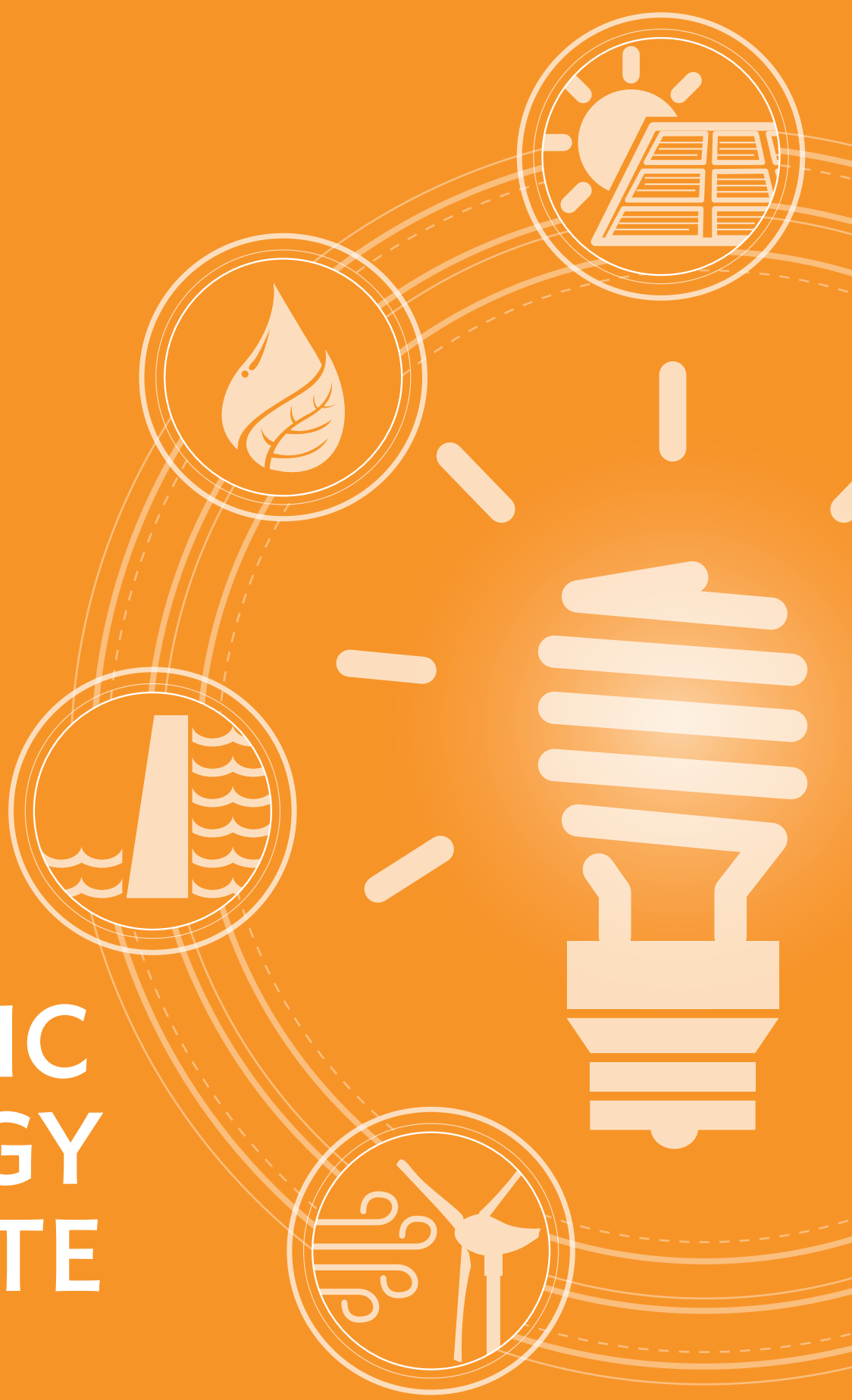


PACIFIC ENERGY UPDATE 2018



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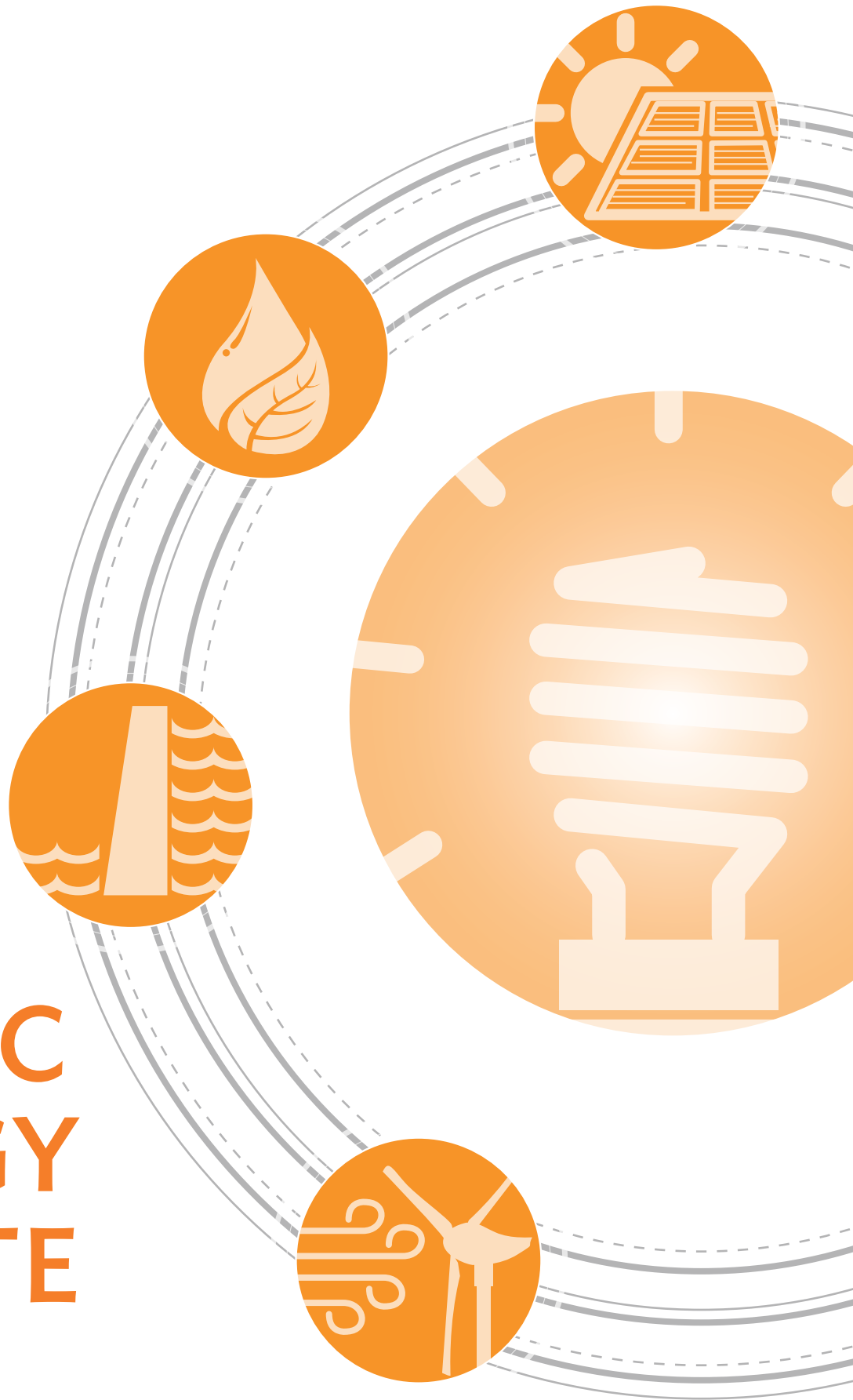
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PACIFIC ENERGY UPDATE 2018



Abbreviations

ADB	–	Asian Development Bank
DMC	–	Developing Member Country
PIC	–	Pacific Island Countries
PIC-11	–	The 11 smallest Pacific island developing member countries
PRIF	–	Pacific Regional Infrastructure Facility
TA	–	Technical Assistance
PV	–	Photovoltaic
GDP	–	gross domestic product

Regional Utilities

Chuuk Public Utility Corporation (Federated States of Micronesia)
Electricidade de Timor Lorosae (Timor-Leste)
Electric Power Corporation (Samoa)
Fiji Electricity Authority (Fiji)
Kwajalein Atoll Joint Utility Resources (Marshall Islands)
Kosrae Utilities Authority (Federated States of Micronesia)
Marshall Energy Company (Federated States of Micronesia)
Nauru Utilities Corporation (Nauru)
PNG Power Ltd. (Papua New Guinea)
Palau Public Utilities Corporation (Palau)
Public Utilities Board (Kiribati)
Pohnpei Utilities Corporation (Federated States of Micronesia)
Solomon Power (Solomon Islands)
Te Aponga Uira O Tumu-Te-Varovaro (Cook Islands)
Tuvalu Electricity Corporation (Tuvalu)
Tonga Power Limited (Tonga)
Union Electrique du Vanuatu Limited (Vanuatu)
Vanuatu Utilities and Infrastructure Limited (Vanuatu)
Yap State Public Service Corporation (Federated States of Micronesia)

Units and Measurements

km = kilometer
kV = kilovolt
kW = kilowatt
MW = megawatt
MWp = megawatt peak
m² = square meter

Foreword

Welcome to the 2018 edition of the Asian Development Bank (ADB) Pacific Energy Update. Last year, ADB continued its support of the sector with \$87 million of renewable energy investment projects approved across four countries. ADB also approved a \$750 million Renewable Energy Investment Facility to expedite a series of projects in the 11 smaller ADB Pacific developing member countries. Across the region, ADB's energy portfolio of active projects is \$426 million with a project pipeline to 2021 of over \$1 billion. ADB is working with governments, donor partners, and the private sector to improve the quality and availability of clean, affordable, and sustainable power. This update highlights some of our core activities, what we aim to achieve in the future, and presents selected impacts.



Ma. Carmela D. Locsin
Director General
Pacific Department
Asian Development Bank

Project Financing (\$ million)

Pacific DMC	Active	Proposed (to 2021)
Cook Islands	33	
Fiji		35
Kiribati		9
Marshall Islands	2	27
Federated States of Micronesia	9	45
Nauru	9	38
Palau		6
Papua New Guinea	189	493
Samoa	126	95
Solomon Islands	20	215
Timor-Leste		15
Tonga	26	75
Tuvalu		6
Vanuatu	12	
Regional		22
All	426	1,080

Planned Outputs

Asset	Active Projects	Proposed Projects
Hydropower	51 MW	28 MW
Solar	10 MW	47 MW
Wind	1 MW	
Batteries	24 MWh	62 MWh
Diesel generation	41 MW	10 MW
Transmission/distribution	1,628 km	3,260 km
Energy access	10,356 households	75,700 households

km = kilometer, MW = megawatt, MWh = megawatt-hour.
Source: ADB estimates.

Overview

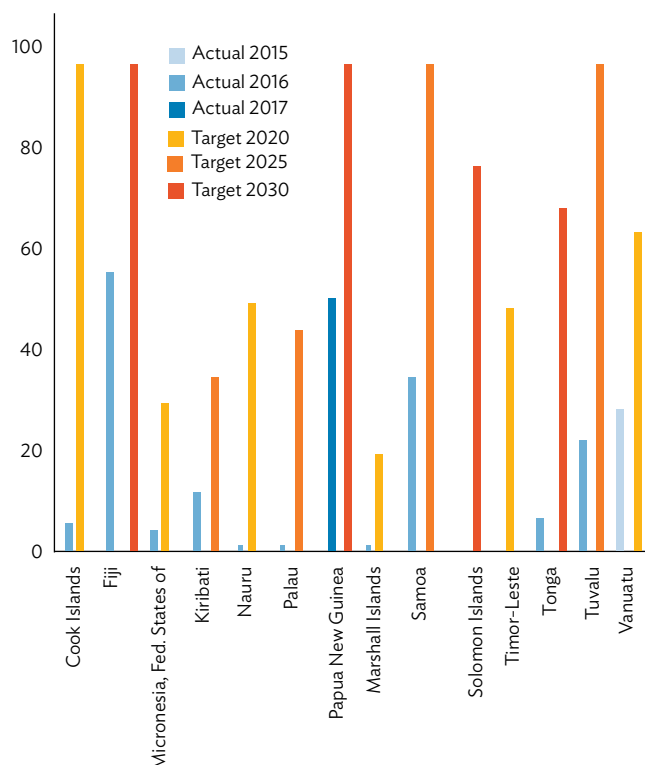
The 14 developing member countries (DMCs) of the Pacific Department of the Asian Development Bank (ADB) cover a wide diversity. Populations range from the top three countries, representing 87% of the region's population, to the remaining 11 countries, with a total of less than 1.5 million people. The region covers 15% of the globe's surface, with remote countries ranging from large single landmass entities to smaller countries covering over 900 islands. The region will suffer from climate change impacts such as rising sea levels and increased storm severity, even while the region is among the world's least contributors of greenhouse gases. The region faces unique challenges in building clean, reliable, and cost-efficient power systems that provide universal supply required for human development.

Only Timor-Leste and Papua New Guinea have proven fossil fuel reserves. However, the region is rich in renewable energy resources with hydropower potential in Fiji, Papua New Guinea, Samoa, Solomon Islands, the Federated States of Micronesia, and Vanuatu; geothermal potential in Fiji, Papua New Guinea, Solomon Islands, and Vanuatu; and solar, and wind to a lesser extent, being a strong renewable energy candidate throughout the region.

DMC power systems traditionally relied on imported fossil fuels whose high cost was compounded by long supply chains. Over the last decade, DMCs, supported by ADB and development partners, have embarked on a policy to reduce costs and increase security by increasing renewable energy as a portion of the fuel mix, while minimizing investment by increasing energy efficiency. While fuel mix is still dominated by diesel, this is changing as new renewable energy projects are being implemented and DMCs are setting ambitious renewable energy targets.

Electricity access is varied, but lowest in high-population countries. Throughout the region, over 8 million people have no electricity supply. Increasing access is a top DMC priority supported by ADB and donor partners. Meanwhile, tariffs are high for customers who enjoy grid supply with an average tariff for domestic supply of \$0.45 per kilowatt-hour.¹

Figure 1: Pacific Renewable Energy
(percent of total electricity generation)



Sources: Pacific Power Association Power Utilities Benchmarking, country energy road maps, Country Intended National Contribution submissions, and Asian Development Bank estimates. Actual PNG for Port Moresby grid.

ADB, together with donor partners, can provide a portion of required capital investment. However, the balance will need to be filled by the private sector. In this regard, ADB and the donor community are supporting the DMCs in creating an enabling commercial, legal, and regulatory environment to support private sector investment. While over 570 megawatts (MW) of private power plants are at various stages of operation and development, further progress is needed.

ADB's energy strategy for the Pacific region is to coordinate with donor partners² and (i) support increased energy efficiency and renewable energy; (ii) maximize access to energy for all; and (iii) promote sector reform, capacity building, and effective governance.

¹ Average over 10 DMCs for 200 kilowatt-hours usage per month. Source: Pacific Power Association Utilities Benchmarking.

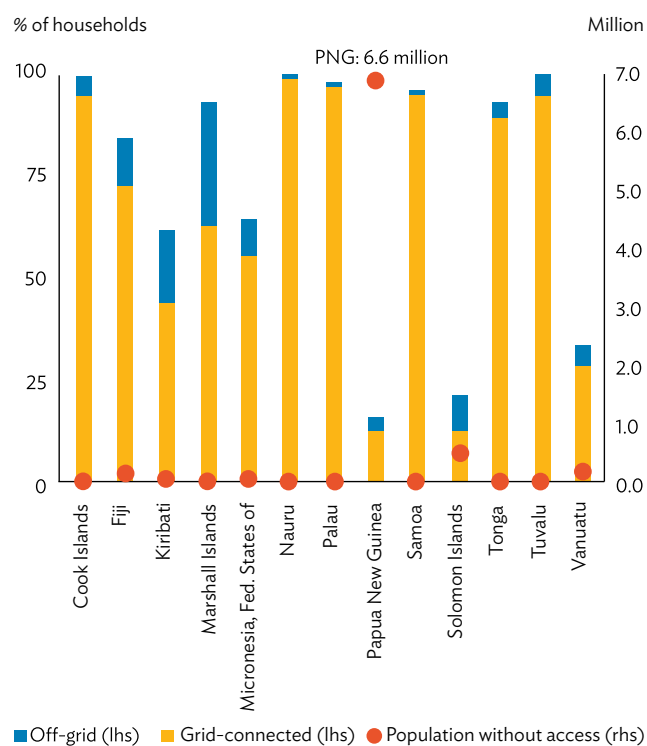
² The main donor partners active in the Pacific region energy sector include (i) the European Union; (ii) the governments of Australia, Denmark, Japan, the Republic of Korea, and New Zealand; and (iii) the World Bank.

Country Data

Pacific DMC	Population ('000) 2017	Exclusive Economic Zone (m ²)	Land Area (m ²)	Number of Islands/Atolls	GDP per capita (current \$) 2017
Papua New Guinea	8,738	2,396,575	452,860	approximately 600	2,651
Timor-Leste	1,237	77,051	14,874	4	1,356
Fiji	885	1,281,122	18,274	332	5,639
Solomon Islands	670	1,597,492	27,990	approximately 998	1,724
Vanuatu	297	827,891	12,274	84	2,876
Samoa	197	131,812	2,934	9 plus adjacent small islets	4,258
Kiribati	113	3,437,345	810	33	1,729
Tonga	105	664,853	750	171	4,011
Micronesia, Federated States of	102	2,992,597	702	607	3,300
Marshall Islands	55	1,992,232	181	34: 5 islands, 29 atolls made up of an indeterminate number of islets	3,669
Cook Islands	19	1,830,000	240	15	15,613
Palau	18	604,289	189	more than 300	16,261
Nauru	13	308,506	21	1	8,330
Tuvalu	10	751,797	27	9	3,545

DMC = developing member country, GDP = gross domestic product, m² = square meter.
Source: Asian Development Outlook database (2018).

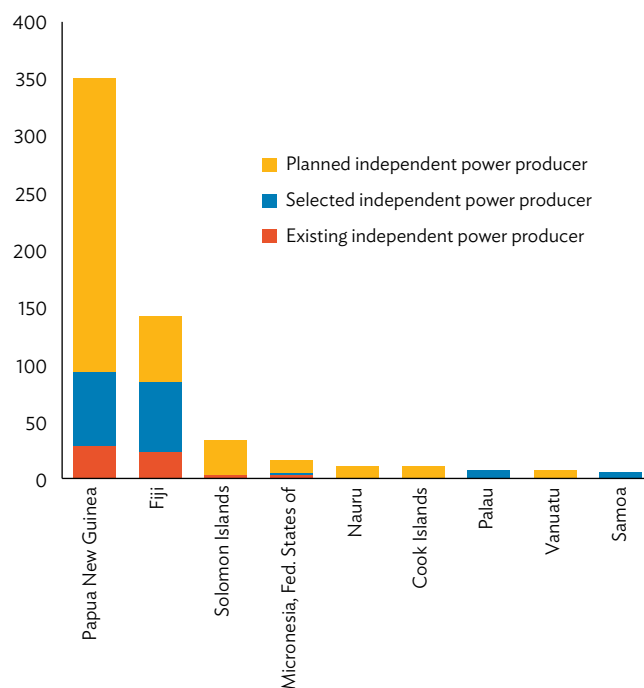
Figure 2: Electricity Access



lhs = left scale, PNG = Papua New Guinea, rhs = right scale.

Sources: Pacific Region Infrastructure Facility. 2016. *Pacific Infrastructure Performance Indicators* and Asian Development Bank estimates.

Figure 3: Planned Independent Power Producer Capacity (megawatt)



Source: Pacific Power Association. Second Pacific Energy Investors Forum. 2016.

ADB ENERGY OPERATIONS IN THE PACIFIC

ONGOING	TOTAL
7 technical assistance 15 projects	\$29M \$426M
PLANNED	TOTAL
19 projects	\$1,080M

Electricity System Strengthening and Sustainability (TA)	\$1M
Electricity System Strengthening and Sustainability	\$15M

Renewable Energy	\$6M
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Yap Renewable Energy Development	\$9M
Renewable Energy Development	\$45M

Electricity Supply Security and Sustainability	\$9M
Renewable Energy	\$38M

Majuro Power Network Strengthening	\$2M
Majuro Power Network Strengthening (TA)	\$1M
Energy Security	\$5M
Waste to Energy	\$4M
Majuro Power Network Strengthening	\$18M

REGIONAL

Supporting the Pacific Renewable Energy Investment Facility (TA)	\$6M
Capacity Building and Sector Reform for Renewable Energy Investments in the Pacific (TA)	\$5M
Establishment of the Pacific Region Infrastructure Facility Coordination Office (TA)	\$13M
University of the South Pacific Campus Smart Grid	\$22M

South Tarawa Water Supply (PV Solar Component)	\$4M
Kiribati Renewable Energy	\$5M

Renewable Energy	\$6M
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Renewable Energy	\$33M
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Town Electrification Investment Program (tranche 1)	\$58M
Town Electrification Investment Program (tranche 2)	\$61M
Improved Energy Access for Rural Communities	\$5M
Port Moresby Power Grid Development	\$66M
Power Sector Development Investment Program (TA)	\$2M
Power Sector Development Program (MFF: tranche 1)	\$221M
Power Sector Development Program (MFF: tranche 2)	\$272M

Provincial Renewable Energy	\$12M
Solar Power Development	\$8M
Tina River Hydropower	\$215M

Energy Access	\$12M
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Support for Energy Sector Regulatory Capacity and Electrification Investment Planning (TA)	\$1M
Electricity Strengthening	\$35M

Power Sector Expansion	\$99M
Renewable Energy Development and Power Sector Rehabilitation	\$27M
Multipurpose Hydropower	\$95M

Outer Island Renewable Energy	\$17M
Cyclone Ian Recovery	\$9M
Renewable Energy	\$56M
Outer Islands Renewable Energy	\$10M
Cyclone Gita Recovery	\$8M

■ Ongoing
 ■ Planned
 M = million, MFF = multitranchise financing facility, PV = photovoltaic, TA = technical assistance.

Printed in April 2018.

Source: ADB estimates.

Regional Initiatives

The **Pacific Region Infrastructure Facility (PRIF)**, launched at the 2008 Pacific Islands Forum, is a multi-partner coordination, research, and technical assistance (TA) facility.¹ The corresponding PRIF Coordination Office was established through the Asian Development Bank (ADB) TA for the Establishment of the Pacific Region Infrastructure Facility Coordination Office.² The purpose of the TA is to improve the development effectiveness and the sustainability of infrastructure investments by (i) strengthening coordination among development partners; (ii) improving policies and regulations; (iii) improving infrastructure cofinancing; and (iv) improving the capacity of Pacific island countries (PICs) to prioritize, plan, develop, and maintain infrastructure investments.

The facility covers 13 PICs and supports five economic infrastructure subsectors (energy; information and communication technology; road, aviation, and maritime transport; urban development; and water and sanitation).³ An Energy Sector Working Group—comprising sector experts and PRIF partners—meets up to four times a year to review the TA and knowledge product activities of the PRIF Coordination Office, and serves as a community of practice for the PRIF partners.

The **Pacific Renewable Energy Investment Facility**, approved by ADB in May 2017, will finance a series of individual renewable energy projects in 11 smaller PICs (PIC-

11).⁴ It will streamline ADB's internal procedures, which will enhance its ability to process small-value projects in the PIC-11 faster and with lower transaction costs. The facility will support the PIC-11 in transforming their power sectors from diesel to sustainable renewable energy generation sources; and will support regional approaches for energy sector reform, private sector development, and capacity building. The facility will finance projects with an overall estimated cost of \$750 million, including an estimated \$500 million from cofinancing sources and an estimated \$50 million from government counterpart financing. ADB will consider projects to be financed by the facility up to July 2022, while the implementation period will be until July 2025.

The facility's impact will be improved energy security in the Pacific; its outcome will be increased generation of clean energy at lower costs. Output 1 is estimated to include (i) installation of 80 MW of combined solar, wind, and hydropower generation capacity; (ii) installation of 30 MW battery storage; (iii) construction or rehabilitation of 300 kilometers of transmission and distribution lines; (iv) refurbishment of five diesel plants to improve efficiency; and (v) implementation of four rural electrification projects. Output 2 will support these activities through energy sector reforms, the promotion of private sector engagement, the preparation of further investment channels, and the dissemination of best practices and lessons learned. The facility will foster regional economic development through improved energy infrastructure, and more efficient donor support.

University of the South Pacific Campus Smart Grid Project

The proposed \$22 million project for 2019 approval will develop 5.5 megawatts (MW) of solar photovoltaic power generation facilities and 7 megawatt-hours (MWh) of battery storage systems in six campuses of the University of the South Pacific. The University of the South Pacific, an intergovernment organization owned by 12 countries, is the premier third level educational institution in the region with over 29,000 students attending at 14 campuses. The proposed \$22 million project, for 2019 approval, will develop 5.5MW of solar photovoltaic power generation and 7 MWh of battery storage system in campuses in Fiji, Kiribati, the Marshall Islands, Samoa, Tonga, and Vanuatu. The project will also include the installation of smart grid systems, provision of electric transport (on Fiji campus), and capacity building.

¹ The PRIF partners comprise (i) ADB, (ii) the Government of Australia, (iii) the European Union, (iv) the European Investment Bank, (v) the Government of Japan, (vi) the Government of New Zealand, and (vii) the World Bank Group.

² The \$16 million regional TA is financed by ADB, the European Investment Bank, and the governments of Australia and New Zealand. (ADB. 2013. *Technical Assistance for the Establishment of the Pacific Region Infrastructure Facility Coordination Office*. Manila [TA 8345-REG]).

³ The 13 PICs are the Cook Islands, the Federated States of Micronesia, Fiji, Kiribati, the Marshall Islands, Nauru, Niue, Palau, Samoa, Solomon Islands, Tonga, Tuvalu, and Vanuatu.

⁴ The 11 participating countries are the Cook Islands, the Federated States of Micronesia, Kiribati, Nauru, Palau, the Marshall Islands, Samoa, Solomon Islands, Tonga, Tuvalu, and Vanuatu.

Cook Islands

The 2011 Cook Islands Renewable Energy Chart has set a target of 100% renewable energy by 2020. Progress towards the target is impressive with 4.2 MW of solar photovoltaic and new high-speed diesel engines designed for operation on biodiesel having been added to the previous 11.75 MW diesel system. Projects for additional solar photovoltaic arrays and battery storage systems are under implementation. The state-owned utility, Te Aponga Uira, is responsible for power supply to the island of Rarotonga, representing 90% of total country demand.

The active \$36 million **Renewable Energy Sector Project** is supporting the Cook Islands in achieving its goal by installing 2-megawatt (MW) solar photovoltaic arrays and battery energy storage systems totalling 7 MW/14 megawatt-hours.^a The battery storage systems, to be installed in Rarotonga, will allow the Te Aponga Uira system to absorb the intermittent solar output, while facilitating private sector investment in renewable energy.

^a Funded by the Asian Development Bank, with cofinancing from the European Union, the Government of the Cook Islands, and the Global Environmental Facility.



Aitutaki Power Supply Facility,
Cook Islands.

Fiji

Fiji has set the targets of 99% renewable energy generation by 2030, and a 100% electrification rate by 2020 requiring investments of approximately \$760 million over the coming decade.

The Fiji Electricity Authority is the sole entity authorized to generate, transmit, distribute, and sell electricity in the power sector. Installed capacity is over 250 MW using hydro, diesel, biomass, and wind resources.

Government priority actions in the energy sector include (i) expanding the role of the private sector in power generation, including the partial privatization of Fiji Electricity Authority; (ii) increasing the role of non-Fiji Electricity Authority renewable energy via small-scale systems; and (iii) restructuring regulatory arrangements to improve transparency and accountability, and to remove possible conflicts of interest.

ADB is providing a TA and developing an investment project.

The active technical assistance (TA), **Support for Energy Sector Regulatory Capacity and Electrification Investment Planning**, is supporting the Government of Fiji by developing (i) the institutional capacity for regulation of the electricity sector and (ii) a sector investment planning framework. The impact of the TA will be a resource-efficient, cost-effective, and environmentally sustainable energy sector; its outcome will be an improved framework for the development of Fiji's energy sector. The TA comprises two outputs: (i) capacity building for selected regulatory agencies and (ii) enhanced sector planning capacity at the relevant government department. The TA will review the existing legal and institutional frameworks, and identify a government agency to serve as a multisector regulatory body. The second output will consist of detailed recommendations for establishing the policy framework for the identification, selection, and implementation of rural electrification investments, and capacity-building support for accelerated investments in Fiji's rural electrification program.

Marshall Islands

The Marshall Islands' energy sector is led by the Ministry of Resources and Development, while the provision of electricity is the responsibility of two state-owned utilities. The Marshalls Energy Company supplies Majuro, Jaluit, and Wotje; and the Kwajalein Atoll Joint Utilities Resources, a water and electricity utility servicing the Kwajalein atoll, including the densely populated Ebeye island. Peak loads in 2015 were 8.6 MW for the Marshalls Energy Company and 2.1 MW for the Kwajalein Atoll Joint Utilities Resources. Approximately 75% of the Marshall Islands population has access to grid electricity; 92% in the urban areas of Majuro and Ebeye, and 32% in the rural outer islands (2012). Supply is 99% diesel based. The Marshall Islands adopted its National Energy Policy and Energy Action Plan in 2009 setting a 20% renewable energy generation target for 2020. The Marshall Islands' nationally determined contributions under the Paris climate accord commits the Marshall Islands to reduce its emissions from power generation to 55% by 2025 and 66% by 2030.

ADB is providing TA and investments for network rehabilitation and loss reduction, and a proposed investment to rehabilitate the Majuro tank farm. ADB is also investigating the opportunity for a waste-to-energy power plant on Majuro.

- The active **Majuro Power Network Strengthening** technical assistance (TA) is identifying approaches to increase the absorption capacity for renewables, and will deliver a road map for investments to increase the share of renewables in Majuro's energy mix. Preliminary findings under the TA indicate that Majuro's absorptive capacity for renewable energy generation has been reached, and that immediate investments should focus on its fuel storage facilities, generation plant, and portions of its distribution network. Feasibility studies under the TA suggest that the most technically and economically viable renewable energy generation sources for midterm investments include solar photovoltaic, waste to energy, and medium-scale wind.
- The active \$2 million **Strengthening Majuro Distribution Network Project** will fund the installation of an advanced metering infrastructure to enable the Marshalls Energy Company (MEC) to identify and reduce its network losses.
- The proposed \$5 million **Majuro Tank Farm Rehabilitation Project** will rehabilitate the existing facility, and address safety and security of supply issues while medium-term renewable energy options are being developed.
- The proposed \$4 million **Waste to Energy Project** is scheduled for 2019 approval.
- The proposed \$18 million **Majuro Power Network Strengthening, Phase 2** is scheduled for 2019 approval, and will include investments to further reduce MEC's network losses, increase renewable energy penetration, and other measures to improve MEC's operational and commercial performance.



Street lights in Majuro, Marshall Islands.

Federated States of Micronesia

The Federated States of Micronesia, spread across 607 islands in the West Pacific, is comprised of the states of Chuuk, Kosrae, Pohnpei, and Yap. Each state enjoys a high degree of autonomy from the central government regarding public services. Generation capacity is 18 MW of diesel, 1.5 MW of solar, and less than 1 MW each for wind and hydro. The National Energy Policy sets 2020 targets that renewable energy sources will be at least 30% of total electricity production, while electricity efficiency will increase by 50% and the rural electrification rate will reach 90%. ADB is implementing a project in Yap state and preparing a new \$45 million Renewable Energy Development Project for all four states.

- **Chuuk**, with a population of 48,000, comprises the main island of Weno and 15 groups of outlying islands. The Chuuk Power Utility Corporation operates a mainly diesel system (5.6 megawatts [MW]) with limited solar (65 kilowatts [kW]). State electrification rate is 26%, but is over 90% in the main island of Weno with rates approaching zero in outlying islands. The state government has prioritized improvement in electricity access.
- The proposed **Yap Renewable Energy Development Project** will improve access in outlying islands with the introduction of mini grids and solar home systems.
- **Kosrae**, with a population of 7,000, is comprised on a single island. The Kosrae Utility Authority operates a diesel (2.4 MW) and solar (350 kW) system with >96% electrification rate. The state government has prioritized increased generation from renewable energy, increasing electrification to 100%, and relocating assets as part of climate adaptation measure.
- The proposed project will (i) add a solar photovoltaic array and battery storage system, (ii) construct mini grid for remote community, and (iii) relocate an 11 kilovolts feeder.
- **Pohnpei**, with a population of 36,000, is composed of a single island. The Pohnpei Utilities Corporation operates a diesel (6.65 MW) and solar (600 kW) system, and hydro (750 kW) with electrification rate of 95%. The state government has prioritized increased generation using renewable sources.
- The proposed project includes (i) adding solar photovoltaic and battery energy storage and (ii) increasing hydroelectric sourced power.
- **Yap**, with a population of 11,000 is comprised of the 4 Yap islands and 15 remote islands and atolls. The Yap State Public Service Corporation operates an integrated diesel system (4.13 MW), solar (500 kW), and wind (825 kW) with 95% electrification on the main island and 70% over the state.
- The active \$11 million **Yap Renewable Energy Development Project** has financed the installation of solar, wind, and high-speed diesel capacity to the Yap State Public Service Corporation system.^a The project will increase the renewable energy share of generation to 18%.
- The proposed project will augment the renewable energy development project, finance additional solar and wind capacity, and add storage to enable increased renewable energy penetration.

^a Funded by the Asian Development Bank and Yap State.

Nauru

The state-owned Nauru Utilities Corporation is responsible for electricity and water supply. Electrification rate is 100% even while the installed capacity (99% diesel-based) is insufficient to meet the demand. The Nauru Utilities Corporation is working to build generation capacity and refurbish existing equipment to provide more reliable power supply. The Government of Nauru has set a renewable energy target of 50% by 2020.

ADB is providing TA and investment support.

- The active \$12 million **Electricity Supply Security and Sustainability Project** is improving the quality and reliability of electricity services in Nauru by increasing generation capacity to supply baseload and by refurbishing degraded assets. The project is supporting the Nauru Utilities Corporation with the installation of 6 megawatts of diesel-fired generation and the replacement of 11-kilovolt switchgear, allowing the utility to retire older generation assets and perform scheduled refurbishments of existing units.
- The active technical assistance for **Tariff and Subsidy Reform** is complementing investments in the Nauru Utilities Corporation's generation assets by assisting Nauru in gradually adjusting tariffs to support cost recovery and decrease subsidies.
- The proposed \$38 million **Renewable Energy Project** will add 10 megawatts of photovoltaic panels and associated battery energy storage systems. The project is slated for approval in 2019.

^a Funded by the Asian Development Bank, with cofinancing from the European Union and the governments of Australia and Nauru.

Palau

The state-owned Palau Public Utilities Corporation manages the electrical power and water and wastewater systems in Palau. Electrification rate is 100%. The Palau Public Utilities Corporation supplied its 2015 peak load of 12 MW using 34 MW of diesel power and 600 kilowatts (kW) of solar power. The government has set a 45% renewable energy target to be achieved by 2025.

The Asian Development Bank is in discussions with the Government of Palau on \$6 million Renewable Energy Project to be financed under the Pacific Renewable Energy Investment Facility.

Papua New Guinea

Papua New Guinea enjoys abundant fossil fuel (oil and gas) and renewable energy (hydro, biomass, and geothermal) resources even while only 12% of its population has access to electricity. The PNG Power Limited, the national state-owned utility, manages generation, transmission, and distribution over three main grids (Port Moresby, Ramu, and Gazelle), which serve the main urban canterers, and 19 isolated independent power grids servicing provincial canterers. PNG Power Limited installed capacity is approximately 260 MW (66% hydro, 44% thermal) with independent power producers adding 50 MW of thermal capacity. Approximately 280 MW is generated by the mining industry as captive power for their own consumption.

The Papua New Guinea Development Strategic Plan 2010–2030 identifies the government's priorities of a 70%

electrification rate and carbon neutrality by 2030. The 2011 Electricity Industry Policy focuses on (i) encouraging private sector participation, (ii) upscaling rural electrification, (iii) enhancing technical regulations, and (iv) sector coordination at the national level.

In 2014, PNG Power Ltd. developed the Fifteen Year Power Development Plan, which provides a road map for priority power infrastructure. In May 2016, the government developed 15-year National Distribution Grid Expansion Plan under ADB's support, which covers the technical, financial, and economic aspects of distribution expansion in PNG Power Ltd. canterers. The government has set a target of 70% electrification by 2030.

ADB energy projects cover an active portfolio of \$240 million and proposed investments of \$493 million.



Provincial Hydro power plant, Papua New Guinea.

- The active **Town Electrification Investment Program**, being implemented under a multitranche financing facility over two tranches, will improve power supply in urban centers by adding renewable energy sources of generation and extending the distribution network. The \$73.77 million tranche 1 covers the construction of Bialla-Kimbe 150-kilometer 66-kilovolt transmission lines and Divune 3-megawatt (MW) hydropower plant.^a The \$76.6 million tranche 2 covers the construction of Ramazon 3 MW hydropower plant, and the rehabilitation of Yonkti Toe 18 MW hydropower plant and Warangoi 10 MW hydropower plant.^b
 - The active \$83 million **Port Moresby Power Grid Development Project** will improve key power infrastructure assets, which will enhance energy efficiency and provide access to renewable power.^c
 - The proposed \$493 million second multitranche financing facility will increase the grid penetration to approximately 19% by 2028, and replace diesel generation with renewable clean energy sources in provincial centers. The program will enhance the PNG Power Limited's operational efficiency and build institutional capacity in the Department of Petroleum and Energy. It will also support renewable energy policy framework and create an enabling environment for the private sector to mobilize in off-grid areas. Tranche 1 is estimated at \$221 million for 2019 approval with tranche 2 estimated at \$272 million for 2021 approval. The proposed \$4 million technical assistance for Power Sector Development Program is linked to tranche 1.
- ^a Funded by the Asian Development Bank (ADB) and the governments of New Zealand and Papua New Guinea (PNG).
^b Funded by ADB and the Government of PNG.
^c Funded by ADB, the Japan Fund for Poverty Reduction, and the Government of PNG.
^d Funded by ADB and the Government of PNG.

Samoa

Samoa is comprised of two main islands, Savaii and Upolu, where over 95% of the 195,000 population live, with seven smaller surrounding islands. Electrification rate is 97%. Fuel mix for electricity generation for financial year 2015/16⁵ was diesel (67%), hydro (24%), and solar (8%). The Samoa Energy Sector Plan has set a target of 100% renewable energy share of electricity generation to be achieved by 2025.

The state-owned Electric Power Corporation is responsible for electricity supply with independent power producers supplying 5% of total energy from solar farms. The government anticipates that, with the successful implementation of new independent power producers, completion of refurbishment of damaged hydro plants, and commissioning of new micro hydro plants in the next financial year, the goal of reaching 100% renewable energy for power generation is achievable.

- The active **Solar Power Development Project** is providing a \$3 million loan to independent power producer, Sun Pacific Energy, to expand its existing 2.2 megawatts (MW) solar farm. The project currently sells 3.5 million kilowatt-hours of solar power per year to the Electric Power Corporation (EPC). With the planned expansion, the energy yield is expected to increase up to 6 million kilowatt-hours per year.
- The active \$32 million **Renewable Energy Development and Power Sector Rehabilitation Project** is supporting Samoa's energy sector by increasing power generation from renewable energy sources, rehabilitating damages to power infrastructure caused by Cyclone Evan, and increasing the power sector's resilience to future natural disasters.^a The project will assist EPC to rehabilitate and reconnect 4.69 MW of hydropower capacity to the existing grid; it will also build and connect an additional 1.49 MW of hydropower to the network.
- The active \$100 million **Power Sector Expansion Project** will support the Government of Samoa in achieving its power sector goal to provide sustainable and reliable electricity services to all consumers at affordable prices.^b To achieve this, the Asian Development Bank is working with EPC to build institutional capacity, improve financial performance, and deliver a higher quality of services to consumers. The project has implemented 29 subprojects, as it approaches successful delivery of all outputs. Subprojects focus on upgrading transmission and distribution lines, installing prepayment meters, constructing and rehabilitating diesel-generation plants, and developing renewable energy resources.
- The proposed \$95 million **Aloao Multi-Purpose Dam Project** is scheduled for 2019 approval.

^a Funded by the Asian Development Bank, the Clean Energy Fund, the European Union, and the governments of New Zealand and Samoa.

^b Funded by the Asian Development Bank, the Japan Bank for International Cooperation, and the governments of Australia and Samoa.

Solomon Islands

Solomon Islands consists of 6 major islands and nearly 1,000 smaller islands covering a land area of 28,000 square kilometers with population of 600,000. The national energy balance is dominated by biomass reflecting a low electrification rate of approximately 16%. The Solomon Islands National Energy Policy targets increasing the urban electrification rate to 100% and the rural rate to 35% by 2020 and increasing the renewable share of electricity generation to 79% by 2030. In 2016, generation was mainly diesel based with a renewable share of less than 1%.

The state-owned Solomon Islands Electricity Authority, trading as Solomon Power, is responsible for electricity supply. Installed generation capacity in the capital Honiara is 26 MW of diesel plants, while a 1 MW photovoltaic plant was added in 2016. Peak load in Honiara was 14.3 MW in 2015. Combined installed capacity in the provincial canters is 4 MW.

- The active **Provincial Renewable Energy Project** is increasing access to clean power in Malaita where 25% of the population live, but with only 2% of total generation capacity. It is doing so by assisting Solomon Power with the installation of a hydropower generation plant to replace the existing diesel plant. The project will also extend the distribution network to households in peri-urban areas.
- The active **Solar Power Development Project** is installing 2 megawatts of grid-connected solar power and associated battery systems. A total of five solar-diesel hybrid systems will be installed at different sites, and will replace between 66% and 87% of diesel generation in the five provinces—Kirakira (320 kilowatts [kW]), Lata (290 kW), Malu'u (140 kW), Munda (1,000 kW), and Tulagi (250 kW).
- The proposed \$214 million **Tina River Hydropower Plant Project** will increase the share of renewable energy supplying Honiara's electricity grid. The 15-megawatt plant is expected to meet approximately 65% of Honiara's projected electricity demand in the commissioning year of 2022. This will provide sufficient flexibility to the power system to permit further integration of renewable energy, without the need for additional battery storage systems. The project is scheduled for 2018 approval.

⁵ Samoa financial year is 1 June 2015 to 31 May 2016.

Timor-Leste

The Government of Timor-Leste has prioritized the development of the power sector as a key driver of economic growth and poverty reduction. Since 2008, the government, through its ministerial department responsible for electricity, Electricidade de Timor-Leste, has invested nearly \$1 billion in the construction of three diesel power plants (with installed capacity of 280 MW), and a countrywide 150-kilovolt (kV) transmission and 20 kV distribution system. Network electricity access rates have increased from 22% to 71%, and Electricidade de Timor-Leste possesses sufficient installed capacity to meet demand through at least 2030 (base demand growth scenario of 5% per annum). However, the cost of providing electricity is extremely high. In 2016, the government spent \$80.9 million to fund operating costs in the power sector, while collecting only \$27.7 million. Reducing network losses and improving revenue collection performance are crucial to reducing the burden on the state budget.

The Asian Development Bank is working with the Government of Timor-Leste to identify and finance investments that will reduce costs and improve Electricidade de Timor-Leste's commercial performance. The proposed \$15 million **Electricity System Strengthening and Sustainability Investment Program** for 2020 approval will provide targeted investments in the utility's network infrastructure, and improve the operation and maintenance of three power plants.

The program will make sequenced investments in the electricity network, revenue management systems, and generation assets. This approach will lead to improved service reliability, reduced system losses, and overall reduction in cost of service (everything else being equal). The impact of the proposed investment program will be access to reliable electricity supplies. The outcome will be an improved level of service and fiscal performance of Electricidade de Timor-Leste.

The investment program will accomplish these by (i) reengineering current business practices; (ii) modernizing and augmenting the distribution network, and (iii) installing meters at the feeder and customer levels.

Tonga

Tonga comprises 176 islands spread over the five island groups of Tongatapu, 'Eua, Ha'apai, Vava'u, and Niuas. Electrification rate is 89%. The state-owned power utility, Tonga Power Ltd., is responsible for on-grid supply to the four island groups (excluding Niuas) where majority of the 104,000 population live. The Ministry of Lands, Survey and Natural Resources is responsible for off-grid services.

The Tonga Energy Road Map sets out the government target to improve energy efficiency and increase renewable energy share of electricity generation to 50% by 2020 and 70% by 2030. In response to government policy, Tonga Power Ltd. has moved from a 100% diesel-powered utility in 2011 to a diesel and solar system in 2016 comprising 14 MW diesel power capacity, 4.2 MW of solar photovoltaic, while over 500 kW of private distributed generation has been connected. In 2016, Tonga Power Ltd. had a 22% renewable energy share, while its 2015 peak load was 8.5 MW. Options to add further solar and new wind farms to meet government renewable targets are under investigation.

- The active \$10 million **Cyclone Ian Recovery Project** restored access to electricity and increased the power system's resilience to future climatic shocks after powerful stormwaters passed directly over Ha'apai, which left the island without power.^a
- The active \$18 million **Outer Island Renewable Energy Project** is constructing solar generation systems on nine of Tonga's outer islands by adding 1.3 megawatts of solar photovoltaic to on-grid and off-grid systems.^b The project also strengthens institutional capacity for the operation and maintenance of solar power and integrated diesel systems.
- The proposed \$7 million of additional financing for the **Outer Island Renewable Energy Project**, to upgrade the electricity grid on Vava'u, is scheduled for 2018 approval.
- The proposed \$8 million **Cyclone Gita Emergency Project** is scheduled for 2018 approval.
- The proposed \$43 million **Renewable Energy Project**, to add grid-connected solar photovoltaic and battery energy storage systems and off-grid diesel and solar hybrid systems, is scheduled for 2018 approval.

^a Funded by the Asian Development Bank, with cofinancing from governments of New Zealand and Tonga.

^b Funded by the Asian Development Bank, with cofinancing from European Union, the Danish International Development Agency, and the governments of Australia and Tonga.

Tuvalu

The energy sector is managed by the Department of Energy within the Ministry of Public Utilities while the state-owned Tuvalu Electricity Corporation is responsible for managing and operating the power system, which supplies 98% of the 11,000 population over eight islands. The Tuvalu Electricity Corporation 2015 peak load of 2.1 MW was supplied by diesel plants and renewable energy plants with renewable sources supplying 22% of total energy. The government has set a target to supply 100% of electricity from renewable sources by 2025. Solar photovoltaic is expected to make up the majority of new renewable sources, albeit availability of land is a constraint. Wind power is under investigation.

The governments of New Zealand and Abu Dhabi have financed various solar projects totaling 1.5 MW, while a further 1 MW solar and wind project with battery storage is under implementation by the World Bank.

The Asian Development Bank is developing a \$12 million **Renewable Energy Project** for 2019 approval.

Vanuatu

Vanuatu is an archipelago with a population of 234,000 people spread across 83 volcanic islands in the West Pacific. The electrification rate is 33%. In accordance with the Vanuatu National Energy Road Map, the Government of Vanuatu has set targets of increasing electrification to 75% and renewable energy share of electricity generation to 65% by 2020.

Two private utilities manage and operate power sector assets owned by the government. Union Electrique du Vanuatu Limited operates concessions on Efate, Malekula, and Tanna islands. The Vanuatu Utilities & Infrastructure Limited operates the Luganville Electricity Concession on the island of Espiritu Santo, Vanuatu.

Generation fuel mix includes diesel, wind, solar, hydro, and biofuels with a 2016 renewable share of 20% for the Union Electrique du Vanuatu Limited concession areas.

The active \$15.1 million **Vanuatu Energy Access Project**, funded by the Asian Development Bank and the Government of Vanuatu, will increase electrification rates on the country's two largest islands (Malekula and Espiritu Santo), and add renewable power generation capacity on Malekula. The project's main activities include the construction of a run-of-river hydropower plant, and the expansion of the distribution grid. Commissioning of the Brenwe hydropower plant will add 400 kilowatts of renewable energy capacity, and is expected to account for more than 90% of the total generation mix on Malekula through 2040. A 72-kilometer expansion of Vanuatu's distribution network will connect approximately 1,050 new households, increasing grid access from 8% to 14% in Malekula, and from 22% to 29% on Espiritu Santo.



Santo solar panels in Vanuatu.

FEDERATED STATES OF MICRONESIA

Yap Renewable Energy Development Project

The Federated States of Micronesia (FSM), a 607-island nation that is one of the most remote on earth, encompasses nearly a million square miles of ocean north of the equator with a population of 104,000. Yap, one of the four states of the FSM with a population 11,000, is comprised of 4 Yap islands and 15 remote islands and atolls. Yap suffered from an overreliance on diesel power generation resulting in high power tariffs, which constrained development. The Yap Renewable Energy Development Project was designed to diversify Yap state's fuel mix, and improve energy security. Phase 1 of the project was approved in 2014 and completed in 2018 with phase 2 to be approved in 2019.

The \$11 million phase 1 installed an integrated solar, wind, and high-efficiency diesel power system for the power utility, the Yap State Public Service Corporation. The project supported the installation of (i) three wind turbines totalling 825 kilowatts (kW) designed for typhoon conditions; and (ii) 300 kW capacity solar panels, which are installed on government buildings, and (iii) two fuel-efficient diesel generators, with capacities of 1.65 megawatts and 830 kW, that replaced aging ones. The solar photovoltaic systems generate an estimated 498 megawatt-hours per year and account for about 3.83% of Yap's current energy mix. The two high-speed diesel generators have been installed to allow for greater penetration of renewable energy, and to increase system efficiency. An integrated control system maximizes output from renewable resources, while keeping diesel consumption to a minimum. The project, together with previously installed 200 kW solar panels, contributes an 18% share of renewable energy generation capacity to Yap's total energy mix.

Phase 2 of the project will (i) expand solar photovoltaic capacity with an additional 1,200 kilowatts peak on floating platforms on Yap's main municipal water storage reservoir; (ii) expand wind capacity by 550 kW; and (iii) add short-term energy storage of 1.5 megawatts for 5 minutes to integrate additional renewable energy into the grid. The completed project will assist Yap State in surpassing its 30% renewable energy target, and contribute to the FSM's clean energy goals. Renewable energy generation will increase to 38%, with a reduction of 1.7 million kilograms of carbon dioxide equivalent per year (1.1% reduction in the FSM's greenhouse gas emissions as of 2000).

Floating Solar Photovoltaic Will Conserve Water in the Federated States of Micronesia

Yap has experienced long periods of drought, which are attributable to the effects of climate change. The floating solar photovoltaic will bolster Yap's water security, while canceling the need to use limited land area. Covering a large portion of the Yap State Public Service Corporation's main storage reservoir with floating solar photovoltaic panels (and other covering methods for the balance of the surface area) will reduce the rate of evaporation. Preliminary estimates suggest that this approach will save approximately 46,000 cubic meters of surface water per year, or roughly 16% of annual reservoir production.

Source: Consultant estimates.



Electrical posts in a town in Chuuk, FSM.

NAURU

Electricity Supply Security and Sustainability Project

Access to grid electricity across Nauru's population is universal. However, the mainly diesel generation capacity does not meet demand. While the Government of Nauru is working to reach a target of 50% of electricity generated from renewable sources by 2020, as an immediate priority, it identified the need to add new and rehabilitate existing diesel capacity to improve service quality and reliability.

The \$13 million Electricity Supply Security and Sustainability Project is financed by the Asian Development Bank, the European Union, and the governments of Australia and Nauru, and is meeting the government's objectives by increasing generation capacity and assisting in sector reform.

The project has installed 6 megawatts of diesel-fired generation and replaced 11 kilovolts switchgear, allowing the utility to retire older generation assets and perform scheduled refurbishments of existing units. This has increased generation efficiency by 20%—from 3.4 kilowatt-hours per liter of fuel consumed to 4.1 kilowatt-hours—and decreased power outages by more than 50%. The project's outcome has also increased reliability, lower cost, and greater sustainability of power generation in Nauru.

The linked technical assistance (TA) for Tariff and Subsidy Reform has assisted Nauru in gradual sector reform to support cost recovery and decrease subsidies. The TA assisted the National Utilities Corporation to (i) analyze long-term marginal costs, (ii) identify the value of all existing subsidies provided to NUC by the government, (iii) propose options for restructuring tariffs to cover generation costs, and (iv) propose subsidy approaches for reducing financial burdens on the residential sector. The TA will support the government's efforts to render NUC financially viable and sustainable in the long run.

The project was completed in 2018.



Diesel power plant,
Nauru.

PAPUA NEW GUINEA

Kimbe-Bialla Transmission Line

The Asian Development Bank (ADB) has supported the Government of Papua New Guinea and the Papua New Guinea Power Limited to construct a 150-kilometer high voltage transmission line linking the West New Britain provincial capital Kimbe and the township of Bialla. The transmission line will connect renewable energy from existing hydropower and biomass facilities and bring electricity to households, schools, and medical clinics along the alignment.

The project will connect the existing Lake Hargy hydropower plant near Bialla with spare capacity (1 megawatt) back to the provincial capital of Kimbe to replace expensive diesel-generated power. The project will also connect a palm oil plantation, which generates power from waste biomass (3 megawatts) for sale back to the grid. It is estimated that the project will replace between 60% and 80% of diesel-generated power in Kimbe with clean and reliable renewable energy.

The project is significantly improving access to energy for the communities along the transmission line, and is bringing electricity to over 8,000 residents for the first time. Additionally, 46 school buildings, 4 church buildings, and 2 medical clinics will be electrified.

Construction commenced in July 2016, and is scheduled for completion in July 2017. The project is supported through ADB-administered Town Electrification Investment Program, a \$150 million multitranches financing facility program. The facility is supporting a range of investments in new and refurbished hydropower plants and transmission and distribution powerlines, including:

- Divune hydropower plant in Oro Province,
- Ramazon hydropower plant in the Autonomous Region of Bougainville,
- Lake Hargy hydropower plant,
- Warangoi hydropower plant, and
- Yonki Toe-of-dam hydropower plant.



Transmission lines installed in Kimbe, Papua New Guinea.

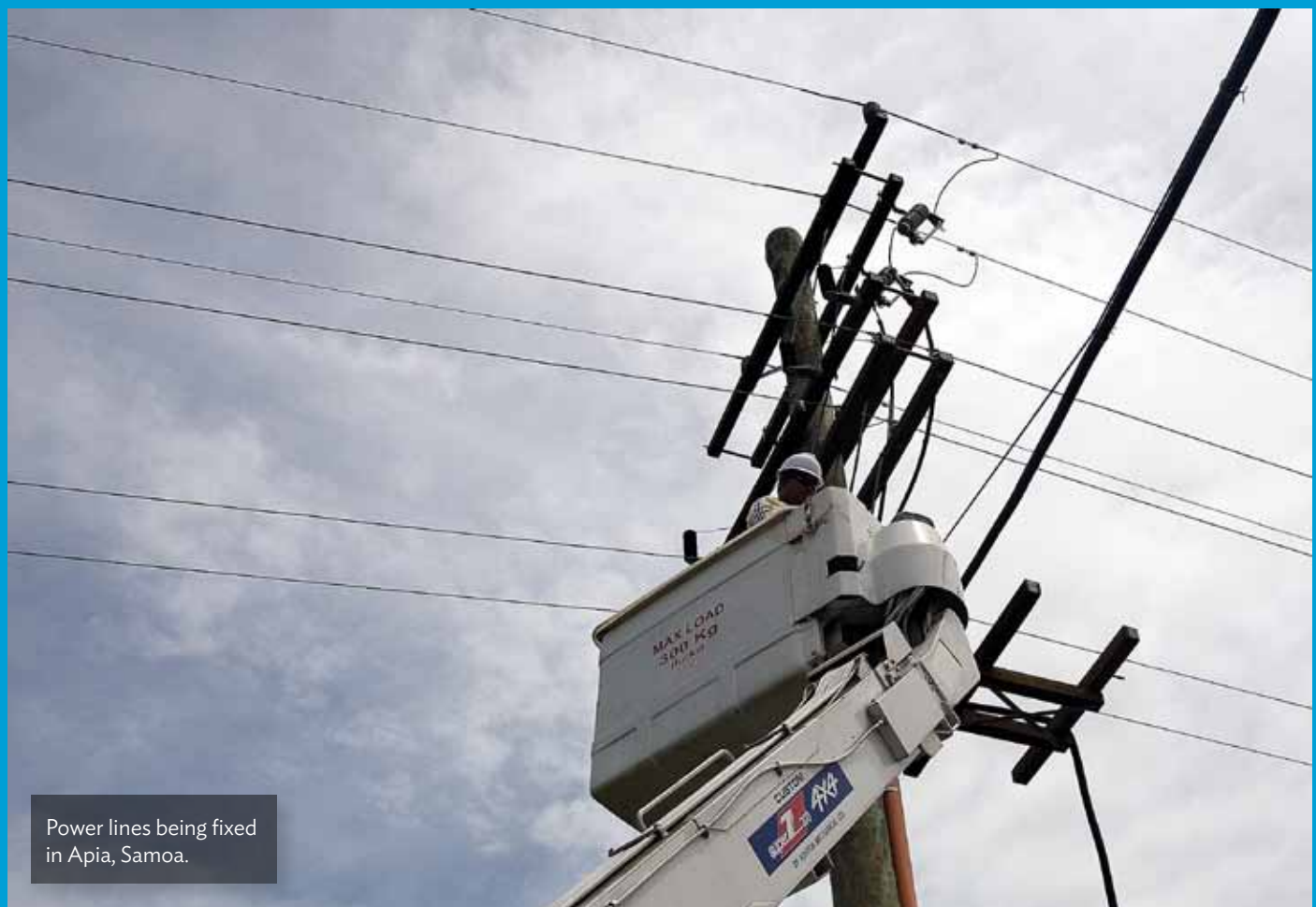
SAMOA

Transmission and Distribution Upgrade

The Asian Development Bank (ADB) has supported the Government of Samoa and the Samoa Electric Power Corporation to upgrade the transmission and distribution system in Samoa. This has included the construction of 16 transmission and distribution subprojects to improve the reliability of the network, reduce system losses, and expand the grid. The total cost of the subprojects is \$14.2 million. The works have resulted in 2,000 kilometers (km) of new or upgraded transmission and distribution lines as well as four substations. The following subprojects were completed:

- upgrade and construction of 4 substations, including Fiaga, Fuluasou, Salelologa, and Tanugamanono substations;
- Savaii low voltage, consisting of replacement of 800 km low voltage distribution;
- Upolu low voltage, consisting of replacement of 1,220 km low voltage distribution;
- hospital feeder, Alaoa and Puapua feeders, consisting of 106 km of 22-kilovolt (kV) power lines;
- Fuluasou Substation to Apia Wharf Area 22 kV Underground Cable Project, consisting of 4 km underground power lines;
- Fiagi to Tanugamanono 33 kV Underground, consisting of 26 km of 33 kv transmission line; and
- installation of SCADA monitoring system.

The project was supported through the ADB-administered Power Sector Expansion Project, which is a \$100 million project to support the rehabilitation and expansion of the Samoa power sector by the Samoa Electric Power Corporation. The project has about 29 subprojects, including the upgrade of transmission and distribution lines, construction and rehabilitation of diesel generation, development of renewable energy resources, and installation of prepayment meters. The project is funded by ADB and cofinanced by the Japan International Cooperation Agency and the Government of Australia.



Power lines being fixed in Apia, Samoa.

TONGA

Outer Island Renewable Energy Project

Tonga comprises five island groups—Tongatapu, ‘Eua, Ha’apai, Vava’u, and Niuas—with a total of 176 islands. Although 89% of Tonga’s households enjoy access to grid electricity, 90% of power generation relies on imported diesel. Renewable energy and improvements to energy efficiency provide opportunities to lower cost, enhance energy security, and decrease emissions.

The Government of Tonga has set targets of reducing fossil fuel imports by generating 70% of electricity from renewable sources by 2030, and improving efficiency by reducing losses from 18% in 2010 to 9% in 2020.

The \$18 million Outer Island Renewable Energy Project, financed by the Asian Development Bank, the European Union, the Danish International Development Agency, and the governments of Australia and Tonga, is supporting these goals by constructing 1.32 megawatts of solar generation systems on nine of Tonga’s outer islands. The project is helping Tonga to build photovoltaic systems into existing grids, rehabilitate and improve energy efficiency among distribution networks, and install photovoltaic systems into community-owned mini grids. The project is also increasing capacity for the operation and maintenance of solar power and integrated diesel systems.

The subprojects include:

- on-grid: connecting photovoltaic generators to existing electricity distribution networks on ‘Eua (0.2 megawatt peak [MWp]) and Ha’apai (0.55 MWp);
- mini grid: connecting photovoltaic generators to existing community-owned and community-managed mini grids on four Ha’apai outer islands, including ‘Uiha (100 kWp), Nomuka (70 kilowatts peak [kWp]), Ha’ano (70 kWp), and Ha’afeva (150 kWp);
- off-grid: expanding existing solar home system capacity in Niuafou’ou and Niuatoputapu (additional 0.18 MWp); and
- energy efficiency: upgrading existing power distribution networks on ‘Eua and Vava’u.

The project, which is due for completion in 2020, will deliver outcomes of optimized on-grid and off-grid generation systems and increased access to more affordable electricity generated by renewable energy resources. It will produce an ongoing impact of reduced dependence on imported fossil fuel for power generation.



Lifuka solar power plant,
Tonga.

About the Pacific Energy Update 2018

The Asian Development Bank (ADB) works across the Asia and Pacific region to strengthen communities and improve lives by supporting governments, businesses, and infrastructure to operate more effectively. Clean energy is an essential resource for driving low-carbon economic growth and for enhancing the quality of life for people in the region. The Pacific Energy Update 2018 describes ADB's work in the energy sector; it highlights how technical assistance and energy sector projects are helping to build resilient, low-carbon economies, while increasing access to clean, reliable power in the Pacific.

About the Asian Development Bank

ADB's vision is an Asia and Pacific region free of poverty. Its mission is to help its developing member countries reduce poverty and improve the quality of life of their people. Despite the region's many successes, it remains home to a large share of the world's poor. ADB is committed to reducing poverty through inclusive economic growth, environmentally sustainable growth, and regional integration.

Based in Manila, ADB is owned by 67 members, including 48 from the region. Its main instruments for helping its developing member countries are policy dialogue, loans, equity investments, guarantees, grants, and technical assistance.



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