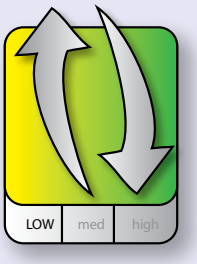
INDICATOR Renewable Energy

DEFINITION	Trend in percentage production of energy from renewable sources
PURPOSE	Energy generation is a major source of GHG emissions. Pacific island countries also have limited capacity for oil and gas storage and are therefore highly vulnerable to fluctuations in fossil fuel price and availability
DESIRED OUTCOME	Positive trend in energy production from renewable sources



Status
Fair to good

Trend
Mixed

Data confidence
Low

Electric Vehicles for Sustainable Transport, Samoa. © Roland Setu

PRESENT STATUS

Here, we focus on the production of *electricity* from renewable sources. As such, we focus on a statistic distinct from SDG 7.2.1 "Renewable energy share in the total final energy consumption". Data for this Pacific regional indicator are relevant for SDG 7.b.1 "Installed renewable energy-generating capacity in developing countries (in watts per capita)".

Renewable energy (RE) is gaining more regional attention and the number of installed renewable systems for electricity supply (directly by national utilities or through independent power producers) has increased in several Pacific island countries and territories. For example, Asian Development Bank (ADB) projects on RE technology continue to 2021 with efforts in 13 Pacific island countries and at the regional level (ADB 2019).

The share of renewables in the total energy demand is not routinely reported (Johnstone 2019). Data are available regarding the planned and installed generation capacity. However, the share of total electricity production that comes from renewables is not regularly reported. Here, we collate data from national presentations at the Pacific Islands Renewable Energy Statistics Workshop[1] and national energy sector plans (Table 27.1). A substantial increase in renewable electricity production is projected from committed project funds; the last summary of projected shares of electricity generation upon the completion of existing projects was prepared in 2016 (MFAT 2016).

Based on assessments from at least 2015 to the latest available year, we consider the present status to be *fair to good* with *mixed* trends among countries. The availability and clarity of the data provide *low* confidence; the absence of data has been identified as one of the challenges for informed decision making, effective energy planning, and tracking of renewable energy deployment in the region.[1]

That said, efforts are underway to improve reporting and, with sustained support for long-term monitoring, data confidence will grow quickly.

Pacific leaders have set RE targets, focusing on the share of domestic electricity production using renewable resources (Table 27.1). In 2012, Tokelau was the first country in the world to achieve 100% of its electricity generation from solar systems, with 45 kW solar plants on all three atolls, reducing diesel imports by 80% (Government of Tokelau 2016). The actual supply is now about 90% with supply difficulties under cloudy conditions or with battery failures.

Electricity is only a portion of the total energy demand in the region. In 2017, modern renewables (which excludes traditional uses of wood biomass burning) supplied 12.3% of the total final energy consumption in the Pacific region (Asia-Pacific Energy Portal). (When including biomass burning, the share of renewables was 13.8%.) The trend in renewables as a share of total final energy consumption is stable: although renewable electricity generation capacity is increasing, overall, the demand for energy is also growing.

The countries with the greatest shares of renewables in energy consumption are Kiribati, Solomon Islands, and Papua New Guinea (PNG). In 2014, 63% of the national energy *supply* for Kiribati came from imported petroleum products; endogenous renewable energy sources (mainly bioenergy, then solar) accounted for the remaining 37% (Taibi et al. 2017). In 2017, RE accounted for 48% of PNG's total primary energy supply; recent values are lower than the nearly 70% pre-2000 share of renewables in total final energy consumption as PNG's demand has increased.[2] Fiji, Samoa, and PNG, all with hydropower systems in place for decades, show this declining trend as demand surpasses existing hydropower supply.

[1] Pacific Islands Renewable Energy Statistics Workshop, Nadi, Fiji, 22–24 October 2019. See: http://prdrse4all.spc.int/node/4/content/pacific-islands-renewable-energy-statistics-workshop-nadi-fiji-22-24-october-2019

[2] APEC Energy Database, Primary Energy Supply Table; see https://www.egeda.ewg.apec.org/egeda/database/php/newprimary2/primary.php

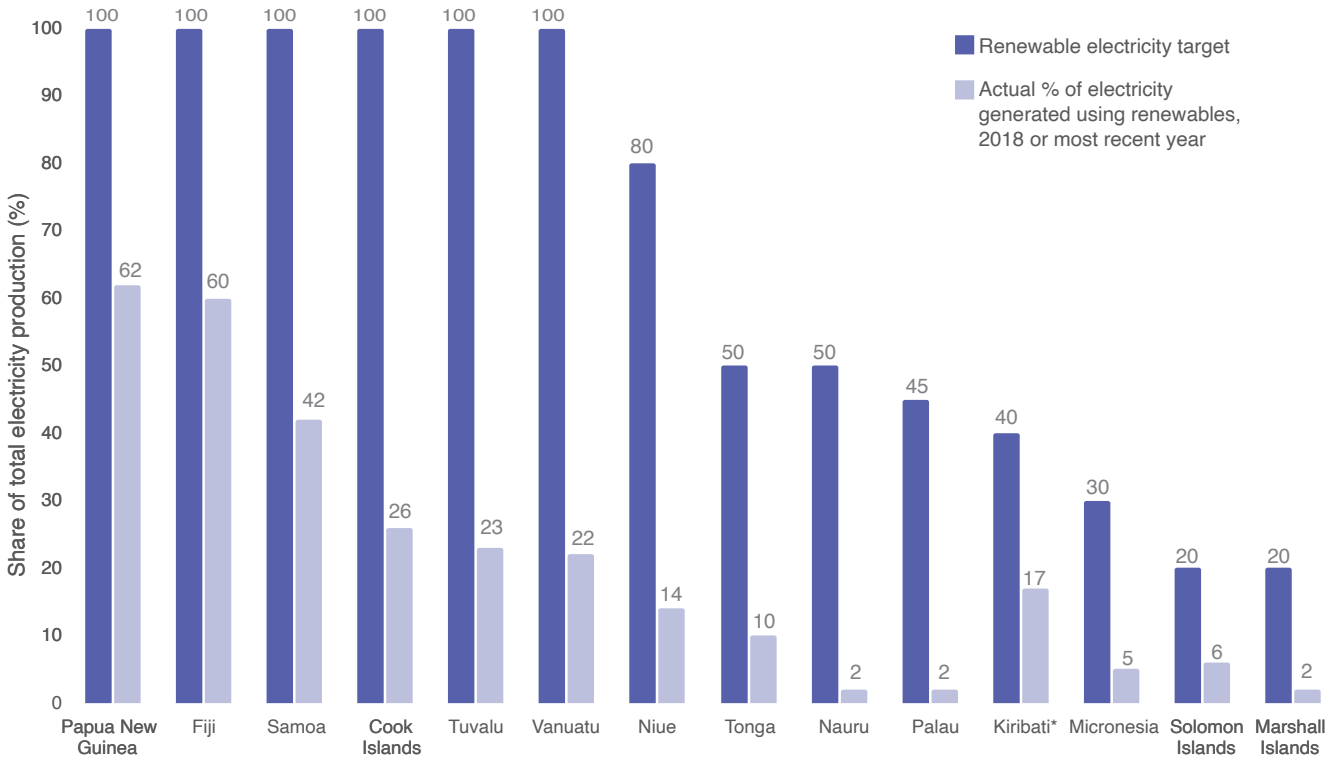


FIGURE 27.1: Target and actual share of renewable energy in electricity production in Pacific island countries. Kiribati's data are for solar only for South Tarawa only. Micronesia: Federated States of Micronesia. Sources: see Table 27.1

WHAT ARE THE RENEWABLE ENERGY OPTIONS FOR PACIFIC ISLANDS?

Solar energy capture has high potential throughout the region and is a focal point for many international projects. Solar is the most common method for micro- and small-scale renewable energy applications, including off-grid applications. In some countries, solar is already commonly used for a portion of household energy uses, such as water heaters.

Hydroelectricity is only available in Fiji, French Polynesia, New Caledonia, PNG, Samoa, Solomon Islands, and Vanuatu.

To date, wind energy is used in Fiji, Federated States of Micronesia (Yap state), New Caledonia, Samoa, Tonga, and Vanuatu. Wind energy can be used for micro- to large-scale applications but most focus on large-scale, grid-connected systems.

Biogas can take advantage of existing waste products, such as piggery effluents or copra residues. Biogas efforts have largely been project-based and face challenges of start-up costs and maintenance. For example, as of October 2019, only 22 of the 49 digesters of Tuvalu's ACSE Biogas Project were working.[1]

Marine energy (tidal, ocean, wave, ocean thermal energy conversion, or salinity gradient) is largely at the development stage around the world. With few constricted harbours and small tidal ranges, the islands are largely unsuited to tidal energy. A 1 MW ocean thermal energy conversion plant is under development in Kiribati, to be completed in 2020.

Biomass (primarily wood) is used on many islands for traditional cooking, excluding atolls. Fiji, PNG, and Solomon Islands also use biomass for electricity production, with Fiji using sugarcane bagasse during the crushing season as well biomass from the timber mill. Solomon Islands and PNG rely heavily on waste biomass from their palm oil industries.

For all technologies and for all countries, the maintenance and modification or innovation of renewable energy technologies remains a challenge. Tropical conditions create a unique set of hazards to sustained production, and geographic remoteness complicates the timely servicing and repair of replaceable components. True energy independence will rely on trained personnel with the skills, time, and resources to develop energy systems.

CRITICAL CONNECTIONS

Renewable energy production assists in the fight against climate change and can increase Pacific resilience. That said, the infrastructure of renewable energy systems is also vulnerable to extreme events. Flooding is a particular concern. With the region's vulnerability to natural disasters, RE systems must be resilient.

As with any land-use change or hardscape development, the installation of renewable energy systems bears risks for local biodiversity and ecosystems. The practice of clearing forest or native landscapes to install RE infrastructure, for example, is to be discouraged. All RE systems are subject to environmental impact assessment, like any other construction.

As part of a system of energy supply and infrastructure throughout the region, RE can support education, communication, and environmental management based on research and data management.

TABLE 27.1: Electricity access, renewable energy targets, status upon completion of active projects, and existing share of renewables in total electricity production in Pacific island countries and territories. Data were unavailable for American Samoa, Commonwealth of the Northern Mariana Islands, and Guam. Note that Tokelau achieved 100% solar power in 2012.

COUNTRY	ELECTRICITY ACCESS, 2017 [ACCESS TARGET] (% OF POPULATION)	RENEWABLE ENERGY TARGET (% OF TOTAL ELECTRICITY PRODUCTION, UNLESS SPECIFIED)	SHARE OF RENEWABLES IN TOTAL ELECTRICITY GENERATION, 2018	SHARE OF RENEWABLES IN ELECTRICITY CAPACITY, 2019
Cook Islands	100%	100% by 2020	26%	28%
Fiji	96% [100% by 2020]	100% by 2036	60%	59%
Kiribati	98.6%	45% reduction of fossil-fuel energy generation by 2025	17%	30%
Marshall Islands	94.8% [95% by 2020]	20% by 2020, 100% by 2050	~2% from government-owned RE; a project underway to reach 9%	5%
Micronesia, Fed. States of	80.8% Access varies significantly among the 4 states: Kosrae 98%, Pohnpei 87%, Yap 67%, Chuuk 26%	30% by 2020	5%	9%
Nauru	99.6%	50% by 2020	2%	5%
Niue	100%	80% by 2025	14%	31%
Palau	100%	45% by 2025	2%	4%
Papua New Guinea	54.4% [70% by 2030]		62%	32%
Samoa	96.8%	100% by 2017	42%	47%
Solomon Islands	62.9% [100% urban and 35% rural by 2020]	20% by 2020	6%	5%
Tokelau	–	100% by 2020	~90%	–
Tonga	98% [100% by 2020]	50% by 2020 (70% by 2030)	10%	30%
Tuvalu	100%	100% by 2020	23%	42%
Vanuatu	62.8% [100% by 2030]	100% by 2030	22%	30%
French territories: French Polynesia (FP), New Caledonia (NC), Wallis & Futuna	100% (FP, NC)	Reductions in diesel use	FP: 29% NC: 12%	FP: 29% NC: 18%

Sources: Access, 2018 generation, and 2019 capacity from International Renewable Energy Agency (IRENA) Statistical Profiles, September 2020 with the following exceptions: Marshall Islands generation data pers. comm. Ben Wakefield, Deputy Director, National Energy Office; Tokelau generation data from Government of Tokelau (2016). Targets based on national energy policies, NDCs, and Asian Development Bank *Pacific Energy Update 2019*. Additional information about existing status available from country presentations at the Pacific Islands Renewable Energy Statistics Workshop, Nadi, Fiji, 22–24 October 2019 as well as: Kiribati data from Kiribati Integrated Energy Roadmap 2017–2025; Nauru data from Wyder (2018) Review of the Nauru Energy Road Map 2014–2020; Niue data from Niue Solar Installations 2016 from PRDRSE4ALL database; Samoa data from EPC 36th Annual Report 2017–2018; Vanuatu data from Vanuatu Utilities Regulatory Authority (2018) Electricity Fact Sheet 2012–2017.

PRESSURES & OPPORTUNITIES

The costs for renewable power generation have continued to decline, with most renewable electricity-generating options, particularly wind and solar, less expensive than fossil fuel options (IRENA 2019; PRIF 2019). That said, up-front investment can still be a barrier. Energy is typically a separate budget from environmental management although the transition to renewable energy (RE) is mutually beneficial; see Regional Indicator: Environment Ministry budget allocation.

According to the ADB (2019), "the uptake of renewables is restricted by lack of finance and private sector participation, capacity barriers, poor sector regulation, and the limited ability of local grids to absorb new sources of renewable power" in the Pacific islands region.

Consistent, sustainable data reporting remains a challenge. Countries identified lack of capacity for data analysis and data management. Given the lack of global standardization in the presentation of RE statistics (for example, as share of electricity production, share of domestic energy production, or share of total final energy supply), managing RE statistics is challenging.

The Review of the *Framework for Action on Energy Security in the Pacific* (FAESP: 2010–2020) gives an overview of the data situation: 'In 2011, a set of quantitative and qualitative indicators was developed to provide a simple and reliable means to measure changes or achievements in energy security for the PICTs. They were chosen as a workable compromise between comprehensiveness and the effort required to acquire data. In 2012, SPC published a set of 14 Country Energy Security Indicator Profiles (2009 data or closest available year) and had planned annual updates, which were stymied due to lack of sufficient data from the countries. […] Access to accurate, consistent and up-to-date energy data remains a serious issue, with the need for improved data highlighted at numerous meetings of the region's energy ministers in the past decade, including 2019. In their 2019 resolution, energy ministers "noted the data management challenges of the Pacific Islands and call on the World Bank to urgently appraise and treat the SPC data funding proposal as a matter of priority"' (Johnstone 2019). The FAESP indicators cover all RE for electricity, which includes estimates for small grids and off-grid supply where available; however, the data supply is unreliable.

In 2014, the Pacific Ministers of Energy and Transport endorsed the establishment of a regional centre of excellence, the Pacific Centre for Renewable Energy and Energy Efficiency (PCREEE), under the umbrella of the FAESP. PCREEE was inaugurated in April 2017.[3] To support efficient coordination of efforts, project investments are streamlined through the Pacific Renewable Energy Investment Facility, with current operation extending through 2021.

Solar farm, Samoa. © Roland Setu

The Pacific Solar Challenge was launched in late 2019 by the Pacific Islands Development Forum (PIDF) in partnership with Solar Head of State as a regional initiative hosting nationally focused competitions for youth to design community outreach materials.

The energy sector alone contributed 40% to nearly 80% of estimated national carbon emissions as reported in Pacific NDCs (see Regional Indicator: Trend in greenhouse gas emissions). Transitioning to RE mitigates carbon emissions. Imported diesel is the dominant source of electricity generated in the Pacific islands, bulking out their imported fossil fuels. For example, prior to the 2018 completion of the Tafitoala-Fausaga and Faleata hydropower plants, diesel for electricity production accounted for 20% of Samoa's annual petroleum imports and 50% of the country's total installed electrical capacity (Bird & Mataita 2019). This reliance on fossil fuels increases greenhouse gas emissions.

Domestic energy production provides independence. Due to the high cost of long-distance fuel shipping and the heavy reliance on fossil fuels, Pacific islands could save substantially through the transition to RE. For example, fuel imports represent nearly 13% of the GDP of the Federated States of Micronesia.[1] The global average expenditure on energy is 8% of GDP (Institute for Energy Research 2010) and spending on energy research and development (R&D) was about 0.04% of the GDP of the major economies in 2018 (IEA 2019). At present, the Pacific islands do not report national investment in energy R&D as a share of GDP.

[3] See: https://sustainabledevelopment.un.org/partnership/?p=7498

REGIONAL RESPONSE RECOMMENDATIONS

The regular use of a clearly defined metric will help identify status and trends in renewable energy systems. Learning alliances within the region can facilitate the sustained reporting of RE indicators, during the planned rapid transition to renewables.

Using the *Framework for Action on Energy Security in the Pacific* (FAESP: 2010–2020) and other regional frameworks, countries can:

- Standardise reporting based on the same data for SDG 7, national energy plans/roadmaps, Pacific NDC Hub requirements, and other MEAs or frameworks;
- Measure investment in renewable energy systems, distinguishing national and project funds;
- Plan for energy system resilience and independence, including preparedness such as disaster risk reduction and biosecurity as well as pollution levies;
- Partner to advance the transition to renewables, focusing on private sector partnerships; and
- Partner for RE data management, resourcing, and capacity building, including South-South partnerships.

INDICATOR IN ACTION SDGs 7.1, 7.2, 7.a, 7.b • SAMOA Pathway • Noumea Convention • Montreal Protocol • Regional Environment Objectives 1.1, 1.3, 1.5 • Pacific Islands Framework for Nature Conservation Objective 2

FOR MORE INFORMATION

Pacific Regional Data Repository for Sustainable Energy for All: http://prdrse4all.spc.int/list/data

Asia Pacific Energy Portal: https://asiapacificenergy.org/

Pacific Power Association; https://www.ppa.org.fj/publications/ Note that PPA data are only for the main grids of each utility.

IRENA Renewable Energy statistics: https://www.irena.org/Statistics

ADB Pacific Energy Update series: https://www.adb.org/publications/series/pacific-energy-update

For Papua New Guinea, APEC Energy Database: https://www.egeda.ewg.apec.org/egeda/database_info/index.html

PRISM: https://prism.spc.int/ link to country statistics websites

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PRIF (2019) Renewable Energy Costs in the Pacific. Lead author: J Wyder. Pacific Region Infrastructure Facility (PRIF).

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SPREP PROE

The Secretariat of the Pacific Regional Environment Programme (SPREP) supports 14 countries and 7 territories in the Pacific to better manage the environment. SPREP member countries and members of the Pacific Roundtable on Nature Conservation (PIRT) have contributed valuable input to the production of this indicator. www.sprep.org

National and regional environment datasets supporting the analysis above can be accessed through the Pacific Environment Portal. pacific-data.sprep.org

For protected areas information, please see the Pacific Islands Protected Area Portal. pipap.sprep.org