road conditions, maintenance and road safety.*

Good transport systems are critical to the growth of Pacific island economies. This includes provision of efficient aviation, road and port/maritime facilities for both urban and rural areas, supporting trade and commerce, increasing employment, providing access to services and reducing poverty in the Pacific. However, most Pacific countries lack the capital to upgrade their transport systems, they do not manage maintenance adequately, and there are capacity issues in respect to planning and implementing improvements across the sector. The collection of data is also not strong, evidenced by there being few updates available for performance indicators since the PIPIs Report for 2011. Therefore, much of the data in this chapter is copied, as is, from that presented in 2011, with the addition of weighted averages to enhance the usefulness of the data. World Bank and JICA studies in the maritime sector have provided useful data from 2015.

Importantly, although the data is presented here according to each indicator in the three transport sub-sectors, to fully understand accessibility in individual countries the data for the three sub-sectors needs to be considered holistically. To take PNG as an example, while the data shows that there are a lot of airports, there must also be a good road network and maritime services to ensure a level of accessibility that will support strong economic development. Checking the data, it shows that 43% of road kilometres across the region are in PNG and it has the highest number of international ports. However, it has the highest percentage of unpaved road and there have been air safety issues. Hence, efficiency and reliability may need improving, both of which impact on economic outcomes.

2.4.1 Aviation

Good aviation services are essential to economic development in the Pacific, including those PICs that rely on tourism and receive most of their visitors via air arrivals. At the same time, it is difficult for many PICs – particularly the smaller nation states - to meet the high standard of safety and security mandated by the ICAO. Most PICs have limited staff resources in the civil aviation regulatory agencies and specialist skills are expensive and difficult to source. A regional treaty – the Pacific Islands Safety and Security Treaty (PICASST) – has been signed by many PICs and these countries are able to access technical expertise and other services from the Pacific Aviation Safety Office (PASO). In addition, a number of aviation programs are supported across the region by development partners including the Pacific Aviation Infrastructure Programme (through the World Bank) and the Pacific Aeronautical Charting and Procedures Project (from NZMFAT).

Although aviation performance indicators were determined in five areas - access, quality, efficiency, affordability and safety - data could only be located for access, affordability and safety indicators.

2.4.1.1 Access

Aviation access indicators include number of airports, domestic and international flights, international freight cost and number of inbound international passengers per week.

Records show there are 722 airports in the PICs, including both those that are government run and those that belong to private hotels/resorts. This is a very high number and it includes 22 international airports. Five of the PICs have more than one international airport. Among these, FSM has four; Vanuatu has three; and Fiji, Kiribati and RMI each have two international airports (see Table 8).

Photo: Entrance to Bonriki International Airport, Kiribati (L. Estigarribia)

Table 8. Number of International Airports, 2014

PIC	Name of International Airports	Number of International Airports
Cook Islands	Rarotonga Airport	1
FSM	Chuuk International Airport	4
	Kosrae International Airport	
	Pohnpei International Airport	
	Yap International Airport	
Fiji	Nadi International Airport	2
	Suva – Nausori International Airport	
Kiribati	Kiritimati – Cassidy International Airport	2
	Tarawa – Bonriki International Airport	
Nauru	Yaren – Nauru International Airport	1
Niue	Alofi – Niue (or Hanan) International Airport	1
Palau	Koror – Roman Tmetuchl International Airport (or Babelthuap Koror Airport or Airai Airport)	1
PNG	Port Moresby – Jacksons International Airport	1
RMI	Kwajalein – Kwajalein International Airport (or Bucholz Army Airfield)	2
	Majuro – Marshall Islands International Airport	
Samoa	Apia – Faleolo International Airport	1
Solomon Islands	Honiara – Honiara International Airport	1
Tonga	Nuku'alofa – Fua'amotu International Airport	1
Tuvalu	Funafuti – Funafuti International Airport	1
Vanuatu	Luganville – Santo-Pekoa International Airport	3
	Port Vila – Bauerfield International Airport	
	Tanna – White Grass Airport	
	Total	**22**

Sources: https://en.wikipedia.org/wiki/List_of_international_airports_by_country (Accessed September 2014) and http://www.airports.vu/ (Accessed January 2016)

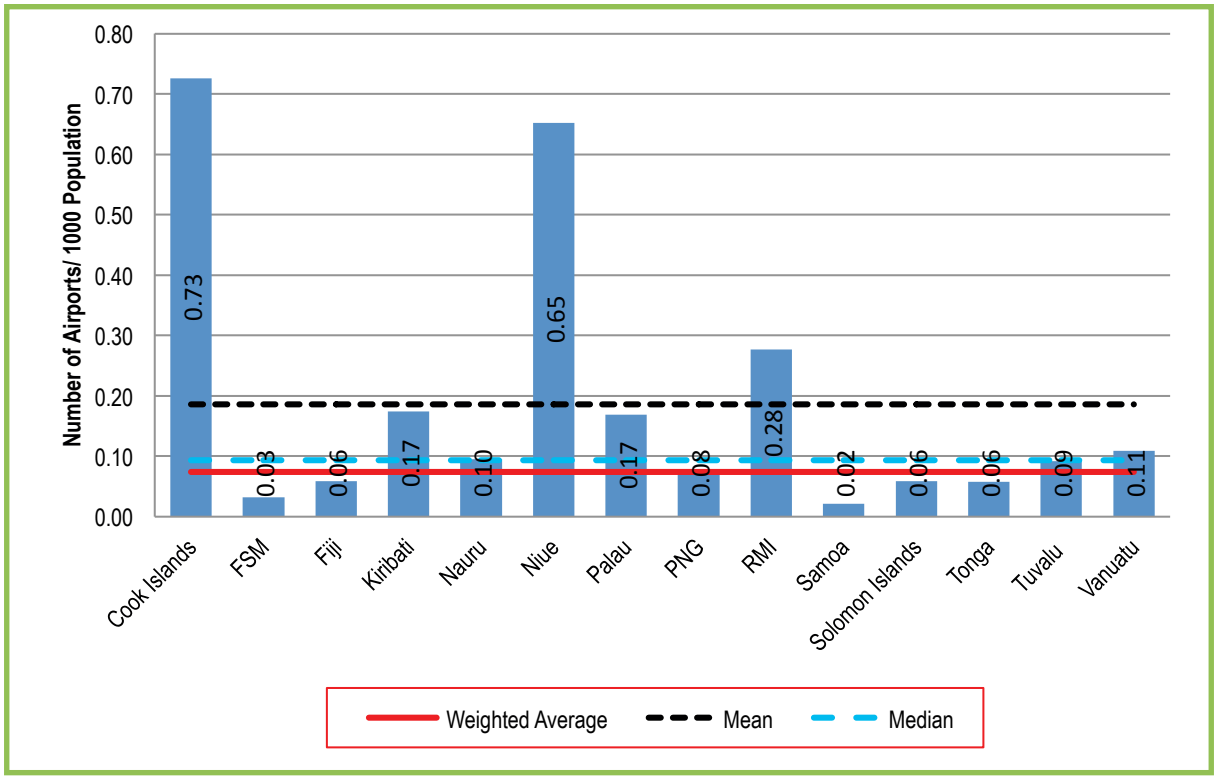
Number of Airports in Each Country

Although there is a high number of airports across the region, the majority are in PNG (562, 77.8%) – with all but one being domestic airports, indicating the importance of aviation in PNG given its terrain. The number of airports (both international and domestic) in the other PICs are: Solomon Islands (36, 5%), Vanuatu (29, 4%), Fiji (28, 3.9%), Kiribati (19, 2.63%) RMI (15, 2.08%), Cook Islands (11, <1%), FSM (6, <1%), Tonga (6, <1%), Samoa (4, <1%), Palau (3, <1%) and one airport each in Nauru, Niue and Tuvalu[42].

In considering what this means for accessibility and service levels, it is useful to refer to the number of airports per 1,000 population (see Figure 29). The data shows that while the mean number of airports per 1,000 population was 0.19, all but three countries were below this level (i.e. Cook Islands at 0.73 per 1,000 population, Niue at 0.65 per 1,000 population, and RMI at 0.28 per 1,000 population). Hence, the median and weighted average number of airports per 1,000 population are more useful in considering the regional situation. The weighted average was 0.07 and the median was 0.09 number of airports per 1,000 population.

42 *Source: SPC, EDD Database, Accessed August 2014; CIA World FactBook (web database).*

Figure 29. Number of Airports per 1000 Population by Country, 2010-2012



Source: CIA World FactBook (web database); Accessed: Sept 2014. Note: Data is taken from 2010, except for Vanuatu (2011) and Cook Islands and Kiribati (2012).

At country level, this indicator is also useful in understanding that although a country like PNG has 562 airports, the number per 1,000 population is among the lowest at 0.08 per 1,000 population. The situation is similar in the Solomon Islands (with 36 airports but 0.06 airports per 1,000 population), Vanuatu (with 29 airports but 0.11 per 1,000 population), and Fiji (with 28 airports but 0.06 per 1,000 population). Samoa and FSM have the lowest number of airports per 1,000 population at 0.02 and 0.03 respectively.

Paved Airports and Unpaved Airports

Table 9 summarises information about the number and percentage of paved and unpaved runways at airports in the PICs. This is an important issue, not only because of the comfort of passengers and transport of cargo, but because it affects the type of aircraft that can land on an airstrip. For paved airports, it is only the international airport in Samoa that can accept large Boeing aircraft such as the 747, while most countries can only take smaller aircraft such as 767s and 737s[43] – affecting the number of passenger arrivals and also the transport of cargo. Unpaved airports (mostly domestic airports) are generally used by smaller turboprop aircraft, with lower passenger and cargo capacity. Very importantly, there is an ongoing need for maintenance of airstrips – including all types of surfacing.

43 PIPIs Report 2011, p.30.

Table 9. Number and Percentage of Airports by Country and by Type of Runway

PICs	Paved Runway		Unpaved Runway		Total No. of Airports	
Cook Islands	1	(9%)	10	(91%)	11	(100%)
FSM	6	(100%)	Nil		6	(100%)
Fiji	4	(14%)	24	(86%)	28	(100%)
Kiribati	4	(21%)	15	(79%)	19	(100%)
Nauru	1	(100%)	Nil		1	(100%)
Niue	1	(100%)	Nil		1	(100%)
Palau	1	(33%)	2	(67%)	3	(100%)
PNG	21	(4%)	541	(96%)	562	(100%)
RMI	4	(27%)	11	(73%)	15	(100%)
Samoa	1	(25%)	3	(75%)	4	(100%)
Solomon Islands	1	(3%)	35	(97%)	36	(100%)
Tonga	1	(17%)	5	(83%)	6	(100%)
Tuvalu	1 (100%)		Nil		1	(100%)
Vanuatu	5	(17%)	25	(83%)	30	(100%)
Total/Overall	52	(7%)	671	(93%)	722	(100%)

Sources: CIA World FactBook (web database), Accessed: Sept 2014; http://www.radionz.co.nz/international/pacific-news/190323/new-sealed-tarmac-runway-opened-on-vanuatu%27s-ambae, Accessed Jan. 2016.
Note: Data is taken from 2010, except for Vanuatu (2011) and Cook Islands and Kiribati (2012).

a) Number of Paved Airports

As shown in Table 9, the total number of airports with paved runways[44] was reported at 50 in 2014. Many of the PICs have only one paved airport, including the Cook Islands, Nauru, Niue, Palau, Samoa, Solomon Islands, Tonga and Tuvalu. PNG has the highest number of paved airports (21), though they only account for 4% of all airports in the country. FSM has six paved airports (100% of all its airports); Fiji, Kiribati and RMI have four paved airports each (representing 14%, 21% and 27% of all airports in the respective countries); and Vanuatu has three paved airports (10% of all its airports).

b) Paved Airports as Percentage of Total Airports in Each Country

As mentioned above, the percentage of paved airports in the PICs is 7% (50 paved airports out of 722 airports). FSM, Nauru, Niue and Tuvalu have 100% paved airports, though in Nauru, Niue and Tuvalu this is only one airport each. The percentage of paved airports is least in Solomon Islands, PNG and the Cook Islands which have 3%, 4% and 9% paved airports out of 36, 562 and 11 airports respectively.

The overall percentage distribution of paved and unpaved airports in the PICs is 7% and 93% respectively. In the nine countries that have more than five airports in total, all but one of them (i.e. FSM) has a higher percentage of unpaved than paved airports.

c) Number of Unpaved Airports

FSM, Nauru, Niue and Tuvalu have paved airports only. The highest number of unpaved airports are found in PNG (541 airports), followed by Solomon Islands (35 airports), Vanuatu (26 airports) and Fiji (24 airports). It is least in Palau and Samoa with two and three unpaved airports respectively.

44 For the purpose of this report, a paved runway is one that is observed as paved in satellite images rather than one that has engineered and structural pavement.

Photo: Funafuti Airport, Tuvalu (J. Overbeek)

d) Unpaved Airports as Percentage of Total Airports

In the Cook Islands, PNG, Solomon Islands and Vanuatu more than 90% of the airports are unpaved. Palau has the lowest percentage of unpaved airports (67%). The rest of the PICs have 68% - 89% as unpaved airports.

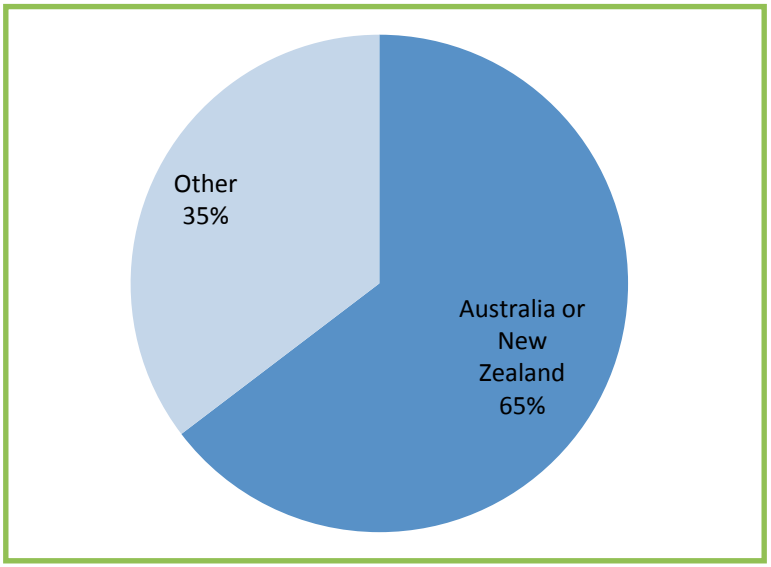
Take-off and Landing Schedules and International Freight Costs

This data was not available during the course of this data collection.

Number of Inbound International Passenger Seats per Week

The reported total number of inbound international passenger seats was 16,678 per week of which 65% (no. = 10,783) were on planes from Australia or New Zealand and the rest 35% (no. = 5,895) were from other countries of the world (Figure 30). Data is not available on passengers, but many of the flights are fully-booked – especially those which are only available once or twice each week.

Figure 30. Aviation Sub-Sector - Distribution of Inbound International Seats per Week by Country of Origin



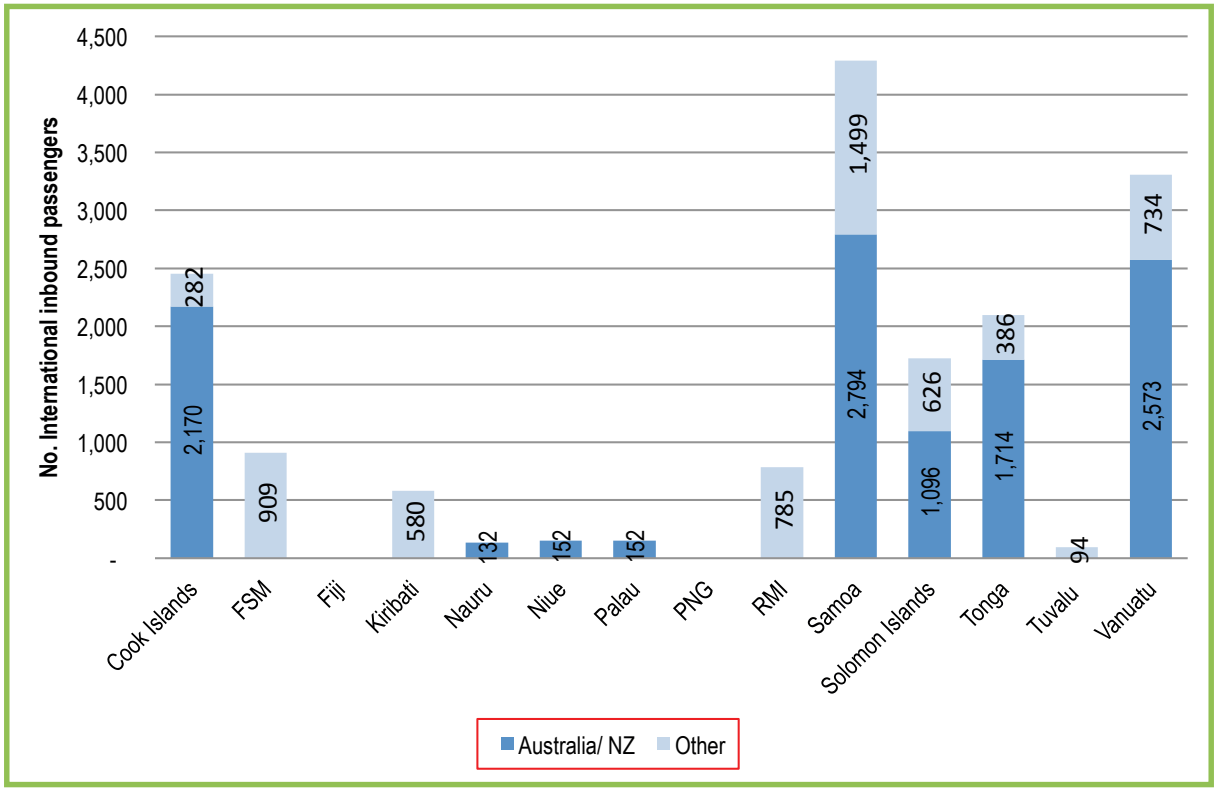
Source: PIPIs 2011.

The highest number of reported inbound international passengers seats were for Samoa (4,293 seats per week) followed by Vanuatu (3,307 seats per week) and the Cook Islands (2,452 seats per week) – three countries (along with Fiji) that are well-known tourist destinations (see Figure 31). In Tuvalu, only 94 seats are available per week and hence, the number of inbound international passengers is much lower.

The data on inbound international passenger seats data was sourced from the PIPIs 2011, so it includes only the 12 PICs that were included in that report. Data for Fiji and PNG is not available. The mean and median number of inbound international passenger seats were 1,390 and 847 per week in 2011. However, the mean figure is only useful if we assume that the total number of inbound international passenger seats were distributed equally among 12 PICs, which is not the case. Instead, the median is a more useful figure as it reveals that six PICs (Kiribati, Nauru, Niue, Palau, RMI and Tuvalu) have less than 847 inbound international seats per week while another six PICs (Cook Islands, FSM, Samoa, Solomon Islands, Tonga and Vanuatu) have more than 847 inbound international seats per week.

Photo: Airport landing strip as seen from Pohnpei Harbour (A. Sammons)

Figure 31. Number of Inbound International Seats per Week by Country of Destination and Country of Origin, 2011



Source: PIPIs 2011. Data not available for Fiji and PNG.

2.4.1.2 Quality

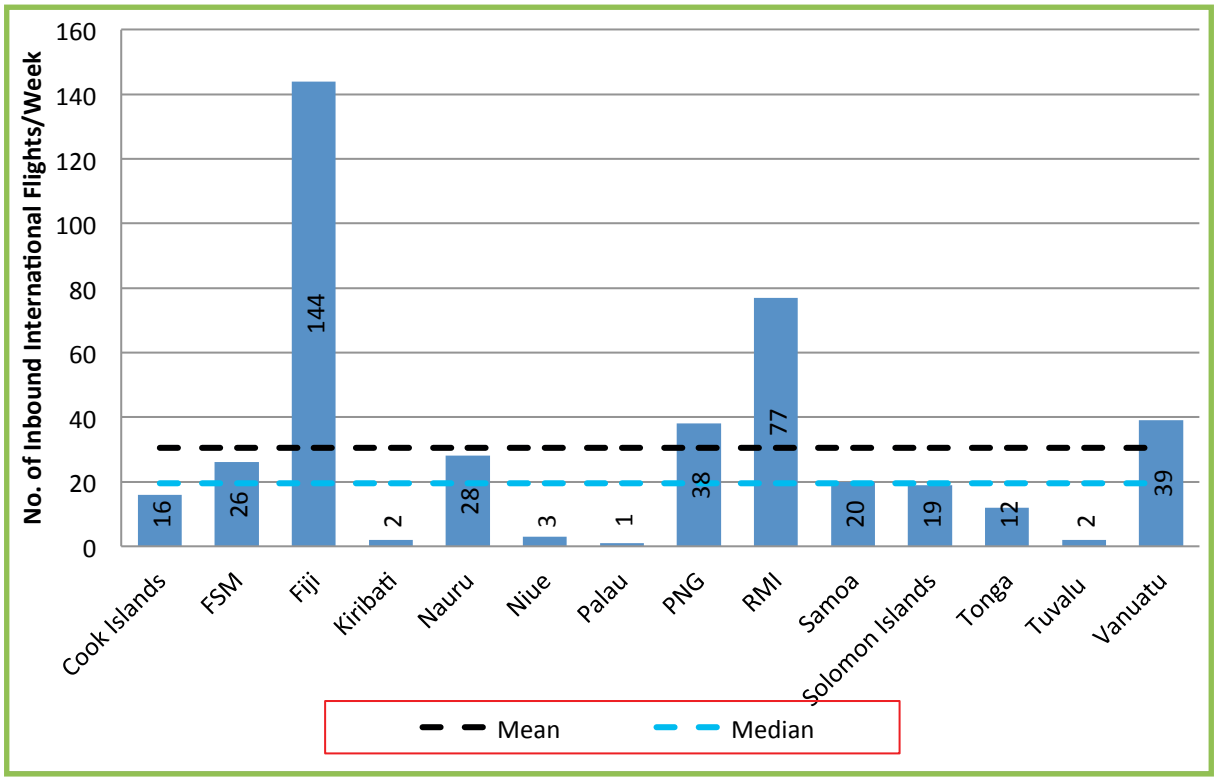
Quality indicators are not represented in the report as the International Air Transport Association (IATA) Level of Service (LOS) data to measure this was not available.

2.4.1.3 Efficiency

Efficiency of aviation is measured by the number of inbound flights per week to dominant hubs. This is Fiji in the south Pacific and RMI in the north. However, the data for all inbound flights will be shown here due to the usefulness of having the data available in a collated report.

In total there were 427 international inbound flights per week reported (see Figure 32). Fiji had the highest number of weekly international inbound flights (144 flights per week), reflecting its importance as an aviation hub. This was followed by RMI (77 flights per week) which is a hub in the northern part of the region, PNG (38 flights per week), Nauru (28 flights per week), FSM (26 flights per week) and Samoa (20 flights per week). The Solomon Islands, Cook Islands and Tonga had 19, 16 and 12 flights per week respectively. The number of international inbound flights per week was least in Palau (one flight per week), Tuvalu and Kiribati (two flights per week each) and Niue (three flights per week). Travel to these countries is generally via another country and it can require a stay of up to a week, unless it is a quick 'turnaround' visit (i.e. fly in and stay only during transit, then fly out again).

Figure 32. Number of Inbound International Flights per Week, 2011



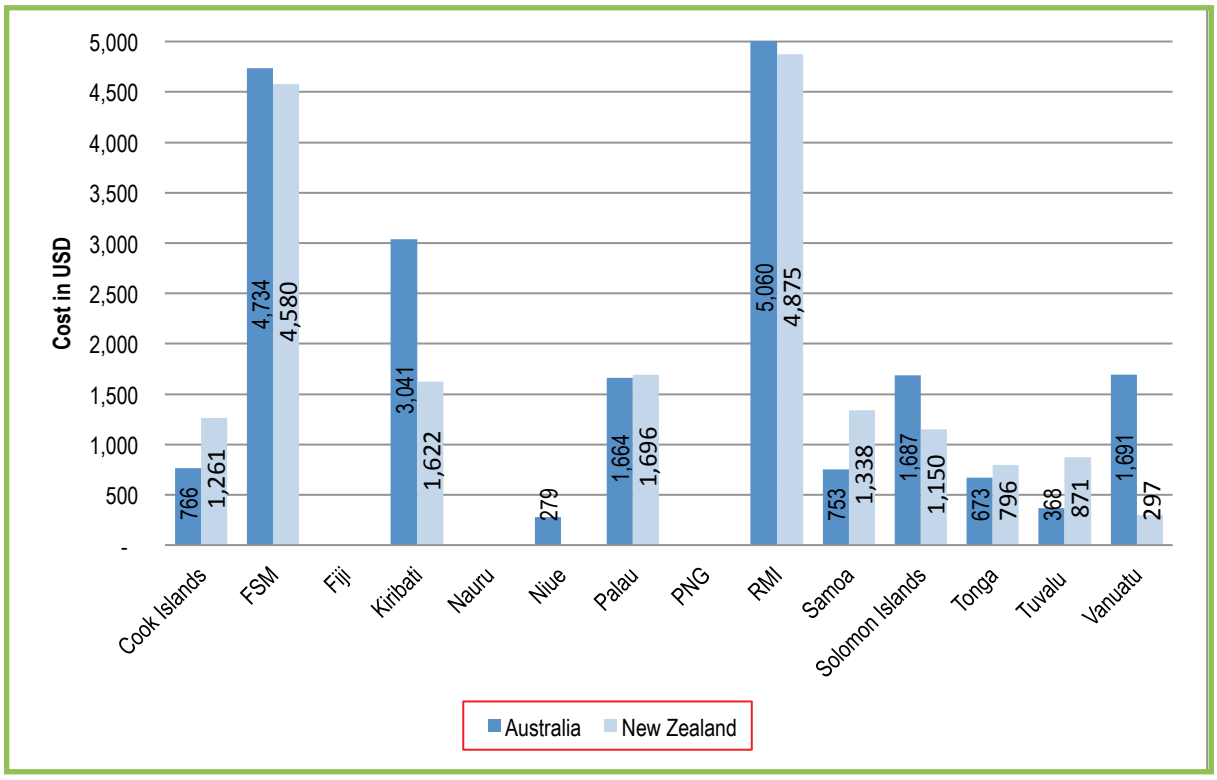
Source: PIPIs 2011.

Grass landing strip, Makira, Solomon Islands – one of 35 unpaved airstrips in the country (C. McMahon)

2.4.1.4 Affordability

Measurement of affordability of air services is based on the economy class airfare to Australia or New Zealand. The reported average return airfare to either Australia or New Zealand was more or less the same, costing USD1,883 for travel to Australia and USD1,848 for travel to New Zealand. Travel from RMI and FSM to Australia or New Zealand is the most expensive (given the distance) while travel from Samoa, Tonga and Tuvalu were much cheaper (see Figure 33).

Figure 33. Average Return Economy Class Air Fare to Australia and New Zealand (USD) by Country of Origin, 2011



Source: PIPIs 2011 Report. Note: Data not available for Fiji, Nauru and PNG.

Data is not available on cost as a percentage of GDP.

2.4.1.5 Safety

Aviation safety in the PICs is determined by the number of aviation incidents per annum and the ICAO safety audit indicator.

The list of aviation incidents in the 14 PICs is presented in Table 10. There were two aviation incidents in PNG, one in 2011 and the other in 2013. In the 2011 incident there were 28 fatalities, while in the 2013 incident there were no fatalities. There were no recorded incidents elsewhere.

Table 10. List of Aviation Incidents in PICs, 2011-2015

Serial Number	Date of Incidents	Aircraft	Description	Fatalities
1	13/10/2011	Dash 8	**Airlines of PNG** P2-MCJ (MSN 125) Near Madang, PNG	28
2	19/10/2013	ATR 42/72	**Air Niugini** P2-PXY (MSN 087) Madang, PNG	0

Source: Airfleet.net; Accessed Oct 2015.

The ICAO reports safety audit indicator is a measure related to implementation of safety oversight systems, taking account of the following issues: aerodromes, air navigation services, accident investigation, airworthiness, operations, licensing, organisation and legislation. In the 2014 ICAO Safety Report, only one PIC appeared in the list of countries across the world that rate above the global average of 62% - that was Fiji[45]. However, in the 2015 Safety Report, none of the PICs are listed[46].

2.4.2 Maritime

Maritime transport is crucial for economic development in the Pacific region, given how dispersed the countries are geographically and the distance between many of them and their key markets. Despite its importance, the volume of trade is relatively low, imports exceed exports, and there are issues with vessel safety in the domestic setting with corresponding concerns about the level of maintenance being undertaken. The main trading partners are Australia and New Zealand (in the south) and the United States and Asian seaboards (in the north). Some transhipment hubs exist (e.g. in Fiji) where cargo is received and then on-shipped to other smaller countries outside major shipping routes; those hubs continue improving the infrastructure at their ports in response to this opportunity. However, the domestic situation in many countries continues to need development. Inbound cargo tends to be delivered to major ports and is then transported further by domestic vessels or road transport, but the supply chains are fairly inefficient with goods being offloaded, stored, then loaded onto other vessels or vehicles – both reducing the efficiencies achieved through containerisation and adding to the cost for business and consumers.

Interisland ferry, Samoa – supplied by the Government of Japan (J. Overbeek)

45 International Civil Aviation Organization. (2014). Safety Report. http://www.icao.int/safety/documents/icao_2014%20safety%20report_final_02042014_web.pdf. pp.6-7, Montréal, Canada. Access Date: 4 November 2015.

46 International Civil Aviation Organization. (2015). Safety Report. http://www.icao.int/safety/Documents/ICAO_Safety_Report_2015_Web.pdf. pp.6-7, Montréal, Canada. Access Date: 6 November 2015.

Another key issue in the domestic context is ferry safety – both for the transfer of passengers and cargo. There have been some major ferry incidents over the last 10 years, resulting from poor maintenance, lack of a safety culture at sea, inadequate safety and communications equipment, and a weak regulatory environment in some countries. In many cases, operators cannot adequately maintain vessels or finance their replacement because domestic passenger shipping is not profitable enough, due to low demand, the long distances being travelled and low levels of cargo.

Like other sectors, maritime performance was measured on the dimensions of access, quality, efficiency, affordability and safety. However, there is little data available and no data was located for indicators related to quality, efficiency, affordability and safety.

Construction of Betio Port on South Tarawa, Kiribati - funded by JICA (O. Whalley)

2.4.2.1 Access

Maritime access is measured by the number of international ports and number of international container services per month.

Number of International Ports

There are 31 international ports in the PICs. The highest number of international ports are in PNG (five ports) and the Solomon Islands (four ports), followed by Fiji, Kiribati, RMI, Tonga, and Vanuatu with three international ports each. The remaining seven PICs have one international port each (Table 11).

Table 11. Number of International Shipping Ports by Country, 2014

PICs	No. of International Ports
Cook Islands	1
FSM	1
Fiji	3
Kiribati	3
Nauru	1
Niue	1
Palau	1
PNG	5
RMI	3
Samoa	1
Solomon Islands	4
Tonga	3
Tuvalu	1
Vanuatu	3
Total	31
Mean	**2.2**
Median	**2**

Source: CIA World FactBook, (web database); Accessed: Sept 2014.

Number of International Container Ships

Port of Pohnpei, FSM (A. Sammons)

The JICA and World Bank 2015 studies on *Supporting Safe, Efficient and Sustainable Maritime Transport Systems*[47] provide a range of data on maritime safety and efficiency in eight Pacific countries – FSM, Kiribati, Palau, RMI, Samoa, Tonga, Tuvalu and Vanuatu. Although it does not cover all the PICs and it includes more than container ships, the data represents the most up-to-date available information. The JICA study refers to the number of international cargo vessels per year, with 2013 data showing that FSM receives 197 international cargo vessels each year (72 to Chuuk, 30 to Kosrae, 52 to Pohnpei and 43 to Yap); Palau receives 72 cargo vessels per year[48]; and RMI receives 112 cargo vessels per year. The World Bank study collates the data in terms of international commercial vessels per year including cargo ships and tanker vessels (as single ship visits by different ships) with Kiribati receiving 51 vessels per year, Samoa receiving 101 vessels per year, Tonga receiving 148 vessels per year; Tuvalu receiving 20 vessels per year, and Vanuatu receiving 295 vessels per year[49]. The data is not broken down to monthly totals.

2.4.2.2 Quality

No performance indicators were defined for the category of Quality.

2.4.2.3 Efficiency

Reconstruction and upgrade of Lapetasi Wharf at Port Vila, Vanuatu with funding from DFAT (feasibility study) and JICA (construction works), Vanuatu Project Management Unit

Average vessel turnover time and delay time waiting to enter ports were the performance indicators selected for measuring the efficiency of maritime transport.

The available data on efficiency is from the 2015 JICA and World Bank studies[50]. It does not include data on delay time waiting to enter ports and it does not report vessel turnover times in terms of days. Instead, the reports contain data on an efficiency rate in terms of the number of containers handled per hour on average. This data shows that FSM handles an average of 10 container movements per hour (varying between four in Yap and 10 in Pohnpei), Fiji handles 20 containers per hour, Kiribati handles four containers per hour, Palau handles 10 containers per hour, RMI handles 10 containers per hour, Samoa handles 12 containers per hour, Tonga handles 14 per hour, and Tuvalu handles four containers per hour. The World Bank report also shows that this is well below the efficiency of ports outside the region, for example, Jamaica where 32 container moves are achieved on average per hour, Mauritius where the figure is 25, and Singapore where it is 73 moves per hour.

47 Japan International Cooperation Agency. (August 2015). Supporting safe, efficient and sustainable maritime transport systems in North Pacific Countries. Tokyo, Japan (to be published); The World Bank, East Asia and Pacific. (June 2015). Pacific Islands: Supporting safe, efficient and sustainable maritime transport systems. Washington DC. Accessed via the PRIF website: http://theprif.ellenet.net/index.php/resources/document-library/124-world-bank-maritime-safety on 6 November 2015.
48 JICA, op cit, p.178.
49 The World Bank, East Asia and Pacific, op cit, pp.33, 47, 59, 72 and 85.
50 JICA, op cit, p, 179; The World Bank, East Asia and Pacific, op cit, p.28.

2.4.2.4 Affordability

There are a number of issues in regard to data on port charges. Firstly, port tariff documents were only available only for seven PICs. In addition, there are numerous charging items in each country that are not comparable as they differ in charge headings[51] and the unit of measurement used as the basis of calculating fees (e.g. combinations of number, volume and weight for goods transported). Therefore, comparisons must be made with caution. Table 12 provides some summary information about port charges (though not in terms of actual costs).

Table 12. Maritime Sector - Summary of Port Charges by Country, 2014

PICs	Port Charges Based Number	Port Charges Based Volume	Port Charges Based Weight
Cook Islands	Yes	Yes	Yes
FSM			
Fiji			
Kiribati	Yes	Yes	Yes
Nauru	Yes	Yes	Yes
Niue			
Palau			
PNG			
RMI	Yes	Yes	Yes
Samoa	Yes	Yes	Yes
Solomon Islands			
Tonga	Yes	Yes	Yes
Tuvalu			
Vanuatu	Yes	Yes	Yes

Source: SPC - EDD Database; Accessed: Sept 2014.

A comparison of port charges in Kiribati and Samoa is in Appendix E to illustrate the difficult with trying to make direct comparisons between them.

2.4.2.5 Safety

The number of maritime incidents is the indicator used for reporting safety in the PICs.

There have been three significant incidents in recent years – the sinking of an inter-island ferry in Kiribati in July 2009 with 33 fatalities; the sinking of the MV Princess Ashika in Tonga in August 2009 in which there were 74 recorded fatalities[52]; and the sinking of an inter-island passenger ferry in Vanuatu in July 2014, with four fatalities[53].

2.4.3 Roads

The domestic road network is critical for both economic and social development – particularly in terms of access to markets, health and educational facilities. Most PICs have one or two main urban centres with a number of rural settlements, sometimes located on different islands. This highlights the need for an integrated transport system as well ongoing investment in the separate components/sub-sectors. Road traffic volumes and accidents are not major issues but the condition of roads and the level of investment in maintenance can jeopardise trading opportunities.

Access, quality, efficiency and safety are the categories of measurement for the road sub-sector indicators. The data was all derived from the SPC-EDD database.

51 Port Charge Headings may be different for imports and exports by type of commodities (e.g. petroleum and non-petroleum).
52 https://en.wikipedia.org/wiki/List_of_maritime_disasters_in_the_21st_century.
53 http://www.radionz.co.nz/international/pacific-news/249822/more-details-of-vanuatu-ferry-sinking-emerge.

2.4.3.1 Access

Access to roads is measured in terms of total road network, number of motor vehicles registered and road density. The road network is further divided to two sub-indicators: paved and unpaved roads. Road density is defined as number of kilometres of road per 100 square kilometres.

Funafuti Road, Tuvalu (J. Overbeek)

Road Networks

In 2011, there was a total of 21,862 kilometres of roads in the PICs, out of which only 33% (7,311 kms) was paved and the rest (67%, 14,551 kms) was unpaved (see Table 13).

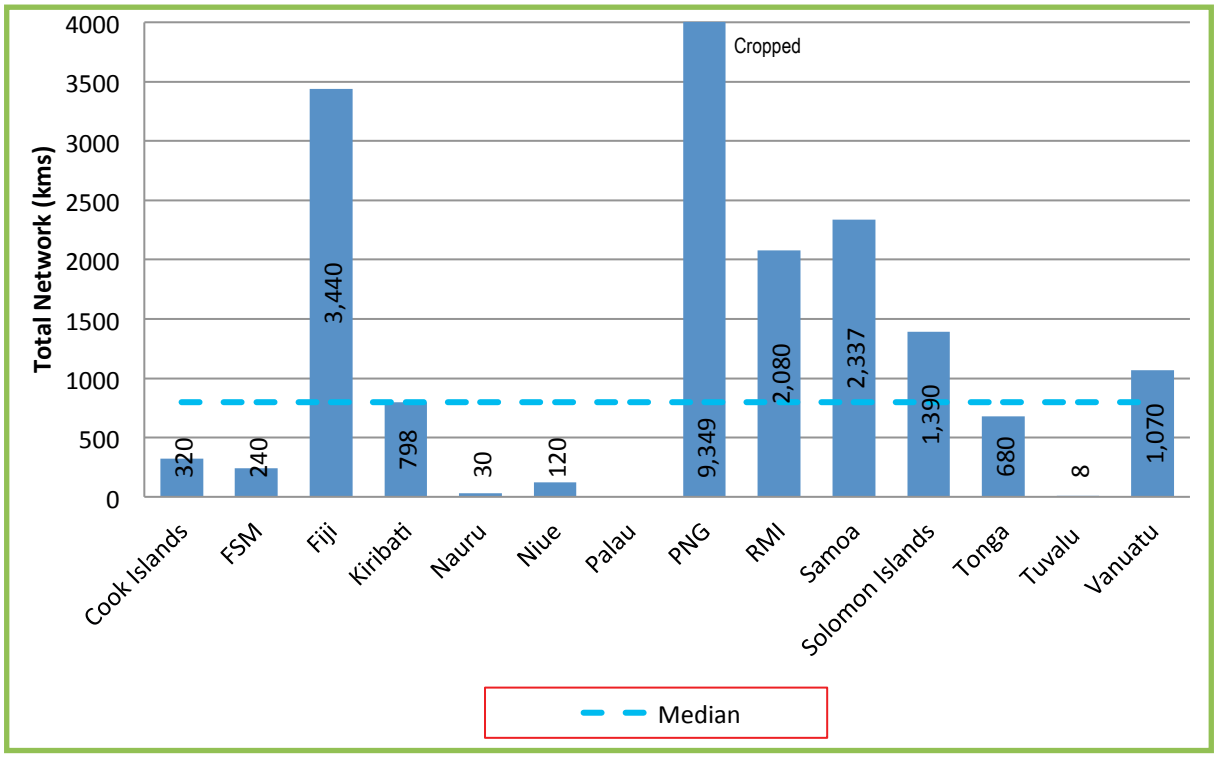
Table 13. Paved and Unpaved Roads by Length of Road, 2011

Road Type	Length of Road
Paved Roads	7,311kms
Unpaved Roads	14,551kms
Total	**21,862kms**

Note: Road Statistics were not available for Palau. Source: SPC Database; Accessed: Sept 2014.

Of the total existing kilometres of roads in the 13 PICs for which data was available, 43% (9,349 kms) were in PNG; 16% (3,440kms) were in Fiji; 11% (2,337 kms) were in Samoa; 9% (2,080 kms) were in RMI; and 6% (1,390 kms) were in the Solomon Islands (see Figure 34). Tuvalu and Nauru had the shortest length of road, at eight kilometres and 30 kilometres respectively[54]. In this Figure, only the median is shown because of the very significant range in the figures.

Figure 34. Total Road Network (in Kilometres) by Country



Source: SPC Database; Accessed Sept 2014. Note: Most of the data in this table is from before 2005 except for Niue (2009), PNG (2011) and RMI (2007), with no data available for Palau. The data is likely to be out-of-date in most of the countries. Whether the percentages are still reflective of the overall situation would need verification through a more recent data set.

54 Not visible in graph.

Of the total 7,311 kilometres of paved roads, 60% was in PNG (4,394 kms) and 23% (1,686 kms) was in Fiji (see Table 14). All other PICs had no more than 5% of the total paved roads (with no data available for Palau).

Table 14. Percentage Distribution of Paved and Unpaved Roads by Country

Country	Road Length (kms)			% Across PICs			% Within PIC		
	Paved	Unpaved	Total	Paved	Unpaved	Total	Paved	Unpaved	Total
Cook Islands	33	287	320	0%	2%	1%	10%	90%	100%
FSM	42	198	240	1%	1%	1%	18%	83%	100%
Fiji	1,686	1,754	3,440	23%	12%	16%	49%	51%	100%
Kiribati	133	665	798	2%	5%	4%	17%	83%	100%
Nauru	24	6	30	0%	0%	0%	80%	20%	100%
Niue	120	0	120	2%	0%	1%	100%	0%	100%
Palau	-	-	-	-	-	-	-	-	-
PNG	4,394	4,955	9,349	60%	34%	43%	47%	53%	100%
RMI	75	2,005	2,080	1%	14%	10%	4%	96%	100%
Samoa	332	2,005	2,337	5%	14%	11%	14%	86%	100%
Solomon Islands	24	1,366	1,390	0%	9%	6%	2%	98%	100%
Tonga	184	496	680	3%	3%	3%	27%	73%	100%
Tuvalu	8	0	8	0%	0%	0%	100%	0%	100%
Vanuatu	256	814	1,070	4%	6%	5%	24%	76%	100%
Total/Overall	**7,311**	**14,551**	**21,862**	**100%**	**100%**	**100%**	**33%**	**67%**	**100%**

Source: SPC Database; Accessed Sept 2014.

Notes:

(1) Given the total amount of road across the PICs, some countries show as 0% even though they do have some paved/unpaved road.

(2) Most of the data in this table is from before 2005 except for Niue (2009), PNG (2011) and RMI (2007). The data is therefore likely to be out-of-date in most of the countries. As an example, 2015 figures from Vanuatu show the total amount of road as 2,233kms with about 5% paved[55]. In addition, the totals for RMI seem disproportionately large. Both these cases suggest that further primary data collection would be useful.

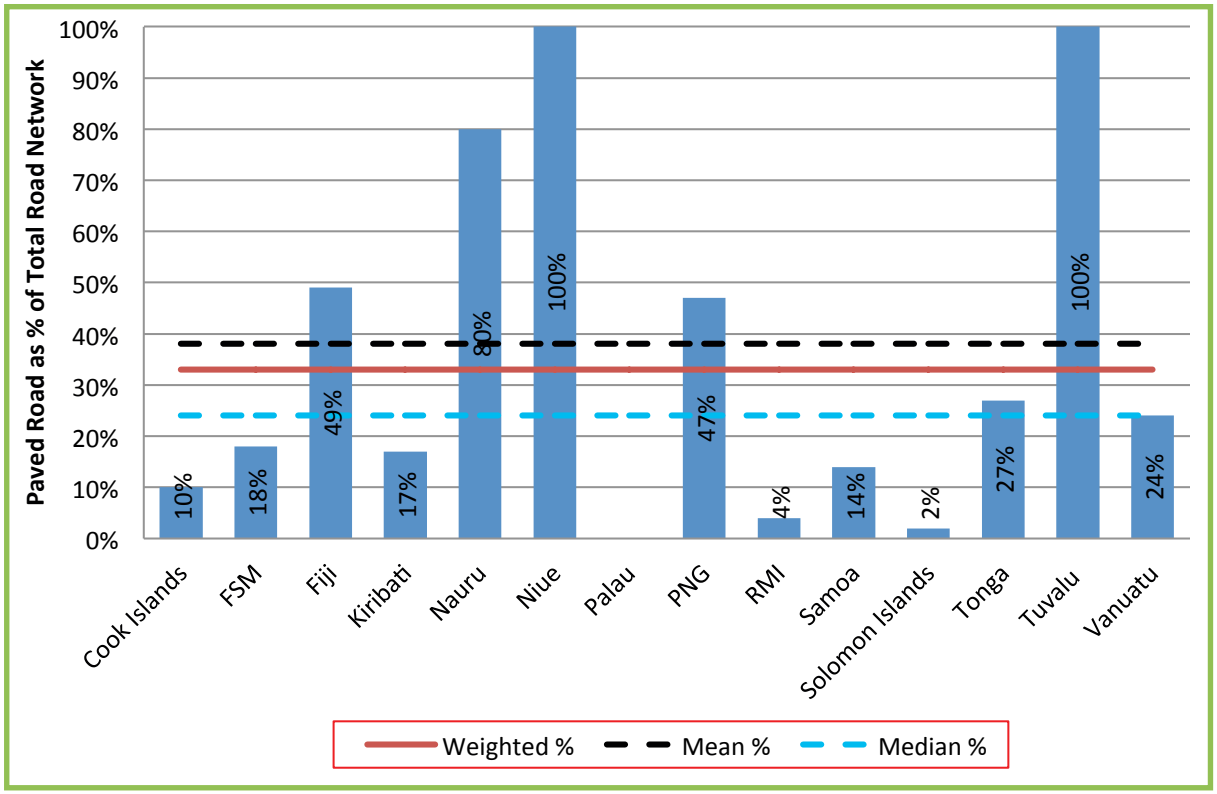
(3) Data not available for Palau.

Niue and Tuvalu had 100% paved roads and Nauru had 80% paved roads (see Figure 35). They are also the countries with the least roads in total. Even so, there is no pattern across the region in terms of the relationship between the level of paving and the total amount of roads. PNG and Fiji have the most kilometres of roads and also the highest percentage of paved roads (60% and 23% respectively), whereas RMI and the Solomon Islands both have a relatively high number of kilometres of roads but a low percentage of the paved roads across the region (i.e. 1% and 0% respectively).

Photo: Suva, Fiji (C. McMahon)

55 Government of Vanuatu. (May 2015). Vanuatu: Draft post-disaster needs assessment – Tropical Cyclone Pam, March 2015, p.64. Provided by World Bank, 11th December 2015.

Figure 35. Paved Road Network as a Percentage of Total Network by Country, 2011

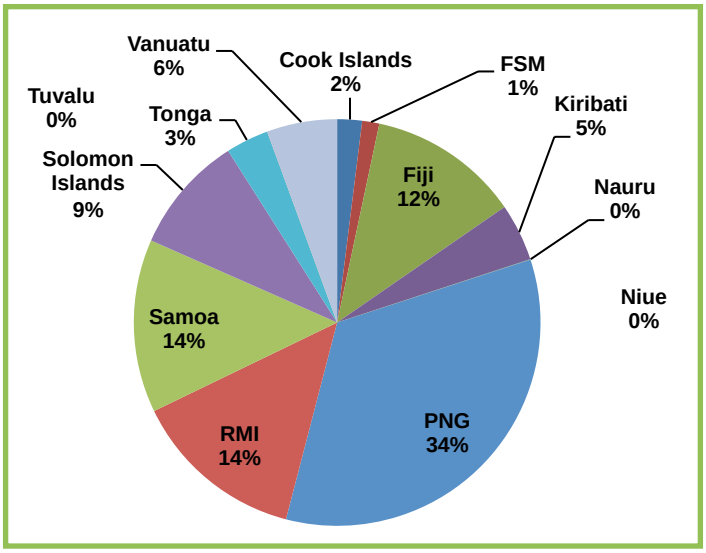


Source: SPC Database, Accessed August 2014. Data not available for Palau.

The available data shows there was as much as 14,551 kilometres of unpaved roads in 11 PICs. As Figure 36 shows, in addition to having the most paved roads, PNG also had the highest percentage of unpaved roads (34% or 4,955 kms) followed by Samoa (14% or 2,005 kms), RMI (14% or 1,953 kms) and Fiji (12% or 1754 kms). (see Figure 36).

Rural bridge near Nadi, Fiji (J. Reichert)

Figure 36. Distribution of Unpaved Roads by Country, 2011

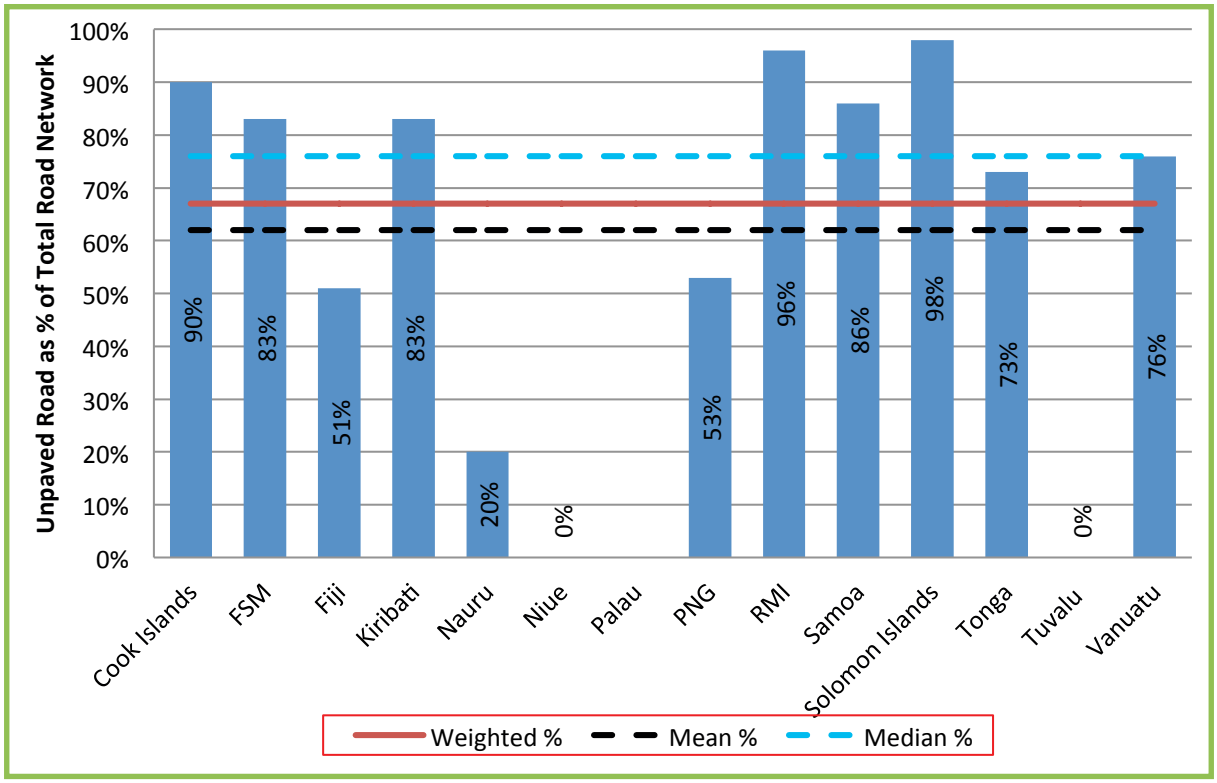


Source: SPC Database; Accessed Sept 2014.

Rural highway, PNG. Approx. 53% of the roads in the country are unpaved. (J. Reichert)

As Figure 37 shows, the PICs that have 90% or more unpaved roads were the Solomon Islands (98%), RMI (96%) and the Cook Islands (90%). As indicated above, Niue, Tuvalu and Niue have no or very little unpaved roads. The weighted percentage of unpaved roads was 67%, with a mean of 62% and a median of 76%. However, given the range of data, these figures should only be used with caution.

Figure 37. Unpaved Road Network as Percentage of Total Network by Country, 2011



Source: SPC Database, Accessed August 2014. Data not available for Palau.

Motor Vehicle Registrations

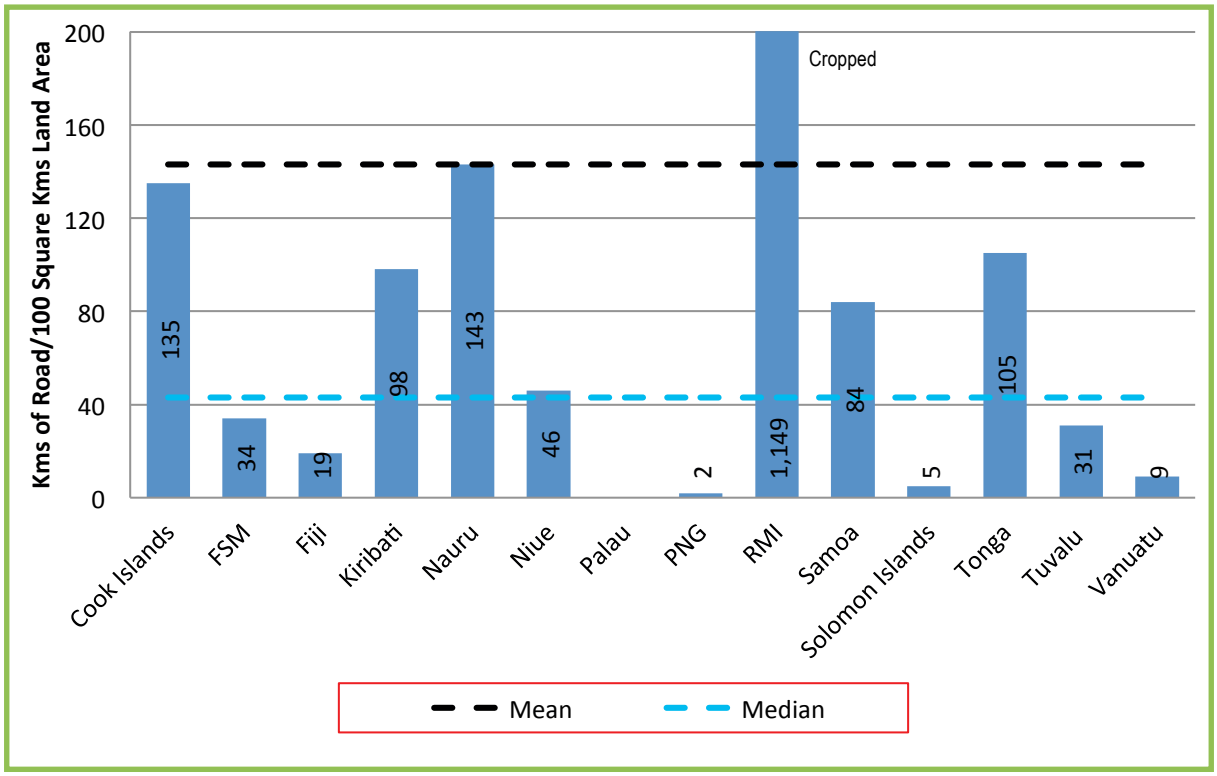
Data is not available at this stage for this indicator.

Road Density

Road density is a measure of road length in relation to the land area. It is expressed as length of road in kilometres per 100 square kilometres of land. As Figure 38 indicates, the mean and median were 143 kilometres per 100 square kilometres of land and 43 kilometres per 100 square kilometres of land respectively. This indicates a very significant spread in the figures. Any countries with a very low road density would generally have a large land area or a lot of inaccessible land (e.g. PNG, Solomon Islands and Vanuatu).

The data shows RMI having the highest road density at 1,149 kilometres per 100 square kilometres of land (though this figure seems abnormally high), followed by Nauru (143 kms per 100 kms²) and the Cook Islands (135 kms per 100 kms²). The largest two PICs (PNG and the Solomon Islands) covering 87.3% and 5.7% of the total land area have the least road density at two kilometres and five kilometres per 100 square kilometres of land respectively.

Figure 38. Road Density by Country, 2011



Source: SPC Database; Accessed Sept 2014. Note: Data not available for Palau.

2.4.3.2 Quality

Condition of roads depends on regular repair and maintenance. Information on condition of roads and whether they receive regular maintenance was not available. The amount of paved roads may give some indication (as a proxy) about quality of roads, though it is not definitive and a well-maintained unpaved road may be in better condition than a paved but poorly-maintained road.

Even so, out of the existing 21,862 kilometres of road in PICs, the reported proportion of paved road was only 33%, a rough guide to quality of road probably not being high. Unfortunately, information about when roads were paved and the standard of paving was not available and paved roads can degrade over years to convert back to being unpaved if they are not adequately maintained[56].

2.4.3.3 Efficiency and Safety

Data is not available for the indicators on efficiency and safety. Both are important indicators, with road efficiency being related mainly to regular repair and maintenance of roads while road safety refers to the number of road incidents per annum.

56 Discussion on the implications and costs of not maintaining infrastructure adequately can be found in the report on *Infrastructure Maintenance in the Pacific: Challenging the Build-Neglect-Rebuild Paradigm*, 2013, Pacific Infrastructure Advisory Centre.

2.5 Water and Sanitation

Key Findings:

- *Across the PICs 97% of the population in urban areas have access to an improved water source; in rural areas it varies from 33% in PNG and 50% in Kiribati up to 100% in the Cook Islands.*
- *Niue and Palau provide access to improved sanitation for 100% of urban and rural populations and another five countries provide access to improved sanitation for 80% or more of both urban and rural populations (i.e. Cook Islands, Fiji, Samoa, Tonga and Tuvalu); on the other hand, there are also disparities (e.g. in the Solomon Islands, 81% of urban populations have access to improved sanitation, but only 15% of those in rural areas).*
- *All countries have some form of piped water supply for a proportion of the population, but it is available for less than three hours a day in some countries.*
- *Within the utility service areas, metered water connections vary between 0% and 100% and non-revenue water ranges between 11.1% and 100%.*
- *Two PICs among those with the lowest levels of non-revenue water from piped networks are Tonga and Vanuatu, where the utilities show high performance in overall efficiency measures within their specific service areas.*

Access to improved water sources and sanitation plays a key role in achieving good health in both urban and rural communities, with consequences for economic and social development. This section of the PIPIs Report presents data on water and sanitation indicators – including measures of access, quality (of service), efficiency, affordability and financial sustainability, and safety (drinking water quality).

This report uses two sources of information: Figures 39 – 46 are from the Water Supply and Sanitation Joint Monitoring Program (JMP) of the Millennium Development Goals (MDGs) managed by UNICEF and WHO. The JMP uses a range of country provided data sources to provide internationally accepted and comparable statistics for national access to water supply and sanitation. Figures 47 – 54 are based on data from the Pacific Waste and Water Association (PWWA) 2013 Benchmarking report. This data is provided by the utilities and refers to their defined service areas. The two data sets are not usually comparable and the water service area is not necessarily the same as the sewerage service area.

2.5.1 Access to Improved Water

Access to Improved Water Sources

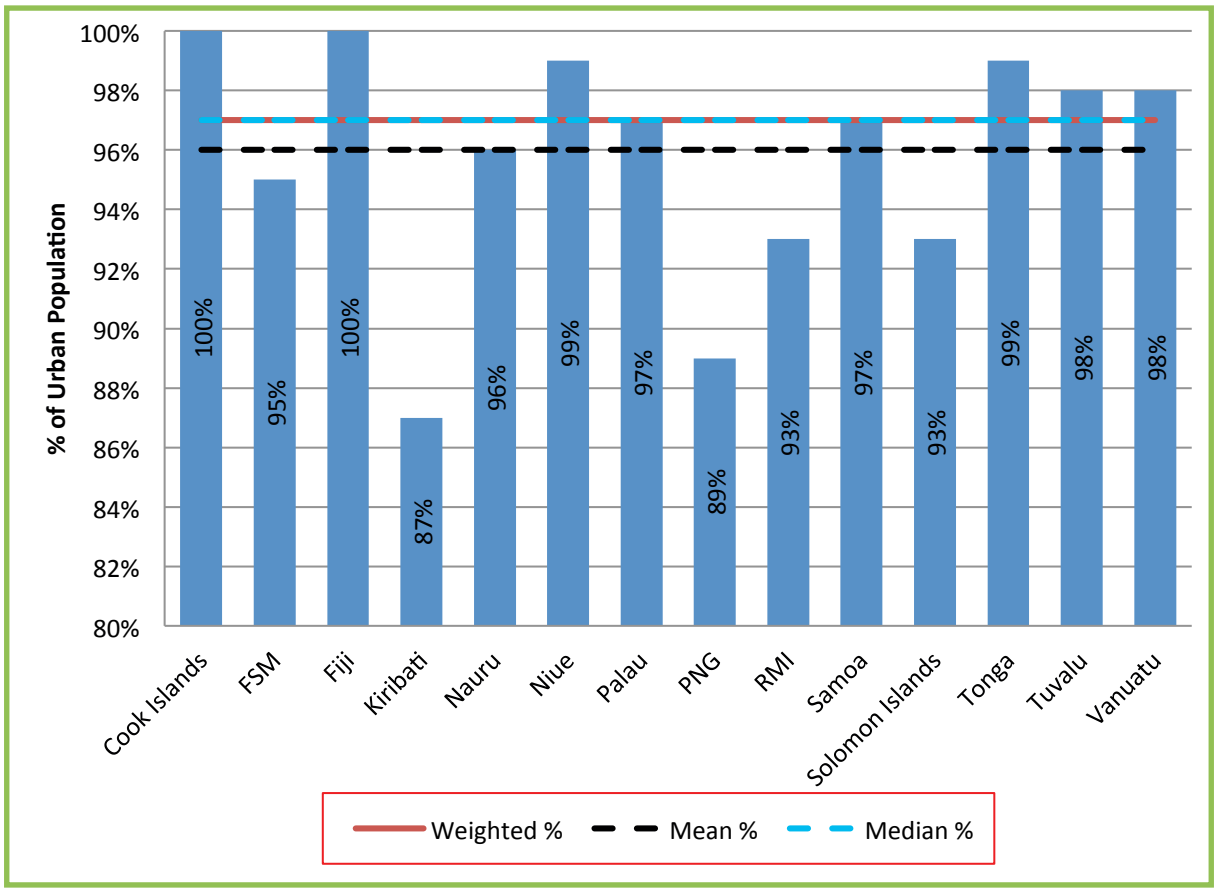
Access to improved water sources is measured as the proportion of population using an improved drinking-water source in urban and rural areas. An improved drinking-water source is defined as one that, "by nature of its construction or through active intervention, is protected from outside contamination, in particular from contamination with faecal matter", UNICEF /WHO[57]. Data used to measure the access to improved water sources was obtained from UNICEF EAPRO_Water_Snapshot_2013_Update_18_11_2013.

57 1251452757-A_Snapshot_of_Drinking_Water_in_SEA_Pacific_Final, Page 1. http://www.unicef.org/eapro/EAPRO_Water_Snapshot_2013_Update_18_11_2013.pdf.

Access to Improved Water Sources in Urban Areas

Across the PICs, in urban areas, a weighted average of 97% of the population has access to an improved water source, with a mean of 96% and median of 97% (see Figure 39). This is a very pleasing result and only two countries (Kiribati at 87% and PNG at 89%) were below 90%. Both the Cook Islands and Fiji were at 100%, with another seven countries at 95% or above i.e. Niue (99%), Tonga (99%), Tuvalu (98%), Vanuatu (98%), Samoa (97%), Nauru (96%) and FSM (95%).

Figure 39. Access to Improved Urban Water Sources as Percentage of Urban Population by Country, 2013



Source: WHO/ UNICEF "A Snapshot of Drinking Water and Sanitation in South-eastern Asia and the Pacific". EAPRO_Water_Snapshot_2013_Update_18_11_2013. http://www.wssinfo.org/; Accessed Sept 2014.

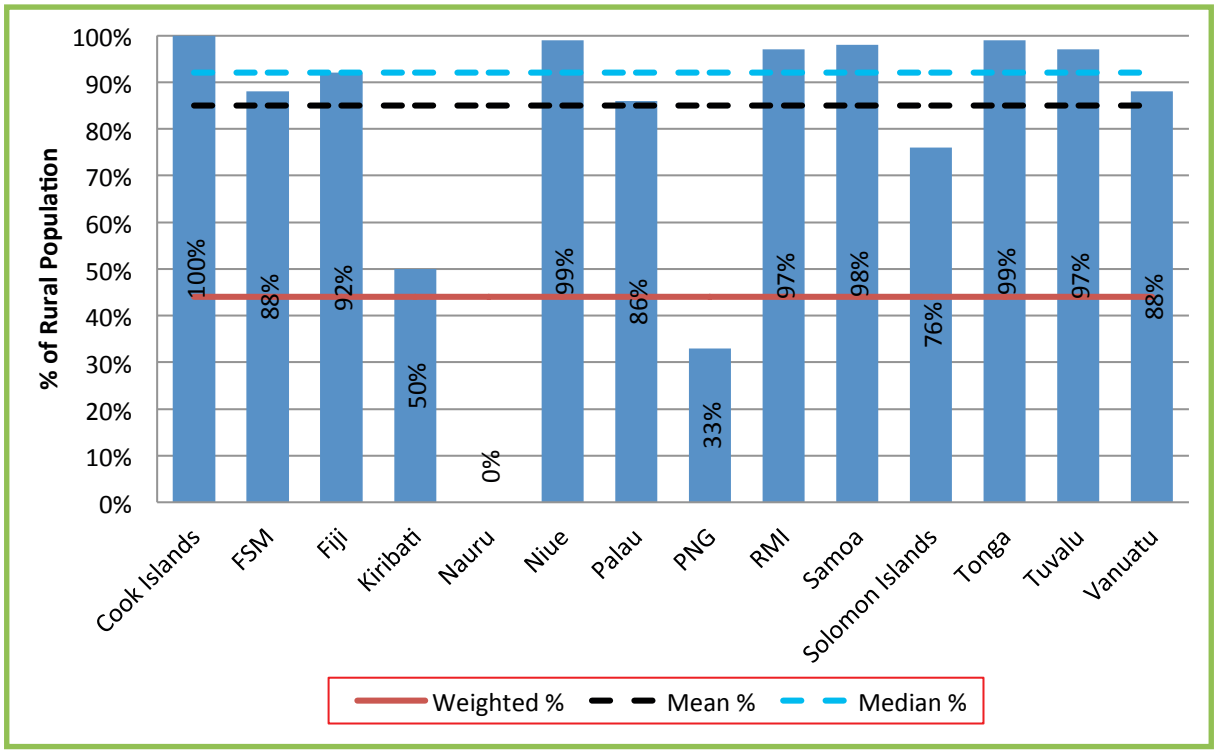
Access to Improved Water Sources in Rural Areas

In half of the countries, 90% or more of the rural population has access to an improved water source (see Figure 40) and in 10 out of 14 countries, 85% or more of the rural population have access to an improved water source[58]. This reflects significant progress over the years by both governments and development partners.

The weighted figure across the region is only 44% and, given it results largely from the situation in PNG (33%), it is a figure to be used with caution. More important is that the mean and median are much higher than the weighted percentage, indicating that many of the smaller PICs have higher coverage of improved water sources than the bigger countries. This reflects not only the size of some of the countries, but the terrain which makes improvements to water supply challenging. Coverage in the Solomon Islands and Kiribati is also low at 76% and 50% respectively.

Women walk long distances to fill containers with water, Port Moresby, PNG (P. Dutton)

Figure 40. Access to Improved Rural Water Sources as Percentage of Rural Population by Country, 2013



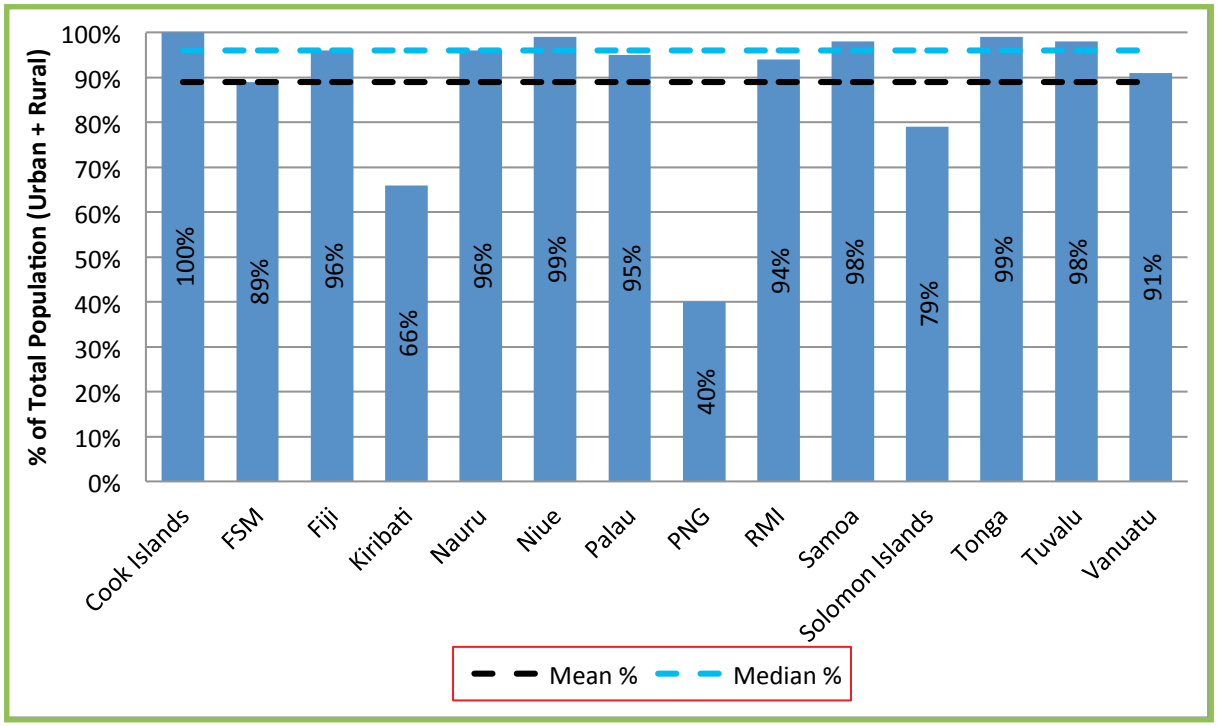
Source: EAPRO_Water_Snapshot_2013_Update_18_11_2013.

58 This does not include Nauru which does not have a rural population.

Overall Access to Improved Water

The overall situation (both urban and rural) of access to an improved water source in PICs is fairly good, given 90% or more of the population have access to an improved water source in 10 out of 14 of the countries (see Figure 41). The Cook Islands, Niue, Samoa, Tonga and Tuvalu have the best service levels with either 99% or 100% of the population having access to improved water. PNG (40%), Kiribati (66%) and the Solomon Islands (79%) need ongoing attention to achieve good water supply across the country.

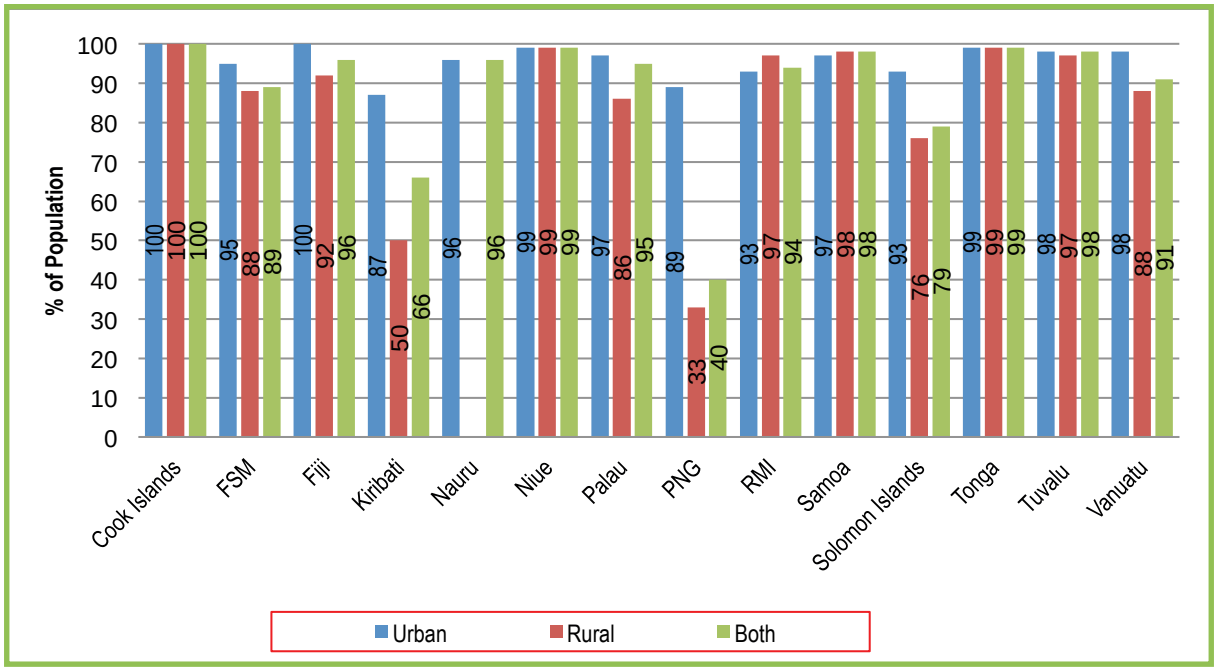
Figure 41. Access to Improved Overall (Urban and Rural) Water Sources as Percentage of Total Population by Country, 2013



Source: EAPRO_Water_Snapshot_2013_Update_18_11_2013.

Figure 42 summarises this information for urban and rural areas, as well as the overall situation in each country. What this highlights again is that, while some countries have equal access in both urban and rural communities (or close to it), in others there is a significant disparity. This information can assist in planning for investments within a particular country.

Figure 42. Access to Improved Water Sources among Urban and Rural Population by Country, 2013



Source: EAPRO_Water_Snapshot_2013_Update_18_11_2013.
Note: Nauru has only one figure given its demographics.

Change in the Access to Improved Water – PIPIs 2011 and 2015

Comparison of the data in the PIPIs 2011 and PIPIs 2015 reveals some interesting points. In regard to improved water in rural areas the indicator and source of data have changed. In the 2011 report, the indicator was access to improved rural water source *as a percentage of the total population, while it is now a percentage of the rural population*. The consequence of this is notable for five countries. For the Cook Islands, the percentage was 87% in the PIPIs Report 2011 and is now 100%; it was 65% for the Solomon Islands and is now 76%; it was 79% in Vanuatu and is now 88%; while in FSM the figure has dropped from 92% to 88%; and in Palau it has dropped from 95% to 86%[59].

There is also show some changes in results that are not in the positive direction. However, it is mostly by a factor of one or two percent and therefore likely to reflect adjustments for accuracy of data. A longer period of comparative data collection is expected to correct this. As examples, both Niue and Tonga dropped the recorded level of access to an improved water source in urban areas from 100% to 99%. The data for access to an improved water source in rural areas in Palau has been adjusted downwards by 9%, so that warrants checking again in the future as it is not likely to reflect a 'real' drop in service levels.

Photo: Water harvesting, Kiribati (W. Paterson)

59 PIPIs Report 2011, p.43.

2.5.2 Access to Improved Sanitation

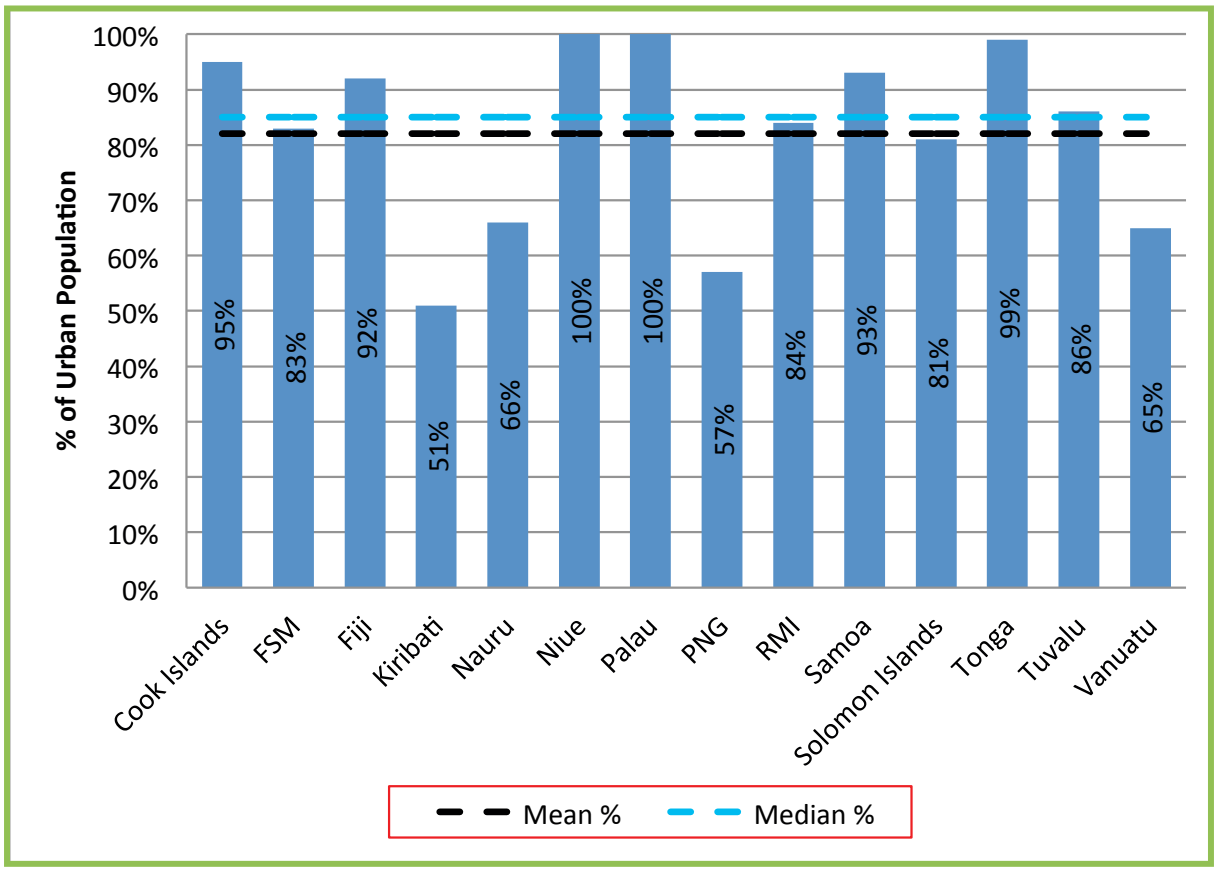
Access to improved sanitation is measured as the proportion of population using improved sanitation facilities in urban and rural areas. An improved sanitation facility is defined as "one that hygienically separates human excreta from human contact"[60]. Data used to measure the access to improved sanitation facilities were sourced from WHO/ UNICEF EAPRO_Sanitation_Snapshot_2013_Update_19_11_2013.

As was the case with the figures for access to improved water sources, the change in the indicator from the PIPIs Report 2011 renders comparison difficult. In the 2011 Report, the figures are expressed as a *percentage of the total population* while in the current report, the figures for access to improved urban sanitation are expressed as a *percentage of the total urban population* and the figures for the access to improved rural sanitation are expressed as a *percentage of the total rural population*.

Access to Improved Sanitation in Urban Areas

Provision of sanitation services lags behind provision of improved water sources in urban areas as a whole across the region (see Figure 43). There are only four countries where 95% or more of the urban population have access to improved sanitation – Niue (100%), Palau (100%), Tonga (99%) and the Cook Islands (95%). At the other end of the spectrum is Kiribati (51%), PNG (57%), Nauru (66%) and Vanuatu (65%). Consequently, the mean is 83% and the median is 85%. There does not appear to be a sub-regional pattern.

Figure 43. Access to Improved Urban Sanitation Sources as Percentage of Urban Population by Country, 2013



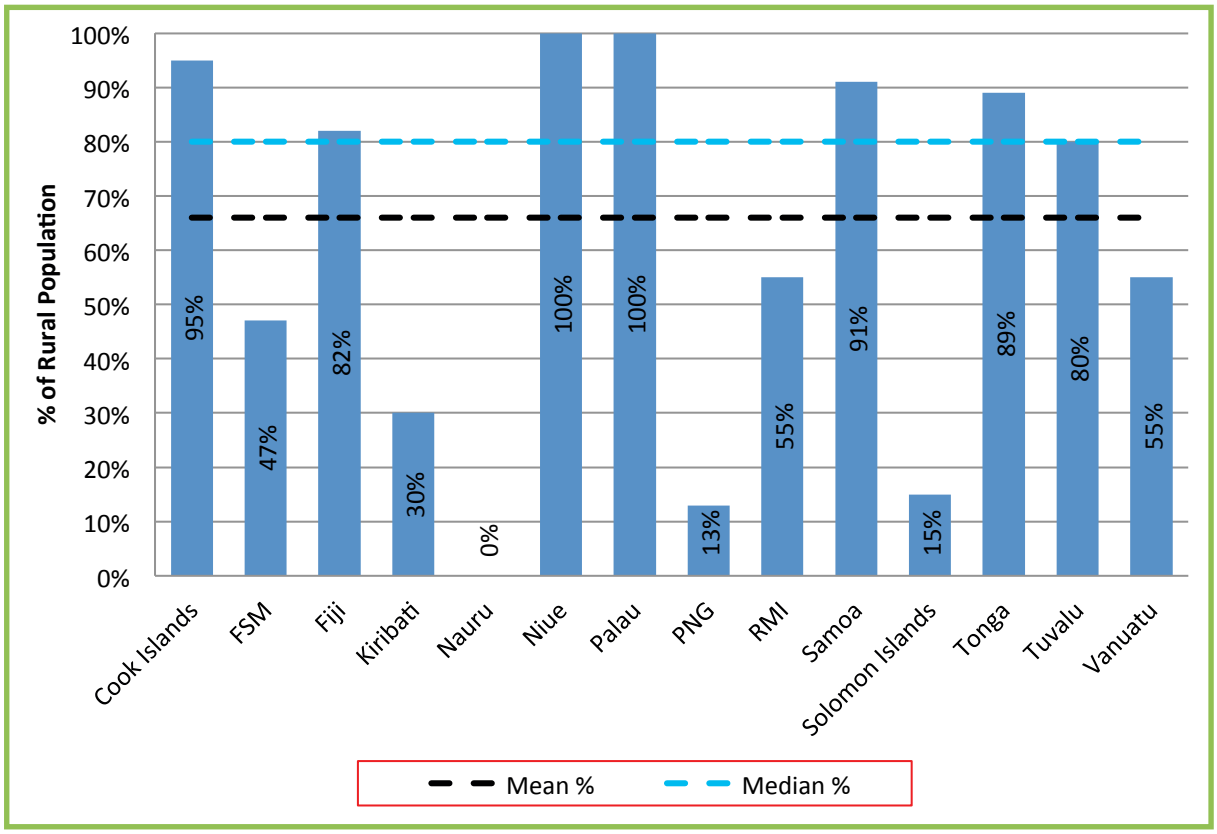
Source: EAPRO_Sanitation_Snapshot_2013_Update_19_11_2013.

60 UNICEF/WHO, 1251452757-A_Snapshot_of_Drinking_Water_in_SEA_Pacific_Final, page 2.

Access to Improved Sanitation in Rural Areas

There are only three countries where 95% or more of the rural population have access to improved sanitation – Niue with 100%, Palau with 100%, and the Cook Islands with 95% (see Figure 44). At the other end of the spectrum lies PNG (13%), Solomon Islands (15%), Kiribati (30%) and FSM (47%).

Figure 44. Access to Improved Rural Sanitation Sources as Percentage of Rural Population by Country, 2013

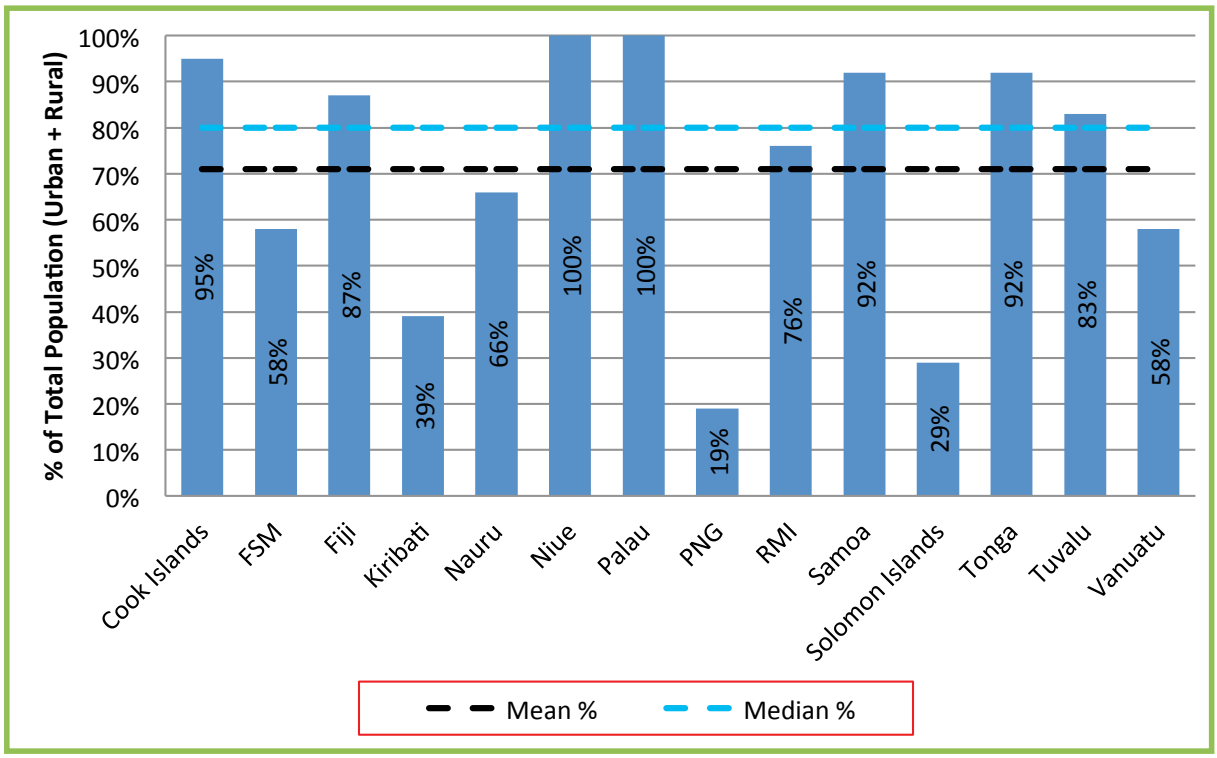


Source: EAPRO_Sanitation_Snapshot_2013_Update_19_11_2013.

Overall Access to Improved Sanitation

Given the data presented above, it is not surprising that although the overall mean and median for access to improved sanitation in the PICs was 71% and 80% of the population respectively, the range shows significant differences between countries (see Figure 45). While Niue and Palau show 100% coverage for improved sanitation in both urban and rural areas and the Cook Islands, Samoa and Tonga all have over 90% coverage, other countries are well behind this. Most notable are PNG (19%), the Solomon Islands (29%), Kiribati (39%), FSM (58%) and Vanuatu (58%).

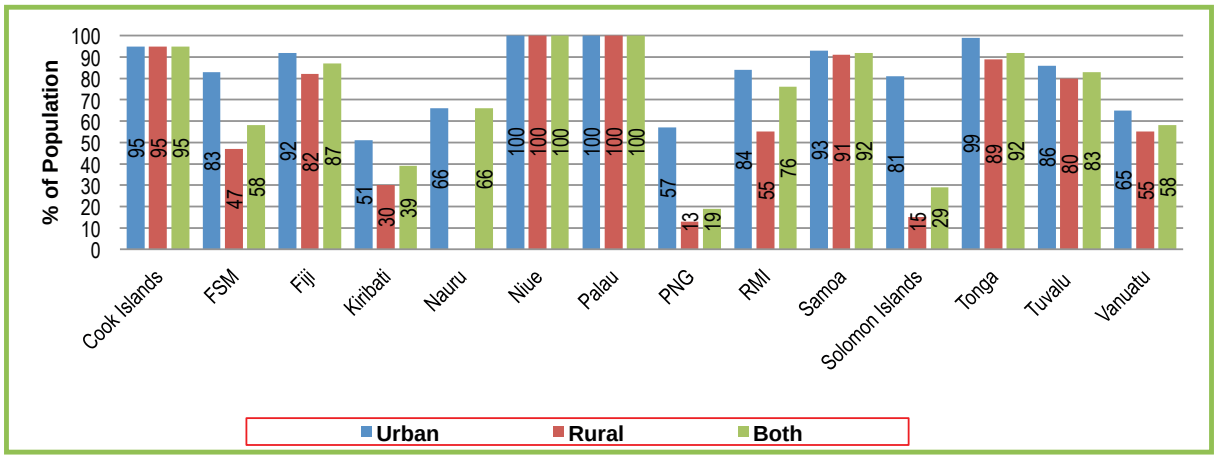
Figure 45. Access to Improved Sanitation Sources as Percentage of Total Population by Country, 2013



Source: EAPRO_Sanitation_Snapshot_2013_Update_19_11_2013.

Figure 46 shows this same data for urban and rural areas separately and then each country as a whole. This highlights the difference in service levels for communities living in urban and rural areas. A number of countries show disparity levels of 10% or less including the Cook Islands (no disparity), Niue (no disparity), Palau (no disparity), Samoa (2% difference), Tuvalu (6% difference), Fiji (10% difference), Tonga (10% difference) and Vanuatu (10% difference). However, significant to very significant differences exist in favour of urban areas in Kiribati (21% difference), RMI (29% difference), FSM (36% difference), PNG (44% difference) and the Solomon Islands (66% difference). As mentioned in respect to the corresponding table for access to improved water, this information may support investment decisions in the sector.

Figure 46. Access to Improved Sanitation among Urban and Rural Population by Country, 2013



Source: EAPRO_Sanitation_Snapshot_2013_Update_19_11_2013.
Note: Nauru has only one figure given its demographics.

2.5.3 Quality of Water Sources

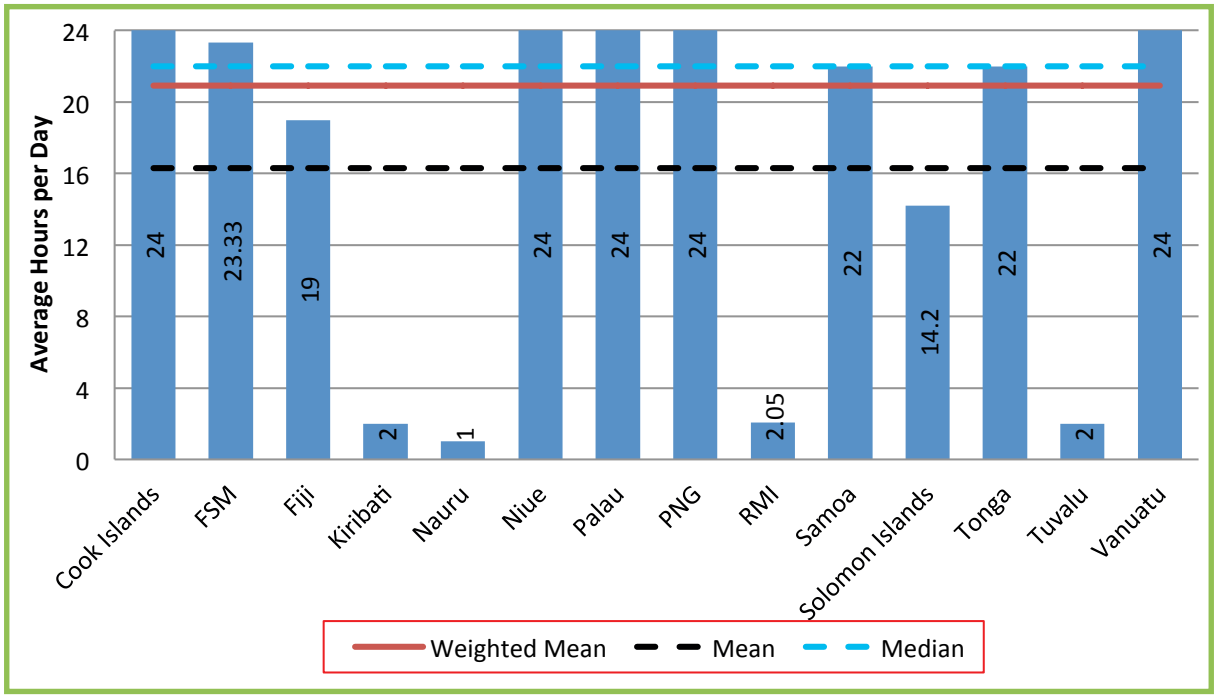
Quality of service delivery is measured in terms of water availability in the piped water supply system (i.e. hours per day) and the percentage of metered connections. The data for this was sourced from the *PWWA Benchmarking Report 2013*, where data is reported by utility. To generate country level data, the individual utility data was aggregated and weighted by population or connections (where necessary). However, it should be noted that in most PICs utilities service the urban population only and not the full urban area in most countries.

Availability of Water Supply in Piped Water Supply System

All of the countries have some form of piped water supply (see Figure 47). Eight countries have 22 – 24 hours water supply in the piped water supply system (i.e. Cook Islands, FSM, Niue, Palau, PNG, Samoa, Tonga and Vanuatu). Importantly, this does not mean that everyone in those countries, or even in the urban areas, necessarily has 22 – 24 hours water supply. It means that water is available for 22 – 24 hours for at least some of the population, reflecting ongoing improvements in providing water to populations in the region. As the Figure shows, continuity of water supply in the piped network is least in Nauru (one hour per day) followed by Tuvalu and Kiribati (two hours per day each) and RMI (just over two hours per day). In the case of Nauru and Tuvalu, the utilities are small and have limited reticulation assets. Water is desalinated, stored, and tankered to customers with the figures for piped water supply most likely representing the periods of water production.

The weighted mean, simple mean and median are 21 hours, 16 hours and 22 hours respectively. The weighted mean hours are higher than the simple average which is generally a statistical indication that water supply is available more hours in bigger PICs than in relatively smaller ones. However, given that in a number of the larger countries (such as PNG and Vanuatu), there is no access to piped water in most rural areas and for a significant part of the urban population), extreme care is needed in using this data and it must be checked against field realities. The median is closer to the weighted mean than the simple mean, implying that the weighted mean also lies almost in the middle of the spread of figures across the 14 PICs[61].

Figure 47. Availability of Water Supply in Piped Water Supply System within Utility Water Service Areas (Average Hours per Day), 2013



Source: PWWA Benchmarking Report 2013.

61 The data used is for the service areas of the (urban) water utilities. The median shown for the 14 PICs is therefore not same as the median for the urban or total population; it is merely a statistical middle point in the data.

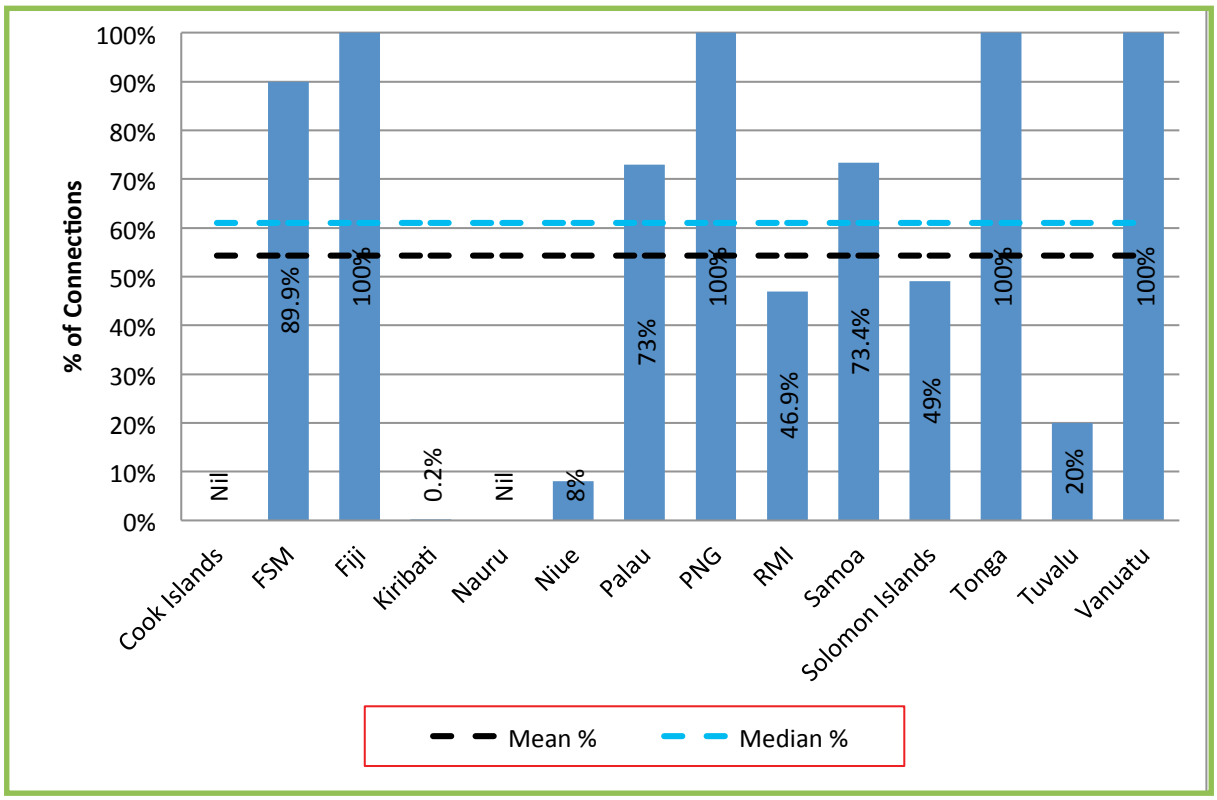
Comparison of these figures to those in the PIPIs Report 2011 shows that FSM has increased the average number of hours of availability from 16 hours per day to 23.3 hours, while both Samoa and Tonga have dropped from 24 hours to 22 hours[62]. However, some caution is needed with this comparison given the sources of data are different.

Metered Connections

Metering of water supply connections varies from none to 100% in the utility water service areas in the PICs (see Figure 48). The Cook Islands and Nauru have no metered water connections, while four PICs with larger populations (Fiji, PNG, Tonga and Vanuatu) have all connections metered within their designated service areas. Metering of water connections in the utility water service areas in remaining PICs is as follows: FSM (89.9%), Samoa (73.4%), Palau (73.0%), Solomon Islands (49.0%), RMI (46.9%), Tuvalu (20.0%), Niue (8.0%), and Kiribati (0.2%).

The reported weighted mean, simple mean and median are 92.2%, 54.3%, and 61.0% respectively. The weighted mean stood much higher compared to the simple mean and median as four PICs (Fiji, PNG, Tonga and Vanuatu) with larger population sizes have 100% water supply connections metered.

Figure 48. Percentage of Metered Connections within Utility Service Areas, 2013



Source: PWWA Benchmarking Report 2013.

Comparison of these figures with those reported in the PIPIs Report 2011 shows that FSM has increased the level of metered connections from 70% to 89.9% and Samoa has increased from 50% to 73.4%[63]. However, some caution is needed with this comparison given the sources of data are different.

62 PIPIs Report 2011, p.45.
63 PIPIs Report 2011, p.45.

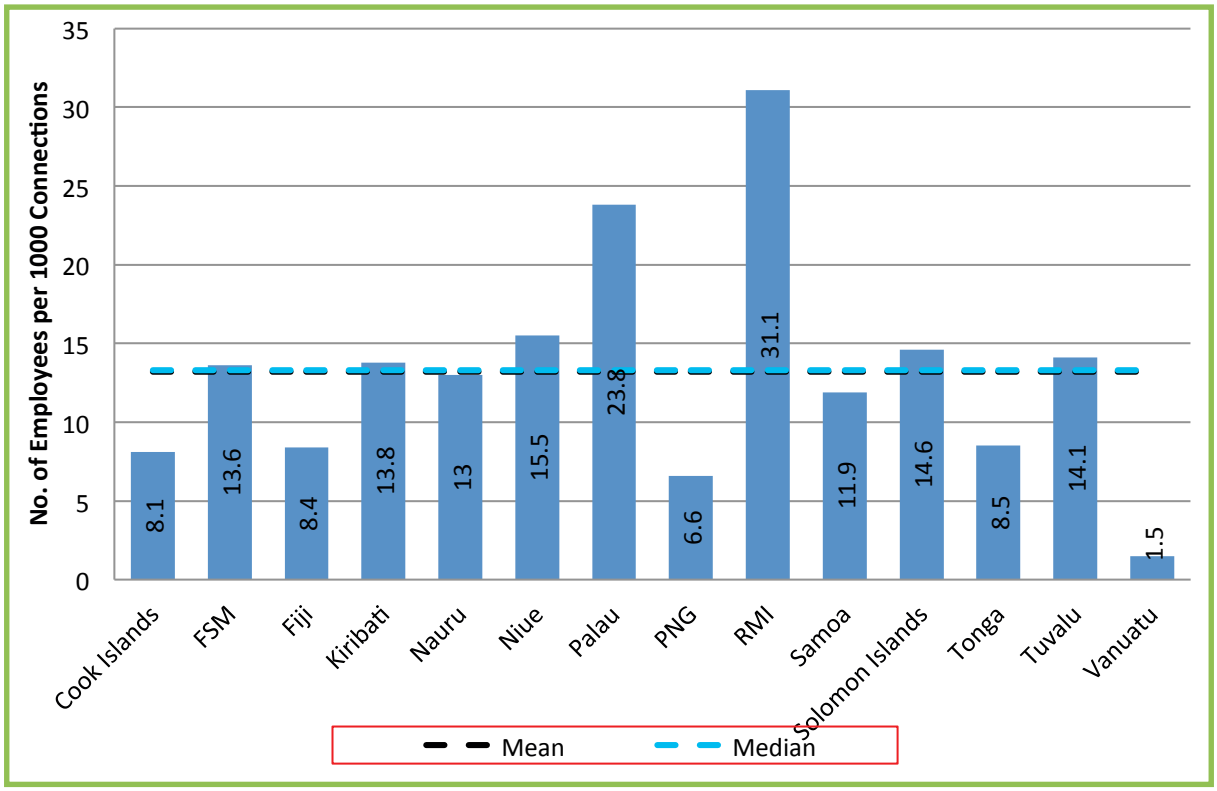
2.5.4 Efficiency of Piped Water Supply System

The PIPIs 2015 measures only the efficiency of piped water supply system, as information on the efficiency of tanker supplied water and improved sanitation is not available. Efficiency of the piped water supply system is measured on the basis of number of employees per 1000 connections and the percentage of non-revenue water (defined as the difference between water produced and water sold within the defined service areas for the utilities). The data is sourced from the *PWWA Benchmarking Report 2013*.

The number of employees per 1000 connections is available for all 14 PICs. In the PWWA Benchmark Report for 2013, the Pacific benchmark was set at 8 full-time equivalent (FTE) employees per 1000 connections. A higher or lower number than this benchmark means high or low efficiency (respectively), and can be affected by many variables (e.g. whether the utility provides both water and sewerage, whether it outsources some of its services, and whether it is privately or publicly owned).

The number of water and sewerage[64] business FTE employees per 1000 connections varied from 1.5 persons to 31.1 persons across the PICs, reflecting a significant difference in professional staffing support (see Figure 49). Only two countries were below the benchmark – Vanuatu with 1.5 FTE employees per 1000 connections and PNG with 6.6 FTE employees per 100 connections. Those countries with the highest number of FTE employees per 1000 connections are RMI (31.1 employees), Palau (23.8 employees), Niue (15.5 employees), Solomon Islands (14.6 employees) and Tuvalu (14.1 employees). Interestingly, most of the utilities at the lower end of the numbers are generally among the higher performing utilities in terms of overall efficiency e.g. Cook Islands, Fiji, Samoa and Tonga[65].

Figure 49. Number of Water and Sewerage Employees per 1000 Connections within Utility Service Areas, 2013



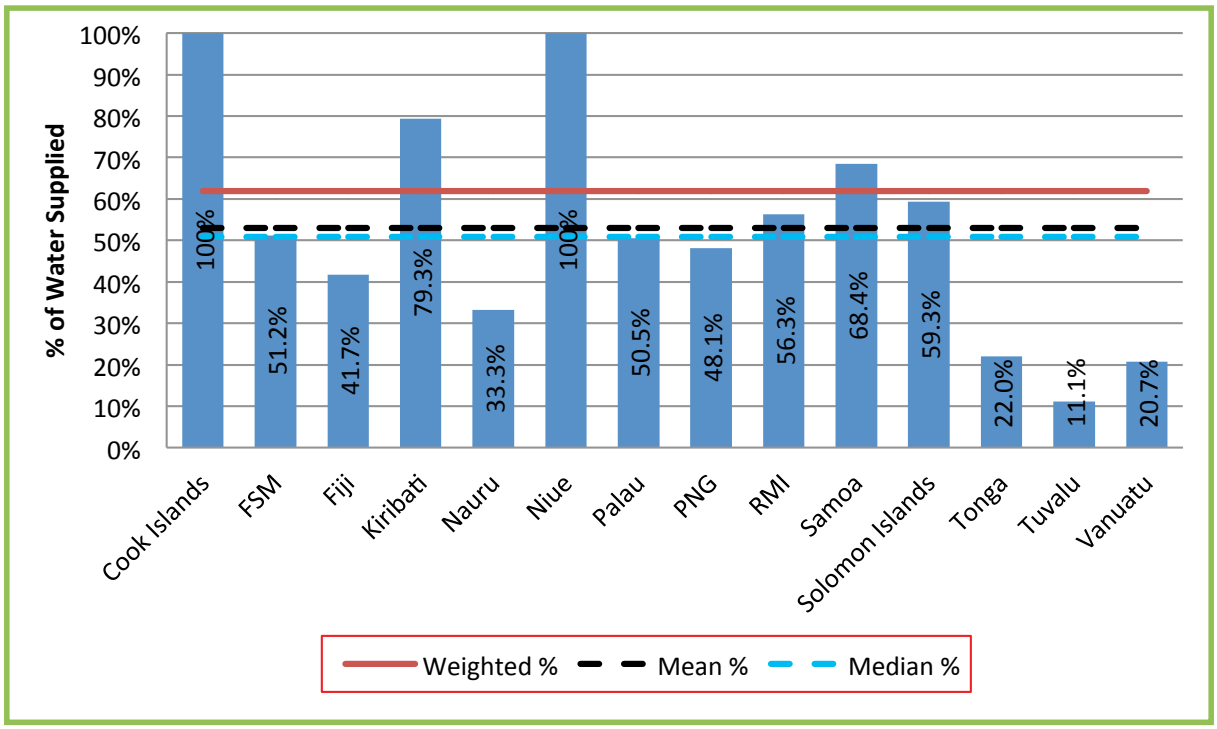
Source: PWWA Benchmarking Report 2013, Tables 3.2, 4.2 and 5.2.

64 The number of employees per water 1000 water connections is not available. PWWA benchmarking reported water and sewerage FTE per 1000 connections.
65 As measured by an overall efficiency indicator in the benchmarking exercises.

Utilities in all 14 PICs reported non-revenue water in their designated service areas, ranging between 11.1% and 100%. The Cook Islands and Niue have 100% non-revenue as they do not currently have a water tariff. Among the 12 PICs that have a water tariff, the percentage of non-revenue water is highest in Kiribati (79.3%) followed by Samoa (68.4%), Solomon Islands (59.3%) and RMI (56.3%). The three PICs with lowest non-revenue water from piped networks are Tuvalu (11.1%), Vanuatu (20.7%) and Tonga (22.0%).

The calculated weighted mean, mean and median percentage of non-revenue water are 61.9%, 53.0% and 50.8% respectively (see Figure 50).

Figure 50. Percentage of Non-Revenue Water within Utility Service Areas, 2013



Source: PWWA Benchmarking Report 2013.

2.5.5 Financial Sustainability and Affordability

The performance indicators for financial sustainability and affordability are:

- cost recovery (revenues from tariffs/operating cost as a %)
- average tariff (USD per m^3) for water and sewerage services, and
- no. of qualified personnel in water utilities (% of staff with a diploma/certificate that qualifies them for their position).

Cost Recovery Practices

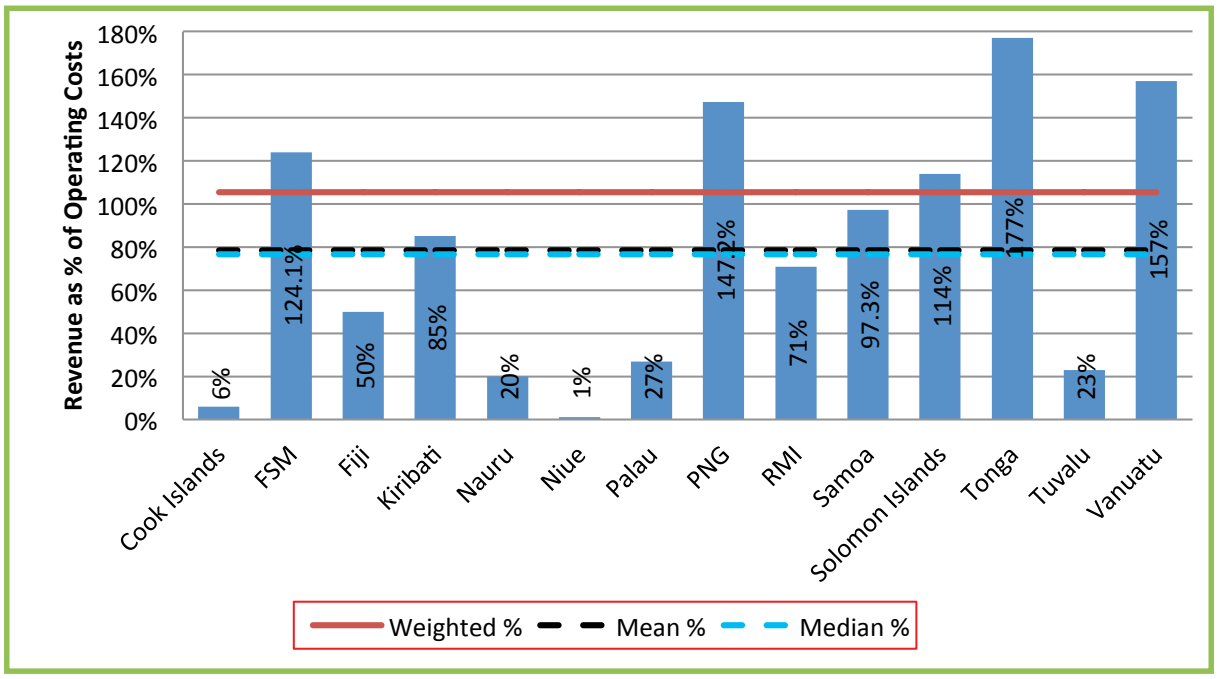
Cost recovery of water utilities varies from 1% to 177% in the PICs. Those countries where the utilities recover more than costs for water services are:

- Solomon Islands - recovered 14% on top of costs
- FSM - recovered 24.1% on top of costs
- PNG - recovered 47.2% on top of costs
- Vanuatu - recovered 57% on top of costs, and
- Tonga - recovered 77% on top of costs (Figure 51).

The least cost recovery occurred in Niue which recovered just 1% of the cost of providing the services followed by Cook Islands (6% cost recovery), Nauru (20% cost recovery), Tuvalu (23% cost recovery), and Palau (27% cost recovery). In the other countries, cost recovery was 50% or above. However, practices vary and there is a reluctance in many countries to charge for the true cost of water supply, with a number of utilities relying on government subsidies (e.g. the Water Authority of Fiji and the Samoa Water Authority) or cross-subsidies from power operations where a utility supplies both power and water (e.g. the Public Utilities Board in Kiribati).

The overall weighted mean, simple mean and median in the PICs is 105.4%, 78.5% and 78.0% respectively showing that the bigger countries have been able to generate revenue through an improved water supply system.

Figure 51. Cost Recovery in Water Sub-Sector - Revenue as % of Total Operating Cost Excluding Depreciation, 2013



Source: PWWA Benchmarking Report 2013.

Comparison of these figures to those in the PIPIs Report 2011 shows a very significant increase in Kiribati from 50% of costs being recovered to 85% of costs, while in Tonga the recovery on top of costs went from 25% to 77%[66]. However, caution is needed with this comparison given the sources of data are different, with 2011 PIPIs Report including both data from utilities and also from project reports.

Tariffs and Affordability

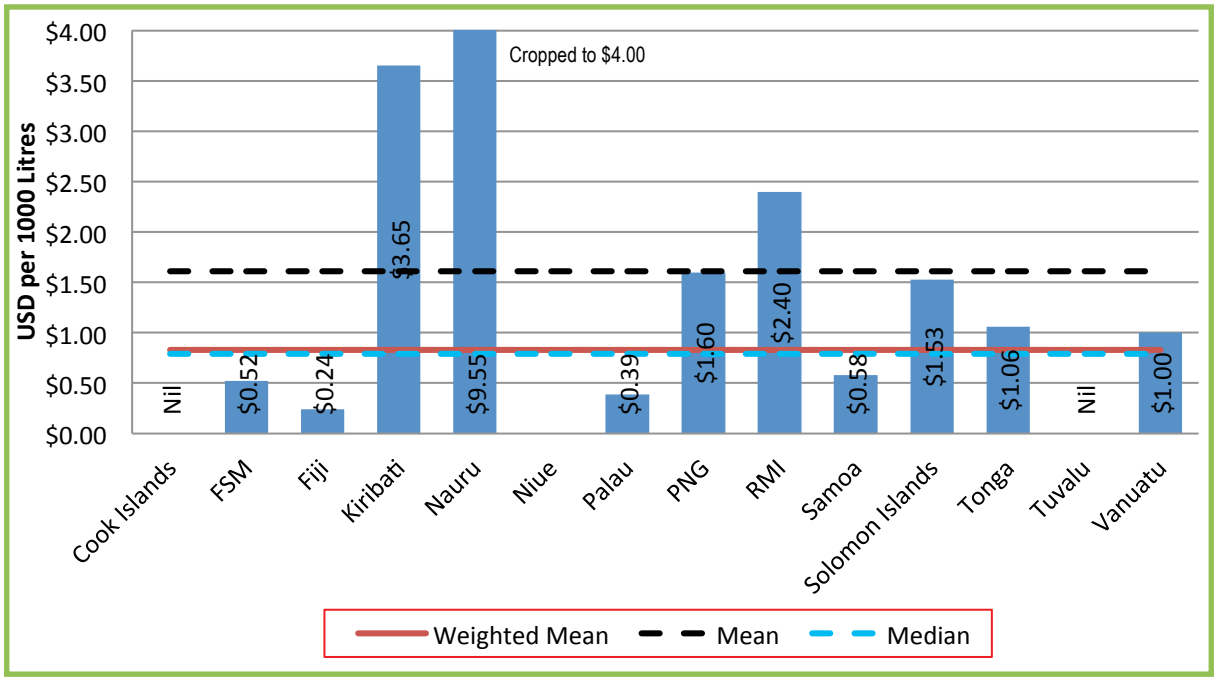
The situation with tariffs varies between countries (see Figure 52). In some countries there is no tariff, in some countries there is one tariff for both the water and sewerage service, and in others there may be a percentage levy on top of the water tariff to cover the service for sewerage. They are reported together here because they are not listed separately in the *PWWA Benchmarking Report*.

In the Cook Islands and Tuvalu, the water supplied in the piped water supply system is currently free. The average price of water supplied in the piped water supply system ranged from US24 cents per kilolitre in Fiji to USD3.65 per kilolitre in Kiribati and USD9.55 per kilolitre in Nauru. In the case of Kiribati the tariff reflects pricing for non-residential customers, while in Nauru the tariff results from the high cost of desalinated and tanker supplied water.

66 PIPIs Report 2011, p.47.

The weighted mean, numerical mean and numerical median are US8 cents, USD1.60, and US8 cents per kilolitre respectively. The countries with pricing above the mean are all in Micronesia, but there are also countries in Micronesia where the price is below the weighted mean, simple mean and the median. Hence, unit price of water is scattered and does not show any pattern.

Figure 52. Average Water Tariff in USD per Cubic Meter for Water and Sewerage Services, 2013



Source: PWWA Benchmarking Report 2013. Data not available for Niue.

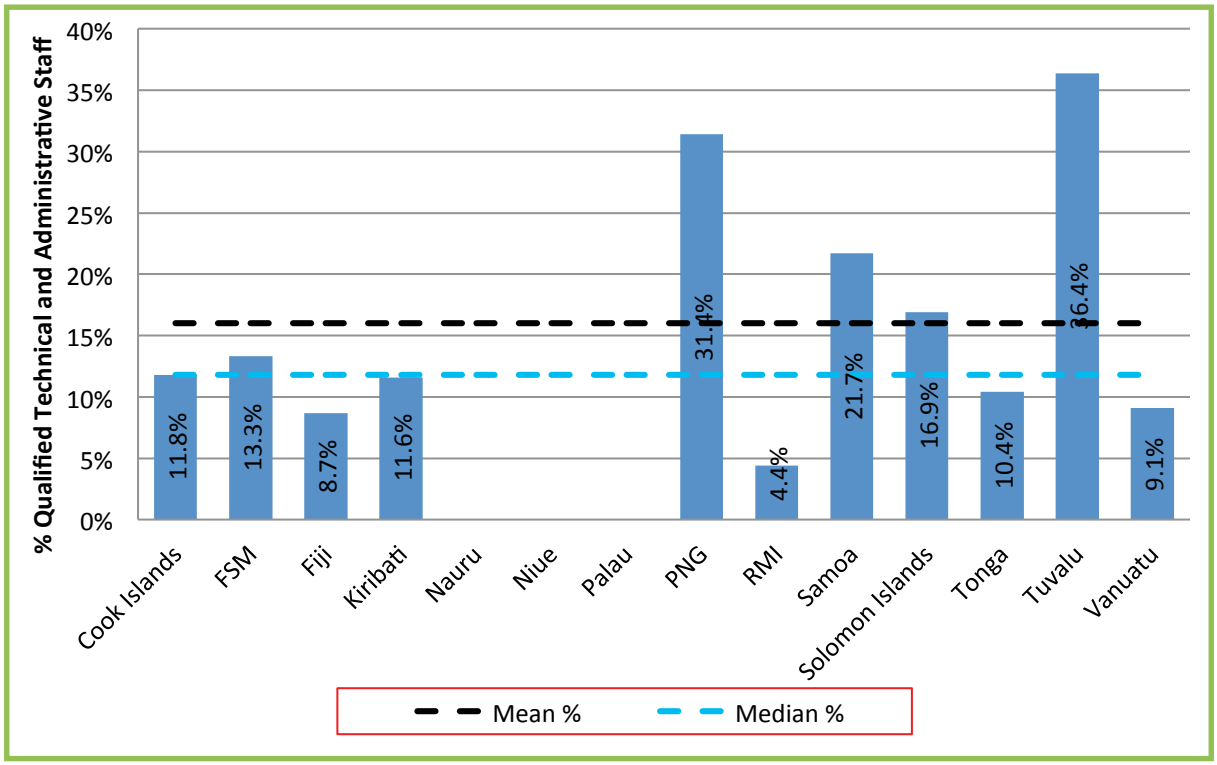
Affordability is measured in terms of an average household water bill as a percentage of Gross National Income (GNI) per person. The 2013 Benchmarking Report found the average for surveyed utilities to be 1.1% and the median to be 0.9%. However, given the lack of comparative figures internationally (i.e. some use data based on households income and expenditure and others use GNI), it is difficult to draw any conclusions at this stage about the Pacific. Concurrent with this study, PRIF is undertaking work on better understanding affordability and pricing strategies for water and sanitation.

Qualifications of Staff

Qualifications of staff are assessed in terms of both water and sewerage staff per thousand connections. It includes both technical and qualified administrative staff. According to the available data, the level of qualified staff is highest in Tuvalu with 36.4% qualified staff. Percentages in the other PICs are 31.4% in PNG, 21.7% in Samoa, 16.9% in the Solomon Islands, 13.3% in FSM, 11.8% in the Cook Islands, 11.6% in Kiribati, 10.4% in Tonga, 9.1% in Vanuatu, 8.7% in Fiji and 4.4% in RMI (see Figure 53).

The mean and median percentages of qualified staff across the utilities 16% and 11.8% respectively. The weighted percentage of qualified staff is much higher than the mean and median percentage indicating that the PICs with larger numbers of staff have higher percentages of qualified staff e.g. PNG reported 31.4% qualified staff out of 628 total water and sanitation utility staff.

Figure 53. Percentage of Qualified Water and Sewerage Business Staff, 2013



Source: PWWA Benchmarking Report 2013. Note: Data for this indicator reflects qualifications but not necessarily whether those people are working in roles requiring those qualifications. Data not available for Nauru, Niue and Palau.

2.5.6 Safety

The defined indicators for measuring the safety of improved water sources are *proportion of the population with access to drinking water sources that meet WHO guidelines* (microbiological compliance with drinking water quality standards) and incidence of water borne diseases (diarrhoea reported as no other data is available). However, the available data in regard to WHO guidelines is on percentage of drinking water that is treated to WHO standards. This is presented as an alternative.

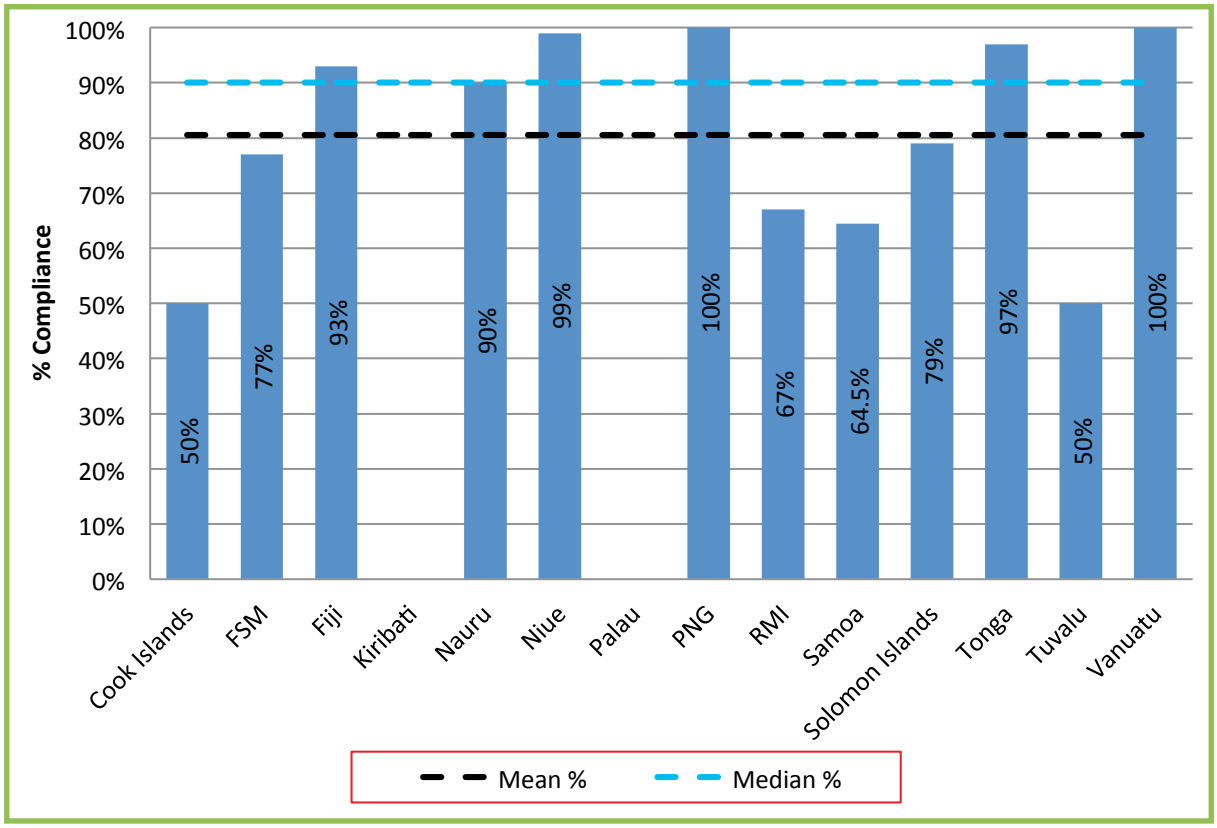
Microbiological Compliance with Drinking Water Quality Standards

Water quality from piped water supply systems in PICs is assessed on the basis of microbiological compliance with drinking water quality standards. Some countries have their own drinking water quality standards; however, most compliance standards across the Pacific region draw on the WHO Drinking Water Guidelines or the EPA rules in the Northern Pacific. The mean and median of compliance are observed at 80.5% and 90.0% percent respectively (see Figure 54). However, it should be noted that five countries fall below the mean and median so this data should be cited in terms of the range of compliance levels.

As the Figure shows, in PNG and Vanuatu the reported results indicate 100% compliance against microbiological standards. The reported compliance level is also high in Niue (99%) and Tonga (97%), while compliance in the other PICs varies between 50% (Cook Islands and Tuvalu) and 93% (Fiji). Data is not available for Kiribati and Palau.

Importantly, in its 2013 benchmarking report, the PWWA indicates that ideally monitoring of water quality should be tested across the network and not only at treatment plants (p.86). This is because water quality at treatment plants may be good but there could be contamination between the treatment plant and the point where the water is used. Hence, in using the data in this Figure, field realities in each country can be verified with the individual utilities or government health and environmental departments.

Figure 54. Microbiological Compliance with Drinking Water Quality Standards, 2013



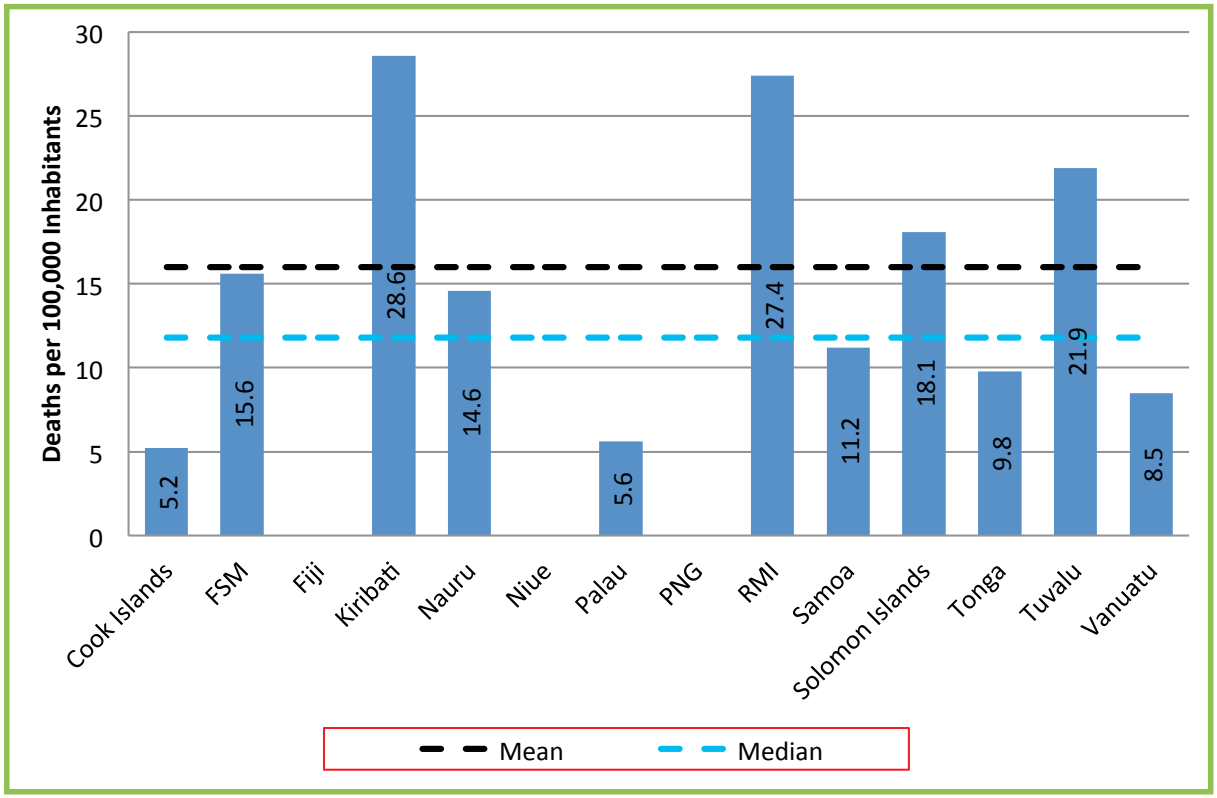
Source: PWWA Benchmarking Report 2013. Data not available for Kiribati and Palau.

Incidence of Diarrhoea

Data on deaths from diarrhoea per 100,000 inhabitants is also helpful in determining the safety level of drinking water sources. The mean percentage of diarrhoeal death per annum per 100,000 inhabitants was 15.1 and the median was 14.6.

As Figure 55 shows, diarrhoeal death was highest in Kiribati (28.6 per 100,000 inhabitants) followed by RMI (27.4 per 100,000 inhabitants), FSM (15.6 per 100,000 inhabitants) and Nauru (14.6 per 100,000 inhabitants). The diarrhoeal death was least in Cook Islands (5.2 per 100,000 inhabitants) and Palau (5.6 per 100,000 inhabitants). Where there are high rates of diarrhoeal deaths, it raises questions about access to clean water and sanitation as well as other environmental factors (e.g. high density living and solid waste management practices).

Figure 55. Incidence of Death from Diarrhoea per 100,000 Inhabitants, 2009



Source: SPC Database and UNICEF websites; Accessed Sept 2014. Note: Data not available for Fiji, Niue and PNG.

3. Conclusions

The PIPIs data collection brings together information from a range of secondary sources, providing a set of data that will be useful for PRIF agencies, governments, regional organisations and other groups. However, given issues associated with the data, it is difficult to draw definitive conclusions e.g. about the precise level of improvement in services and safety levels across the PICs, whether costs are reasonable, and how much progress is being made towards environmental sustainability. Consequently, there are limitations when using the data for policy guidance and decision-making.

Most of the data is drawn from websites, some of which have not been updated for some time (up to five years). Information is more readily available on access to services while data on quality, efficiency, affordability, sustainability, and safety are harder to obtain. Likewise, availability and veracity of data varies between the sectors. In the energy and WSS sectors, benchmarking has been undertaken for several years creating a comprehensive data set that has undergone an extensive verification process and can be reported as a time series for monitoring changes over time. The ICT sector is also well represented, as almost all the ICT operators have information on their websites about coverage, affordability, and efficiency, though there is a limitation in comparing between countries for some of the indicators given that the data for individual countries comes from different years. Solid waste and the transport sector are the most difficult for data collection, with either no recent data or a need to use multiple sources to construct the numbers. For both the energy and transport sectors, the establishment of regional data repositories at SPC is an important initiative.

This means that there are data gaps in both the PIPIs Report 2011 and 2015. Indeed, more than half of the PIPIs indicators are affected by this shortfall in the data (i.e. 46 indicators out of 82), either with no data available, no new data since 2011, or only partial data being available. This suggests that benchmarking fewer indicators across all sectors as a primary data collection could be a worthwhile exercise though relevant stakeholders (including the governments, regional organisations, utilities and development partners) would need to discuss this further. Comparison between data in the 2011 and 2015 Reports is complicated by lack of data and changes in the data sources between the years – though comparisons have been provided where they may be useful.

One of the key features of the PIPIs 2015 is the inclusion of weighted data to take account of large variations in data among countries with significantly different populations. However, as explained in the report, this needs to be used with caution and is only applied in some of the graphs and tables where it adds value to understanding the raw data. Another key feature of the PIPIs 2015 has been the involvement of regional organisations, members of PRIF's Sector Working Groups and other sectoral experts. They have been able to provide advice on selecting appropriate performance indicators and interpreting a lot of the data within the Pacific context.

Appendix A: Sources of Data

List of Key Websites Visited During Preparation of PIPIs 2015

No	Sector	Webpage
1	Aviation	http://www.paso.aero/
2	Aviation	http://aspa.aero/
3	Aviation	http://www.icao.int
4	Energy	http://www.ppa.org.fj/publication-report/
5	Energy	http://www.data.iea.org
6	Energy	http://www.emdat.be
7	Energy	http://www.iea.org/statistics
8	Energy	http://www.eia.gov/cfapps/ipdbproject/IEDIndex3.cfm?tid=44&pid=44&aid=2
9	Energy	http://www.irena.org/menu/index.aspx?mnu=Subcat&PriMenuID=36&CatID=141&SubcatID=353
10	ICT	http://www.theprif.org
11	ICT	http://www.itu.int
12	ICT	http://www.apt.int
13	ICT	http://www.telecom.co.ck/
14	ICT	http://www.telecom.fm/
15	ICT	http://tskl.net.ki/
16	ICT	http://www.digicelnauru.com/
17	ICT	www.Palaumobile.com
18	ICT	http://www.blueskysamoa.ws/
19	ICT	http://www.digicelsamoa.com/
20	ICT	https://www.ourtelekom.com.sb/
21	ICT	http://www.bemobile.com.sb/
22	ICT	http://www.tcc.to/
23	ICT	http://www.digiceltonga.com/
24	ICT	http://www.pactelint.com/press/detail.php?2.5G-Mobile-Network-Officially-Launched-in-Funafuti-11
25	ICT	http://www.digicelvanuatu.com/
26	ICT	http://www.tvl.vu/
27	ICT	http://www.itu.int/en/ITU-D/Statistics/Pages/default.aspx
28	SWM	http://www.pacific-environment.com/practices/solid-waste-management/
29	SWM	http://www.sprep.org/Waste-Management-and-Pollution-Control/Solid-Waste-Management/
30	SWM	http://www.sprep.org/Projects/afdsprep-regional-solid-waste-management-initiative

No	Sector	Webpage
31	SWM	https://www.sprep.org/j-prism
32	SWM	http://www.adb.org/publications/solid-waste-management-pacific-cook-islands-country-snapshot
33	SWM	http://www.adb.org/sites/default/files/publication/42662/solid-waste-management-solomon-islands.pdf
34	SWM	http://www.asiapathways-adbi.org/2014/06/better-urban-management-in-the-pacific-offers-double-dividends/
35	SWM	http://www.sprep.org/attachments/VirLib/Regional/16.pdf
36	Maritime	http://www.maritimecookislands.com/publications.html
37	Maritime	http://www.maritime-database.com/countries/
38	Maritime	http://www.marad.dot.gov/
39	Maritime	https://en.wikipedia.org/wiki/List_of_maritime_disasters_in_the_21st_century
40	Maritime	http://www.loc.gov/law/foreign-news/article/tonga-royal-commission-report-on-princess-ashika-ferry-disaster/
41	Roads	http://www.irfnet.org
42	WSS	http://www.unicef.org/eapro/EAPRO_Sanitation_Snapshot_2013_Update_19_11_2013.pdf
43	WSS	http://www.unicef.org/eapro/Community_Led_Total_Sanitation.pdf
44	WSS	http://www.unicef.org/eapro/progress_on_sanitation_and_drinking_water_2013.pdf
45	WSS	http://www.unicef.org/eapro/EAPRO_Sanitation_Snapshot_2012.pdf
46	WSS	http://www.unicef.org/eapro/staus_and_trends_wes_publication.pdf
47	Maritime	http://www.imo.org/Pages/home.aspx
48	Multi-sector	http://www.factfish.com/statistic/electricity%20consumption
49	Multi-sector	http://knoema.com/atlas/topics/Transportation/Air-transport/Air-transport-freight
50	Multi-sector	http://www.spc.int/prism/
51	Multi-sector	http://data.worldbank.org/indicator/NY.GDP.PCAP.CD
52	Multi-sector	http://databank.worldbank.org/data/views/reports/tableview.aspx
53	Multi-sector	http://www.data.un.org
54	Multi-sector	http://www.hdr.undp/en/data
55	Multi-sector	http://www.who.it
56	Multi-sector	http://www.worldbank.org
57	Multi-sector	http://www.sdbs.adb.orgsdbs/index.jsp
58	Multi-sector	http://www.unescap.org/data/ststdb/dataexplorer.apx
59	Multi-sector	https://www.cia.gov/library/publications/the-world-factbook/rankorder/2053rank.html
60	Multi-sector	https://www.cia.gov/library/publications/the-world-factbook/fields/2032.html

Appendix B: Raw Data

To request copies of the spreadsheets that contain the raw data used in this report, please contact:

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Level 20, 45 Clarence Street, Sydney, New South Wales, Australia, 2000.

Tel: +61 2 8270 9444. Email: enquiries@theprif.org. Website: www.theprif.org.

Appendix C: Population in PICs – Actual and Projected – 2000-2018

Year	Cook Islands	Federated States of Micronesia	Fiji	Kiribati	Nauru	Niue	Palau	Papua New Guinea	Republic of Marshall Islands	Samoa	Solomon Islands	Tonga	Tuvalu	Vanuatu	Total
Area (km^2)	236.7	701	18,273	811	21	261.5	444	462,840	181	2785	30407	650	26	12281	529918.2
2000	15,743	107,021	798,751	84,230	10,123	1,864	19,129	5,398,419	51,755	175,066	416,018	99,162	9,540	189,542	7,376,364
2001	15,030	106,840	804,572	85,872	10,106	1,788	19,293	5,525,884	51,210	176,710	427,804	99,755	9,576	194,605	7,529,044
2002	15,113	106,612	810,335	87,396	10,064	1,754	19,454	5,654,875	50,506	177,751	439,987	100,238	9,544	199,750	7,683,380
2003	15,193	106,339	816,029	88,756	9,871	1,722	19,610	5,785,467	50,902	178,683	452,555	100,741	9,682	204,985	7,840,533
2004	15,270	106,021	821,637	90,272	9,668	1,690	19,761	5,917,583	51,454	179,501	465,494	101,265	9,980	210,319	7,999,915
2005	15,345	105,654	827,125	91,984	9,456	1,660	19,932	6,051,431	52,268	180,203	478,792	101,482	10,285	215,769	8,161,384
2006	15,308	105,232	832,449	93,698	9,232	1,626	20,047	6,186,956	52,625	180,474	492,438	101,807	10,432	221,344	8,323,669
2007	15,369	104,754	836,239	95,470	9,373	1,587	20,162	6,324,106	53,059	181,267	506,422	102,248	11,130	227,056	8,488,240
2008	15,426	104,217	840,033	97,201	9,570	1,550	20,278	6,462,840	53,889	181,964	520,617	102,652	11,035	232,908	8,654,179
2009	15,479	103,620	843,845	98,989	9,771	1,514	20,397	6,603,131	54,065	182,578	551,302	103,023	11,093	239,000	8,837,805
2010	15,529	102,782	847,663	102,279	9,976	1,479	17,501	6,744,955	54,439	183,123	565,817	103,365	11,149	245,376	9,005,434
2011	14,995	102,891	851,485	104,421	10,122	1,612	17,594	7,059,654	53,231	187,283	580,575	103,071	10,583	251,784	9,349,301
2012	15,077	102,946	855,320	106,608	10,303	1,572	17,684	7,228,072	53,727	187,409	595,567	103,220	10,750	258,214	9,546,470
2013	15,154	102,952	859,178	108,840	10,482	1,535	17,774	7,398,456	54,166	187,430	610,790	103,311	10,922	264,654	9,745,641
2014	15,225	102,908	863,073	111,117	10,660	1,499	17,862	7,570,686	54,550	187,372	626,247	103,347	11,099	271,089	9,946,734
2015	15,292	102,813	867,013	113,438	10,837	1,466	17,948	7,744,601	54,880	187,256	641,947	103,335	11,282	277,506	10,149,613
2016	15,355	102,664	870,996	115,800	11,014	1,435	18,031	7,920,059	55,161	187,100	657,899	103,278	11,470	283,920	10,354,183
2017	15,415	102,460	875,014	118,202	11,191	1,407	18,110	8,096,946	55,396	186,919	674,113	103,181	11,663	290,319	10,560,338
2018	15,472	102,198	879,057	120,640	11,369	1,382	18,185	8,275,154	55,591	186,737	690,600	103,052	11,861	296,690	10,767,988

Source: SPC-SDD Database, Fiji. Estimates as at 2010. Accessed August 2014.

Appendix D: Limitations in Data and Reporting – 2011 and 2015

Limitation	PIPIs Report 2011	PIPIs Report 2015
Dataset features only countries that are included in PRIF	Countries included in the Report were Cook Islands, FSM, Kiribati, RMI, Nauru, Niue, Palau, Samoa, Solomon Islands, Tonga, Tuvalu and Vanuatu.	Papua New Guinea and Fiji included as well.
Applicability of common indicators	Access, affordability and quality were the only categories used for performance indicators.	Safety has been added as an additional category, where applicable.
'Snapshot' approach	The PIPIs data did not present a time series but was a 'snapshot' based on the latest available data, including periodic census and survey data.	As in 2011, though comparisons are made between the two datasets where appropriate.
Timeliness, accuracy and consistency of data	Data from consistent years were collected and applied as much as possible. However, where no data existed for a particular time period, the latest available data was applied. Where data obsolescence was an issue, an interpretation of performance was made based on qualitative evidence sourced from specialists (as the best available indication at the time). The months included in financial years varies between the PICs (e.g. January-December, July-June, and October-September) so there are inherent differences in data sets that report annual data. The data was compiled from multiple sources, thus reducing the consistency of the information presented. Selected reports used in the exercise were often several years old, but were the best available source of comparative data for certain indicators. Consulting individual service providers and organisations often resulted in the need to collate information from a number of sources to represent country data. This is likely to result in some inconsistencies in data sets or under-representation in some cases (e.g. where utilities provide the data, it is only for their customer base and may lead to some missing data). Within individual sectors or countries, there may be different sources of data for the PIPIs. This means that in some cases the different data sets may not be consistent because of use of varying counting rules, data being collected at different times, or due to other factors.	Data from specialists was only used in the ICT chapter. As in 2011 As in 2011 (including population data) As in 2011 As in 2011

Limitation	PIPIs Report 2011	PIPIs Report 2015
Data gaps	Data gaps existed for some of the indicators, with resulting challenges in interpreting data at a whole-of-region level. In the Energy and Transport sectors in particular, data was limited and comparable regional data was rarely collected. In contrast, data for Water and Sanitation and Telecommunications had been regularly updated by various interest groups in the Pacific given the links to the Millennium Development Goals (MDGs) and the number of donor-agency projects conducted in these fields. A further issue concerned the consistency in data collection processes and 'counting rules' within any given indicator. Where this was known it is noted, but, because the data was drawn from secondary sources, discrepancies may not always have been identified.	As in 2011 In the Energy sector, data is almost all available except for a few data points. However, there was no new data available in the Transport sector. Access data for Solid Waste Management and WSS are available from project reports and UNICEF/WHO reports but quality, efficiency, affordability, sustainability and safety data are not available. As in 2011
Data sources	Although some data originated from primary sources, the report was mainly based on secondary research. It was developed by collating statistical data from global, regional or industry publications, commissioned or special topic research reports in particular sectors, and literature review of research reports on the five infrastructure sub-sectors. As primary infrastructure data is not readily accessible in the Pacific, the accuracy of information and analysis presented in the PIPIs Report was consequently limited.	Various sources of data were used (as in PIPIs 2011). Use of multiple sources to develop individual datasets was minimised.
Lack of common statistical framework	The lack of common statistical frameworks required cautious interpretation and use of the Report.	As in 2011
Data disaggregation	The report did not systematically disaggregate data by gender (male/female) or use geographical/demographic differentiation (urban/rural). Urban/rural comparisons were in the WSS sector.	As in 2011

Appendix E: Indicators with Missing Data

List of Indicators for which Data was Unavailable

No.	Sector	Category	Performance Indicators
1	Energy	Efficiency/Energy Use	7a) Total fuel imports for power generation as % of GDP
2		Affordability	11) Total fuel imports as a percentage of total imports
3			13 a,b,c) Average annual wholesale fuel price (US cents/litre) Automotive Fuel Oil Unleaded Petroleum Kerosene
4	Transport - Aviation	Access	2) Scheduled take-off and landing by airport (in-bound international and domestic flights/week)
5			Average air cost (international freight/USD/ton-km)
6		Quality	5) IATA LOS by country
7		Efficiency	6) Number of international flights per week to dominant hub
8		Safety	9) ICAO safety audit indicator
9	Transport – Maritime	Quality	3) Vessel turnaround time (days)
10		Efficiency	4) Delay waiting to enter port (days)
11		Affordability	5) Port charges (USD/TEU)
12	Transport – Roads	Access	4) No. of motor vehicle registrations
13		Quality	6) Condition of roads
14		Efficiency	7) % of road network receiving regular routine maintenance
15		Safety	8) No. of road accidents (per 10,000 registered vehicles)
16	Water and Sanitation	Safety	14) Diarrhoea and dysentery per year as a percentage of the total population (divided into urban/rural and gender)

List of Indicators with Data Gaps*

No.	Sector	Category	Performance Indicators
	Energy	Efficiency/ Energy Use	7) Total fuel imports (% of GDP)
			7b) Energy Intensity (fuel imports) – Amount of petroleum fuel consumed in country to produce $US1GDP(MJ/USD)
			8) Distribution losses (% of output)
	ICT	Affordability	6) Mobile-cellular prepaid – price of local calls (off-peak on-net) in USD (avg)
			7) Price of calls to major market destinations (Sydney and San Francisco) – peak business time
			8) Price of 3G (reported against the lowest value prepay reload amount available plus dollars per Mb for that amount)
			9) Price of monthly ADSL – postpaid (reported against lowest priced fixed postpaid service plus associated data cap e.g. USD per Mb) – any service that offers less than 512 kbps bandwidth
	Solid Waste Management	Access	2) Frequency of solid waste collection service per week in urban areas (number)
		Quality	3) No. of each type of waste management facility in urban areas
			4) % of facilities that meet environmental best practice standards
			5) % of facilities with up-to-date environmental monitoring reports readily available
		Efficiency	6) Cost per capita for waste disposal
		Sustainability	7) No. of systems for sorting solid and/or hazardous waste
			8) No. of shipping containers exported that contain recyclable commodities or waste
	Transport - Aviation	Access	4) No. of in-bound international passengers per day
		Affordability	7) Average cost of economy air travel (% of per capita GDP)
	Transport – Maritime	Access	1) No. of international ports
		Safety	6) No. of maritime incidents per annum
	Transport - Roads	Access	1) Total road network (kms)
			2) Paved roads (kms)
			5) Road density (kms of road/100kms[2)]
	Water and Sanitation	Safety	13) Incidence of water-borne diseases (reported cases)
			14) Diarrhoea and dysentery per year as a percentage of the total population (if possible divided into urban/rural and gender)

(Only partial data available)*

Appendix F: Port Tariffs

Port Tariffs in Kiribati, 2014

Country :	Kiribati
Port :	**Betio Port**
Inward or outward full 20' container	130.37 per container of max weight 25 tons Double rate if in excess
Inward or outward 20; empty container	65.19 per container
Dockage	1.93 per m length per 24 hrs
Devaning mix cargo	5.79 per cubic metre tonne
Discharging or loading breakbulk	14.49 per cubic metre tonne
Restowing 20' containers	65.67 per container
Moving breakbulk cargo	65.67 per move
Pilotage	0.048 per GRT(Min 100 max 400)
Pilot travel time	96.57 per hr
Pilotage	Saturday rate + half Sunday & Public Hol double rate
Cleaning of empty containers	24.14 /container
Cleaning 20' container	4.83 per container
Cleaning inside ships hold	3.86 per hr per person
Port Dues	0.03 per m length per call or 1.00 per m length per day for craft using inner harbour basin anchorage
Lashing / unlashing	4.83 per container 10.00 per bundle of breakbulk
Storage	Timber - 3.86/M3/tonne/day Cars/Vehicles - 11.59 /unit/day Iron Rod - 4.83 /M3/tonne/day Videos&Musical Instruments -5.79 / carton/day Cement - 5.79 /M3/day General cargo - 2.41 /M3/ tonne/day Freezer cargo and transhipment reefer cargo - 4.83 /reefer container/hr Storage on explosives, Flammable & Dangerous cargoes - 144.86 /tanktainer M3/tonne/day or part there of
Agency charges	Negotiable for freight commission, buying commission, standby fees, boarding fees, escort fees and other fees
Power Charges	

Port Tariffs in Samoa, 2014

Country :	Samoa (Tala)
Port :	**Salelologa Port**
Port Charge Item	Charge Rate (USD)
Import	2.13 per ton + whichever applies of 10' container 18.28 + 31.88 service charge; 20' container 36.13 + 63.75 service charge; 40' container 78.63 + 110.50 service charge
Export	0.85 per ton per 10' container + 3.19 service charge; 0.85 per 20' container + 9.35 service charge; 0.85 per 40' continer + 46.75 service charge
Transhipment	1.06 per ton
Breakbulk	1.70 + 2.98 service charge
Bulk Petroleum	0.43 per metric ton
20' container	48.88
40' container	106.25
Dockage	0.02 per GRT per day
Berthage per GRT for labour and tug boat	0.17+ 25.50 per hr
Pilotage	0.08 per GRT
Authority Staff overtime	Cost to Authority + 20% of such cost
Shuttle bus	212.50
Cleaning wharf after vessel departure	23.38 per visit
Port service charge per 20' container	85.00
Port service charge per 40' container	148.75
ISPS Security per GRT	0.04
Cruise liner confirmed booking	212.50
Telephone connection to ship	42.50
Transhipment per m3 or per tonnage	1.06
Workboats up to 200HP per hr	85.00
Workboats 201 - 400 HP per hr	106.25
Workboats 401 - 600 HP per hr	148.74
Workboats 601 - 800 HP per hr	191.25
Workboats 801 - 1000 HP per hr	318.75
Light dues per visit	42.50
Fresh water	0.72 per m^3

More information and additional copies of this report can be obtained from:

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