PACIFIC ENERGY UPDATE 2017

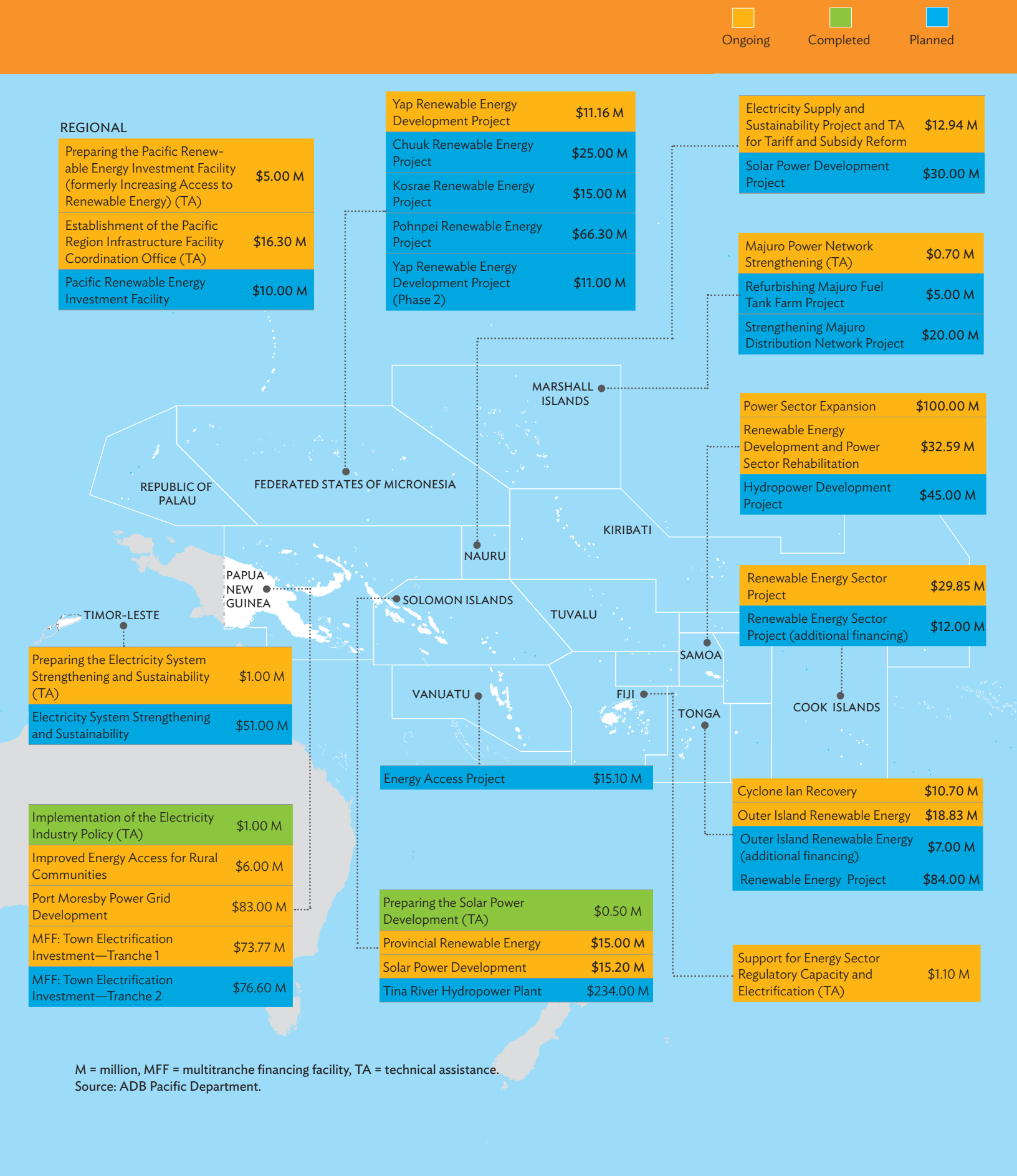
50 YEARS
ADB

Contents

Welcome to the 2017 edition of the Pacific Energy Update of the Asian Development Bank (ADB). Over the past year, ADB's Pacific Department has continued partnering with governments, communities, and the private sector, to improve the quality and availability of clean, affordable, and sustainable power. ADB's work in the Pacific energy sector is improving efficiency and scaling up the use of renewable energy, to drive resilient, low-carbon economic growth for a more prosperous Pacific. This update highlights some of our core activities, the impacts they produce, and what we aim to achieve in the future.

Xianbin Yao
Director General
Pacific Department

ADB Energy Operations in the Pacific



M = million, MFF = multitranche financing facility, TA = technical assistance.
Source: ADB Pacific Department.

Abbreviations

ADB	–	Asian Development Bank
CO_2e	–	Carbon dioxide equivalent
DMC	–	Developing Member Country
EDTL	–	Electricidade de Timor-Leste
EPC	–	Electrical Power Corporation [of Samoa]
FEA	–	Fiji Electricity Authority
FSM	–	Federated States of Micronesia
MEC	–	Marshalls Energy Company
NUC	–	Nauru Utilities Corporation
O&M	–	Operation and Maintenance
PIC-11	–	The 11 smallest Pacific island developing member countries
PNG	–	Papua New Guinea
PRIF	–	Pacific Region Infrastructure Facility
Solomon Power	–	Solomon Islands Electricity Authority
TA	–	Technical Assistance
TASF	–	Technical Assistance Special Fund
TBC	–	To be confirmed

Units and Measurements

km = kilometer

kV = kilovolt

kW = kilowatt

MW = Megawatt

MWp = Megawatt peak

Notes: In this publication, "$" refers to US dollars. Unless otherwise cited, the source for all tables and boxes is information provided by ADB's Pacific Department (PARD) to the author.

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Overview

Achieving reliable access to clean energy is essential to human development and low-carbon economic growth. As energy demand in the Asia and Pacific region grows rapidly, the Asian Development Bank (ADB) is helping to improve regional energy systems with a three-tiered energy approach. ADB seeks to (i) promote energy efficiency and renewable energy; (ii) maximize access to energy for all; and (iii) promote energy sector reform, capacity building, and effective governance. This approach leverages national and regional partnerships to strengthen energy systems, support low-carbon economic growth, and improve living conditions across ADB's Pacific developing member countries (DMCs).[1]

The Pacific Energy Update 2017 provides an overview of ADB's technical assistance (TA) and lending activities in the Pacific region. It highlights the impacts and outcomes of initiatives completed in 2016 and active in 2017, and provides an overview of proposed lending projects and TAs. ADB's activities in the region are helping to increase access to modern energy services, increase renewable energy generation capacity, ensure efficient use of resources, and strengthen public and private sector institutions.

Meeting Regional Energy Challenges with Cleaner, More Efficient Power

The Pacific region faces a unique set of energy challenges. Its limited supply of domestic fossil fuel resources has led to a historical dependence on imported fuels, and a corresponding vulnerability to fluctuating energy prices. At the same time, outdated power infrastructures, geographical constraints, small economies of scale, and limited generation capacity lead to high electricity tariffs (or costly subsidies), transmission and distribution losses, and low electrification rates in a number of Pacific developing member countries.

Pacific island countries possess a large potential to strengthen local economies and enhance quality of life by scaling up the use of renewable power and increasing energy efficiency. Governments, utilities, and development partners in the region are collaborating to enhance energy security, improve living standards, and build a more prosperous economy. The Asian Development Bank's work in the Pacific energy sector helps strengthen institutional capacity, introduce and deploy advanced technologies, and improve energy management to support countries in realizing crosscutting opportunities.

Solar system going up on Espiritu Santo, Vanuatu

ADB Photo Library

[1] ADB's 14 Pacific DMCs comprise the Cook Islands, Fiji, Kiribati, the Marshall Islands, the Federated States of Micronesia, Nauru, Palau, Papua New Guinea, Samoa, Solomon Islands, Timor-Leste, Tonga, Tuvalu, and Vanuatu.

Regional Initiatives

Regional approaches help deliver regional solutions. In addition to national and subnational lending and TA activities in its Pacific DMCs, ADB collaborates with stakeholders across the region to ensure that development efforts are well planned, and contribute to meeting shared goals.

The Pacific Region Infrastructure Facility (PRIF) was officially launched in August 2008 at the Pacific Islands Forum, and the corresponding PRIF Coordination Office was established through a TA in 2013.[2] The purpose of the TA for **Pacific Region Infrastructure Facility Coordination Office** is to improve 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 to prioritize, plan, develop, and maintain infrastructure investments.

The facility covers 12 Pacific island countries and supports 5 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.

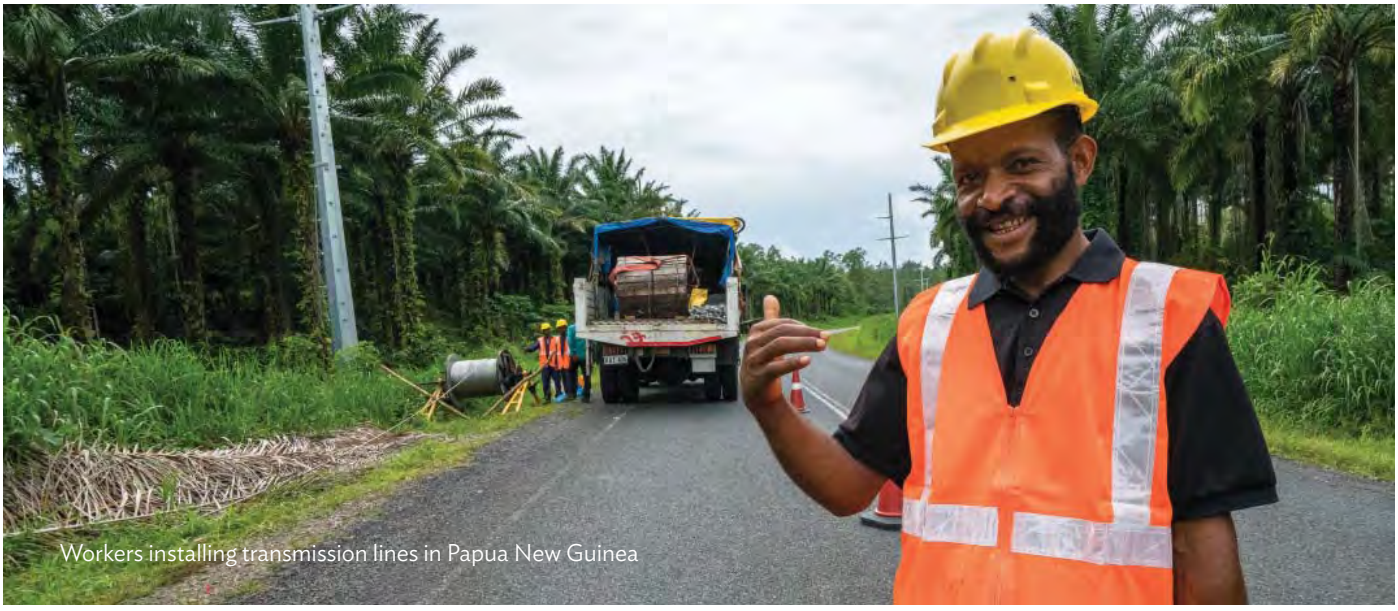
PACIFIC REGION INFRASTRUCTURE FACILITY COORDINATION OFFICE

Coordination among development partners in the Pacific region will be improved through the establishment of the Pacific Region Infrastructure Facility.

Executing agency	Asian Development Bank
Project officer	Roland Rajah
Status	Active
Funding by Source	
Australia (technical assistance grant)	$8.90 million
European Investment Bank	$1.10 million
New Zealand (grant)	$4.30 million
Asian Development Bank Technical Assistance Special Fund	$2.00 million
Total	**$16.30 million**

The Pacific Renewable Energy Investment Facility will streamline ADB and donor partner investments in the 11 smallest Pacific island developing member countries (PIC-11).[4] It will accomplish this by financing a series of individual renewable energy subprojects and overseeing energy sector reforms.

The PIC-11 are endowed with cost-competitive renewable energy resources, and each country has aggressive renewable



Workers installing transmission lines in Papua New Guinea

ADB Photo Library

[2] 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, including the International Finance Corporation.

[3] The 12 Pacific island countries are the Cook Islands, the Federated States of Micronesia, 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. Ten of the PIC-11 are included in the world's 25 smallest countries by size of population.

Improving Development Effectiveness through Regional Approaches

Energy sector development in the Pacific requires a different investment approach. The region's small economies and geographically dispersed populations typically necessitate a higher volume of relatively small investments, when compared with the lower volume of large projects being implemented in other developing member countries across Asia.

From the development perspective, working with small communities allows donor partners to provide rapid impact: Installing a 1 megawatt (MW) solar photovoltaic system can bring a rural town from 0% to 100% electrification in several months—immediately providing new opportunities for income generation, food storage, better health and education facilities, and other tangible improvements to quality of life.

However, meeting the energy needs of thousands of isolated island communities—spread across millions of kilometers (km) of ocean and hundreds of subnational jurisdictions and economies—provides a distinct set of challenges. The process for administering finance remains similar across projects of varying sizes, making it more time consuming to invest in a series of small unbundled projects than it is to finance a single, large-scale initiative. A regional approach to project financing can help capitalize on economies of scale and lower transaction costs.

To address this, the Asian Development Bank is collaborating with donor partners, the Secretariat of the Pacific Community, and national and subnational governments to pioneer swift and flexible financing approaches that will meet unique regional needs. Doing so will reduce the processing time for investments in order to deliver more impact faster. The Pacific Region Infrastructure Facility and the Pacific Renewable Energy Investment Facility are designed to improve development effectiveness across the Pacific region; they support deeper collaboration, greater private sector engagement, and more efficient project management.

PREPARING THE PACIFIC RENEWABLE ENERGY INVESTMENT FACILITY

The proposed financing facility will increase investment in clean energy across 11 Pacific developing member countries, and strengthen the Pacific energy sector.

Executing agency	Government counterparts, by country
Project officer	Anthony Maxwell
Status	Proposed
Funding by Source	
Asian Development Bank Technical Assistance Special Fund (for preparing the project)	$2.00 million
Clean Energy Fund under the Clean Energy Financing Partnership Facility (for preparing the project)	$3.00 million
Total	**$5.00 million**

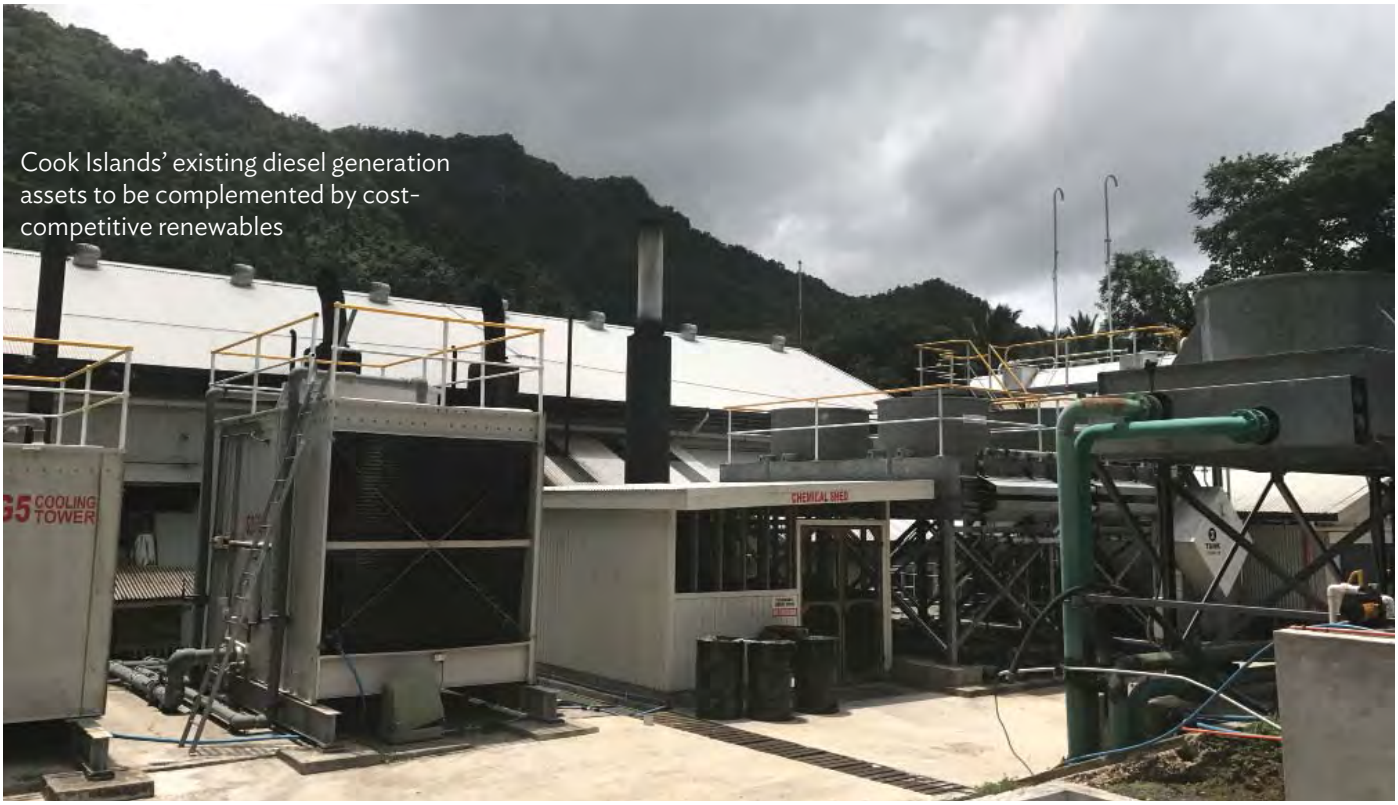
energy targets—ranging from 20% to 100% of total generation mix. However, uptake of renewables is restricted by lack of funding, capacity barriers, limited private sector investment, and the need for sector reform. The facility will address these barriers through grants and investments, and by improving efficiency to allow faster delivery of a larger number of small-scale projects. The number of subprojects processed in the PIC-11 annually is expected to increase by 30%.

The program has been designed to achieve a paradigm shift in the Pacific island region—helping rapidly move the PIC-11 from their current energy pathway (which is almost entirely dependent on fossil fuels) to one that is low-carbon, climate resilient, and provides greatly increased levels of energy access to marginalized populations.

The facility's impact will be the improved energy security in the Pacific; its outcome will be the increased generation of clean energy at lower costs. The facility anticipates providing development support for 20 separate renewable energy projects (and corresponding infrastructure works) over a 5-year period. 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 km 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.



Cook Islands' existing diesel generation assets to be complemented by cost-competitive renewables

ADB:Aivy Dizon

Cook Islands

In the Cook Islands, it is estimated that supplanting diesel power with renewables can reduce the cost of generation by up to 40%—significantly lowering household and business expenditures on electricity. In 2011, the government issued the Cook Islands Renewable Energy Chart, which sets a target of supplying 100% of inhabited islands with renewable energy by 2020.

The **Renewable Energy Sector Project** is supporting the Cook Islands in achieving this goal by installing solar-generating systems on five islands. Solar photovoltaic systems will provide a combined installed capacity of about 3 MW peak, coupled with batteries to store electricity from solar energy.

Additional grant financing will expand the scope of the project with the installation of three additional battery energy storage systems, contributing a preliminary capacity of 3.0 MW and 12.0 MW per hour. The proposed battery storage systems will allow the state-owned utility—Te Aponga Uira—to connect more intermittent electricity generated by solar and wind power, without negatively affecting the grid. Battery storage, in turn, will allow upscaling of private sector investment in renewable energy.

The project's impact will be increased energy security in an environmentally sustainable manner; its outcome will be a higher share of electricity generated by renewable energy resources. The project has two corresponding outputs. It is (i) developing five photovoltaic systems, coupled with lithium battery storage; and (ii) strengthening institutional capacity for future clean energy initiatives, through training programs and project management support.

RENEWABLE ENERGY SECTOR PROJECT

The installation of solar power systems will increase the penetration of renewable energy in the Cook Islands.

Executing agency	Ministry of Finance and Economic Management
Project officer	Woo Yul Lee
Status	Active
Funding by Source	
Asian Development Bank Ordinary capital resources (loan)	$11.19 million
European Union (grant)	$7.26 million
Government of the Cook Islands	$7.14 million
Global Environment Facility (grant)	$4.26 million
Green Climate Fund (grant)	$12.0 million
Total	**$41.85 million**

Fiji

Fiji's newly revised sector policy sets the target of 99% renewable energy generation by 2030, and a 100% electrification rate by 2020. Achieving these goals will require significant investment—approximately $760 million over the coming decade—as well as increased regulation of Fiji's electricity sector.

Currently, the Fiji Electricity Authority (FEA) is the sole entity authorized to generate, transmit, distribute, and sell electricity in the power sector. Although the Fiji Commerce Commission approves tariffs, the manner in which tariffs have been established has not offered the long-term certainty and predictability that private investors would prefer.

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

In 2015, the Government of Fiji requested assistance from ADB to develop the institutional capacity for regulation of Fiji's electricity sector, and to develop a sector investment planning framework. The corresponding TA—**Support for Energy Sector Regulatory Capacity and Electrification Investment Planning**—reflects the government's intentions for sector regulation, and will improve the environment for investment in Fiji's renewable energy sector.

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. It will also define the selected agency's capacity development requirements, and provide training and recommendations on legislation to enable the agency to discharge its functions.

The second output will consist of detailed recommendations for establishing the policy framework for the identification, selection, and implementation of energy investment options. The TA will develop the sector planning capacity within a selected government agency, and support it in assessing existing resources and investment needs.

SUPPORT FOR ENERGY SECTOR REGULATORY CAPACITY AND ELECTRIFICATION INVESTMENT PLANNING

The technical assistance will help the Government of Fiji to enhance energy sector regulation and management.

Executing agency	Asian Development Bank
Project officer	Michael Trainor
Status	Active
Funding by Source	
Asian Development Bank Technical Assistance Special Fund	$1.00 million
Total	$1.10 million

Construction team installing power lines in Fiji

ADB Anthony Maxwell

Marshall Islands

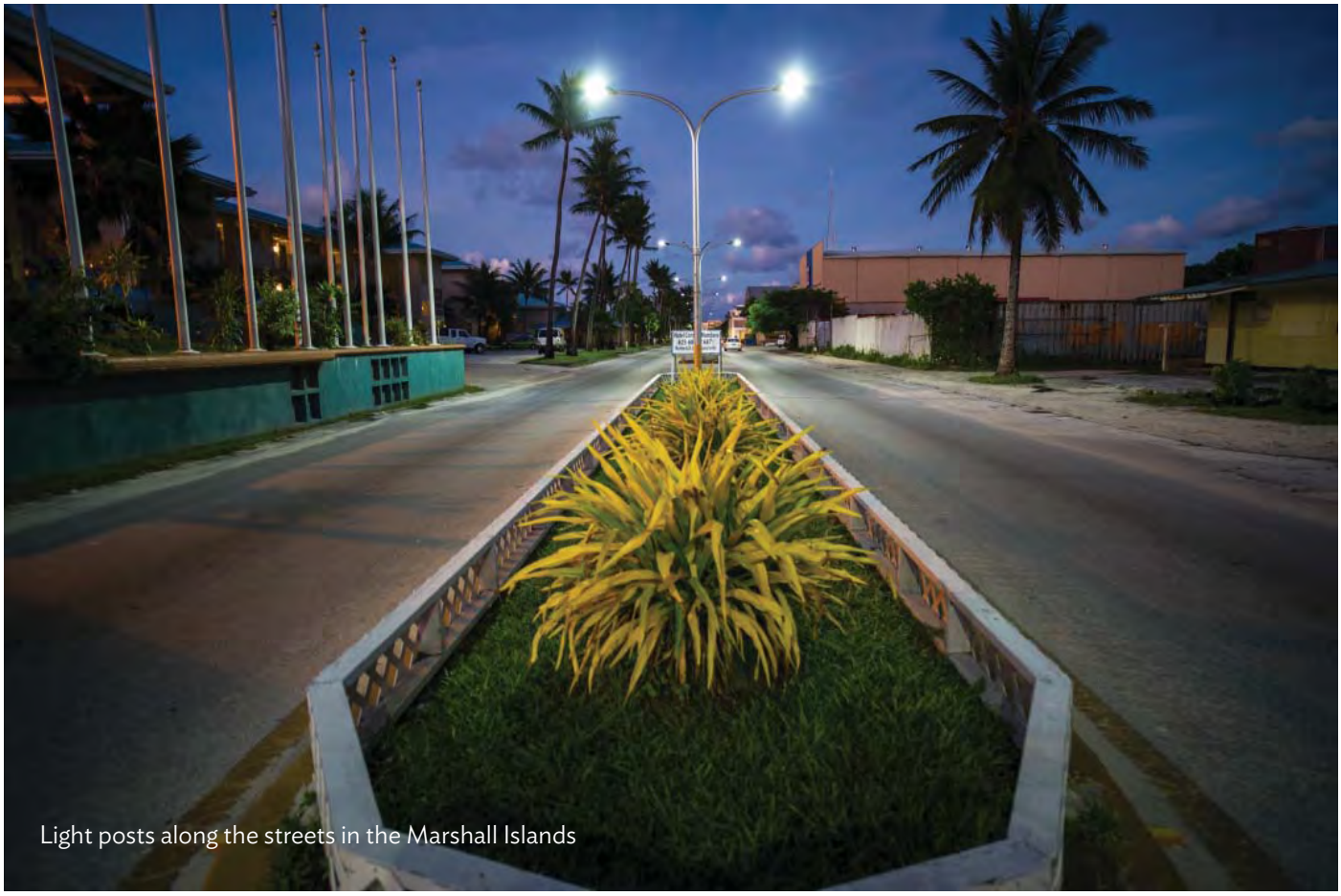
In 2009, the Marshall Islands adopted its National Energy Policy and Energy Action Plan, setting a 20% renewable energy generation target for 2020. Achieving this will require considerable investment in the power system on the country's capital, Majuro, which currently relies on diesel for power generation. Installing new renewable energy capacity in provincial centers will also play an important role in meeting the country's clean energy goals and increasing electrification rates.

MAJURO POWER NETWORK STRENGTHENING The technical assistance will identify viable options for scaling up renewable energy penetration in Majuro's electricity system.	
Executing agency	Asian Development Bank
Project officer	Michael Trainor
Status	Active
Funding by Source	
Clean Energy Financing Partnership Facility	$0.70 million
Total	**$0.70 million**

The distribution system of the Marshalls Energy Company (MEC) in Majuro is over 30 years old, and was not designed to accommodate renewable energy resources. Analysis conducted by the Japan International Cooperation Agency in 2015 revealed that the current system can accommodate no more than approximately 11.8% renewables—well below the national energy policy's 20% target—without upgrades to the Majuro power plant and distribution network.

The TA for **Majuro Power Network Strengthening** 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. The TA is also building the capacity of MEC and the Ministry of Resource and Development to assess, procure, operate, and maintain renewable energy generation assets.

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 (to address critical safety risks), 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 on Majuro include solar photovoltaic, waste to energy, and medium-scale wind.



Light posts along the streets in the Marshall Islands

ADB Photo Library

The TA's impact will be an increased contribution of renewable energy to the generation mix, improved service reliability, reduced reliance on imported fossil fuels, a lower cost of electricity services, and improved sustainability of MEC's operations through improved management practices. The outcome will be MEC's adoption of a detailed investment plan, which will support a pipeline of renewable energy and network development projects in Majuro.

The proposed **Strengthening Majuro Distribution Network Project** builds on research and capacity building carried out under the TA for Power Network Strengthening, and will oversee improvements in Majuro's distribution network, as well as the addition of renewable energy generation capacity. The proposed activities include:

(i) upgrading the distribution network by replacing conductors and transformers to reduce system losses,
(ii) replacing degraded diesel generators with appropriately sized units to allow more intermittent power generation from solar photovoltaic and other renewable energy sources,
(iii) installing a new power plant control and communication system to optimize distributed generation dispatch and reduce curtailment,
(iv) installing flywheel and battery systems to provide short- and long-term storage to ensure grid stability and maximize renewable energy generation, and
(v) installing approximately 2 megawatt-peaks (MWp) of solar photovoltaic panels.

These activities will increase the efficiency of Majuro's power network and reduce distribution losses from 16% to 10%. They will also increase the power network's absorptive capacity to integrate renewable energy generation—from the current 11.8% to 38.6%—thereby enabling future incremental investment. The project is expected to contribute an overall national emission reduction of 5.3%.

STRENGTHENING MAJURO DISTRIBUTION NETWORK PROJECT

The proposed project will improve Majuro's distribution network and install new renewable energy generation capacity.

Executing agency	Asian Development Bank
Project officer	Michael Trainor
Status	Proposed
Funding by Source	
Asian Development Bank Special Funds resources (grant)	$2.00 million
Government of the Marshall Islands	$2.00 million
Cofinancing (TBC)	$16.00 million
Total	**$20.00 million**

REFURBISHING MAJURO FUEL TANK FARM

The proposed project will identify and invest in solutions to address environmental and safety risks with resilient infrastructure.

Executing agency	Marshalls Energy Company
Project officer	Michael Trainor
Status	Proposed
Funding by Source	
Asian Development Fund (grant)	$5.00 million
Total	**$5.00 million**

Addressing Infrastructure Needs to Support Environmental Safety

Majuro houses the largest fuel storage facility in the Central Pacific. The facility was constructed in 1981 to meet increasing electricity demand, and as a strategic fuel storage site for the US Navy. Nearly four decades later, the site continues to supply fuel to Majuro, Kwajalein Atoll, and licensed fishing vessels. However, the facility is in critical need of repair.

The fuel tank farm is located approximately 30 meters from the ocean, making it extremely vulnerable to atmospheric corrosion. At the same time, constrained funds have contributed to limited maintenance and corresponding degradation of facility equipment. The Marshalls Energy Company and the Ministry of Resources and Development Islands have flagged the fuel tank farm as an urgent investment need. They are working with the Asian Development Bank to safeguard against potential health, safety, and environmental risks associated with tank floor leaks, pipeline leaks, or tank failure.

The **Refurbishing Majuro Fuel Tank Farm Project** will assess the best method of addressing current risk through a corresponding project—slated for implementation beginning in 2018. Rehabilitation is estimated to cost $5 million, and will significantly reduce existing risk while supporting more resilient infrastructure. The anticipated outcome of this project is controlled risk through improvements to, or replacement of, parts of the existing fuel storage infrastructure. The intended impact is increased public and environmental safety, and enhanced fuel security.

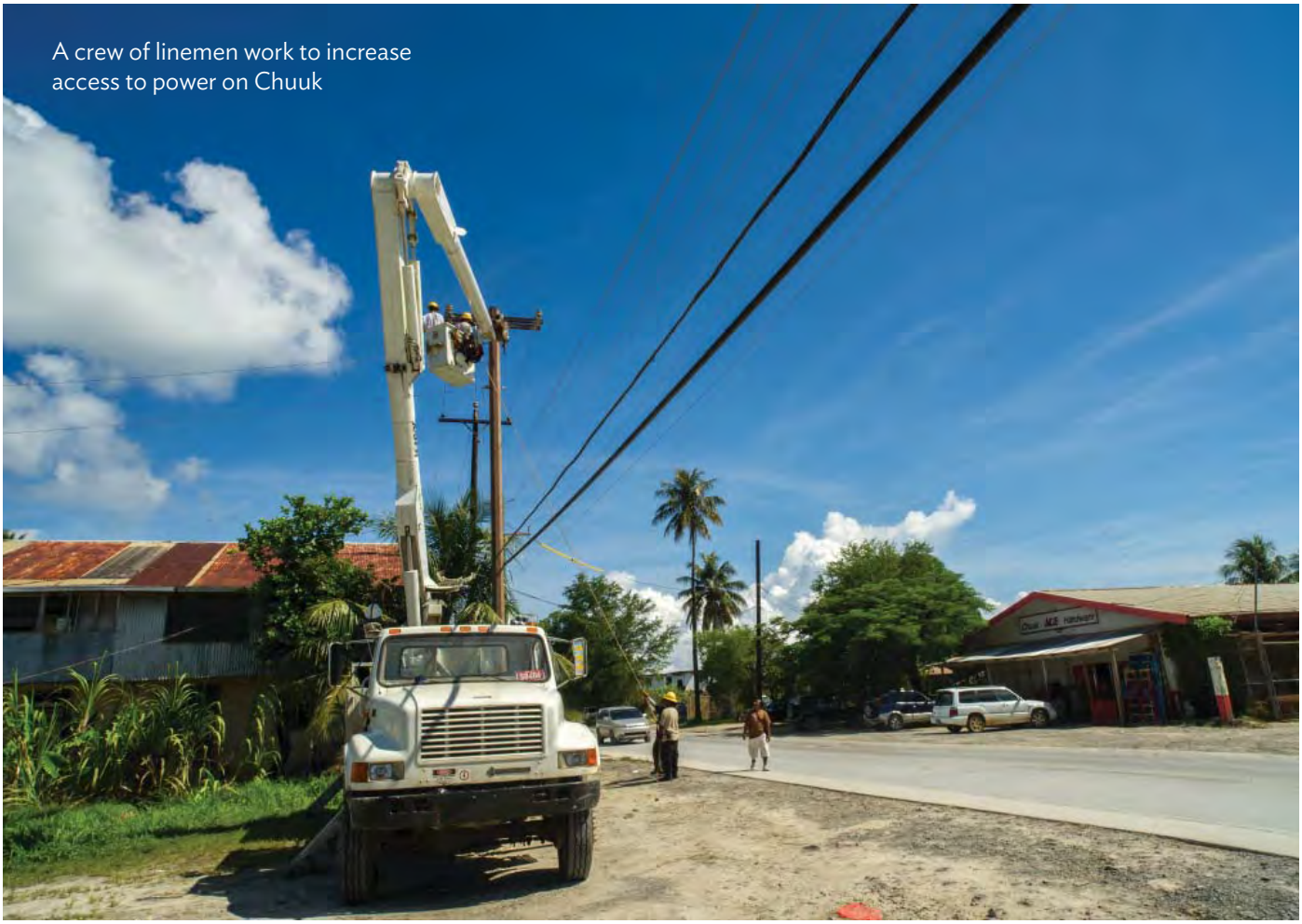
Federated States of Micronesia

The Federated States of Micronesia (FSM) comprises four states—Chuuk, Kosrae, Pohnpei, and Yap—spread across 607 islands in the West Pacific. Each state enjoys considerable autonomy, with responsibility for many public services (including power sector management) devolved from the central government.

As a whole, the FSM is working to lower its import dependence on diesel for power generation, and to reduce its exposure to fluctuating fuel prices. State targets are aligned with the FSM's National Energy Policy (2012), which seeks to reduce generation costs and address energy security in a financially and environmentally sustainable way. Specific targets include 30% power generation from renewable energy sources, a 50% increase in end-use efficiency, and a 90% rural-household electrification rate by 2020.[5]

The National Energy Policy recognizes the potential for the private sector to help meet these objectives. However, to date, the private sector has not made any considerable renewable energy sector investments in the FSM. Although tariffs are generally considered sufficient to cover current operating costs, revenues are not sufficient to cover proper maintenance or capital investments. Given its limited borrowing capacity, FSM currently has few options for financing energy sector investments needs, aside from external assistance grants.

ADB will implement four subprojects to build renewable generation capacity on each of FSM's states; and to increase battery storage, improve system efficiency, and increase electrification rates. Crucially, capital investments will be coupled with assistance to improve utilities' management practices, including financial management. The subprojects will contribute to the National Energy Policy's priority to: "improve the life and livelihoods of all FSM citizens with affordable, reliable, and environmentally sound energy". Descriptions of each subproject are organized by state below.



A crew of linemen work to increase access to power on Chuuk

ADB Photo Library

[5] Of the FSM's total population of approximately 111,000 people, about 55% enjoy access to electricity. However, this figure varies widely between states.

Chuuk State
Utility: Chuuk Public Utility Corporation
Electrification rate: 26%

To meet targets and increase access to clean energy, Chuuk State will focus on the installation of solar photovoltaic systems in various configurations, including battery storage and solar-diesel hybrid integration systems.

The proposed project will deploy nine solar-diesel hybrid systems (with battery storage) in communities with populations of about 800 people. Implementation will connect new customers, enhance the current network, and integrate 12 existing stand-alone photovoltaic systems (total capacity of 90 kilowatt-peak [kWp]). The subproject will also provide solar home systems for 13 communities with fewer than 50 households.

Overall, the grant is expected to increase access to clean energy on Chuuk State from 26% to 50%. Identified benefits to the affected communities will be manifold, and include increased educational opportunities; improved health and welfare, including improved food preservation and preparation; and improved environmental conditions as use of scarce wood resources diminishes in favor of electricity.

CHUUK STATE RENEWABLE ENERGY PROJECT The proposed project will build new renewable energy generation capacity and increase electrification rates in rural communities.	
Executing agency	Chuuk Public Utility Corporation
Project officer	Michael Trainor
Status	Proposed
Funding by Source	
Asian Development Bank Special Funds resources (grant)	$1.00 million
Government of Chuuk State	$1.00 million
Cofinancing (TBC)	$23.00 million
Total	**$25.00 million**

Kosrae State
Utility: Kosrae Utilities Authority
Electrification rate: 100%

Kosrae's existing grid supplies 1,800 customers, and is serviced by 3.1 MW of installed diesel capacity and 345 kWp of distributed solar photovoltaic. The proposed project will support the Kosrae Utilities Authority by increasing renewable energy generation capacity with 500 kWp of installed solar photovoltaic—reducing carbon dioxide equivalent (CO_2e) by 485 tons per year, against business-as-usual projections.

KOSRAE STATE RENEWABLE ENERGY PROJECT The proposed project will build new renewable energy generation capacity and resilient, high-efficiency distribution lines.	
Executing agency	Kosrae Utilities Authority
Project officer	Michael Trainor
Status	Proposed
Funding by Source	
Asian Development Bank Special Funds resources (grant)	$1.00 million
Government of Kosrae State	$1.00 million
Cofinancing (TBC)	$13.00 million
Total	**$15.00 million**

The project will also support the construction of 42.69 km of distribution lines, which will complement inland roadwork and reduce the network's vulnerability to coastal erosion. Improvements to the distribution network will support more resilient infrastructure, while enhancing system efficiency.

Pohnpei State
Utility: Pohnpei Utilities Corporation
Electrification rate: 95%

The Pohnpei Utilities Corporation manages a 6 MWp system, which is served by a diesel fleet (combined 5,850 kilowatts [kW]), run-of-river hydropower plant (725 kW), and grid-connected solar photovoltaic (980 kW). The utility plans to develop an additional 10 MW of solar photovoltaic and 10 MW of hydroelectric capacity to reliably serve its 7,000 customers and contribute to national clean energy targets.

The proposed project will help meet these goals by contributing a total of 14.5 MW of renewable power generation capacity—comprising 9 MW of solar and 5.5 MW of hydropower. Activities under the project will also introduce

POHNPEI STATE RENEWABLE ENERGY PROJECT The proposed project will build new renewable energy generation capacity, add battery storage, and support system integration.	
Executing agency	Pohnpei Utilities Corporation
Project officer	Michael Trainor
Status	Proposed
Funding by Source	
Asian Development Bank Special Funds resources (grant)	$1.00 million
Government of Pohnpei State	$12.30 million
Cofinancing (TBC)	$53.00 million
Total	**$66.30 million**

5 megawatt-hours of battery storage, and support systems integration to improve overall efficiency.

The successful implementation of the project will produce a drastic paradigm shift in Pohnpei's energy system, placing the state on a solid low-emissions development pathway and contributing markedly to the FSM's emissions reductions targets. The project will bolster economic development by increasing energy security and reducing exposure to fluctuating fuel prices.

Yap State

Utility: Yap State Public Service Corporation
Electrification rate: 95% (on the main island, and 70% statewide)

The **Yap Renewable Energy Development Project** is currently installing an integrated solar, wind, and high-efficiency diesel power system for the Yap State Public Service Corporation. Rooftop-mounted solar photovoltaic systems will generate an estimated 498 megawatt-hours per year, and account for about 3.83% of Yap's current energy mix.

A three-turbine wind farm will provide combined capacity of 0.75 MW–1.00 MW, and two high-speed diesel generators (1.65 MW and 0.83 MW) will be installed to allow for greater penetration of renewable energy, and to increase system efficiency.[6] The subproject will contribute an 18% share of renewable energy-generation capacity to Yap's total energy mix.[7]

The proposed project will (i) expand solar photovoltaic capacity with an additional 1,200 kWp 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 MW for 5 minutes, in order to integrate additional renewable energy into the grid.

The current and proposed projects 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 CO_2e per year (1.1% reduction in the FSM's greenhouse gas emissions as of 2000).

YAP RENEWABLE ENERGY DEVELOPMENT PROJECT

The project will install renewable energy systems, which will diversify Yap state's fuel mix and improve energy security.

Executing agency	Yap State Public Service Corporation
Project officer	Michael Trainor
Status	Active
Funding by Source	
Asian Development Bank Ordinary capital resources (loan)	$4.68 million
Asian Development Fund (loan)	$4.36 million
Government of Yap State	$2.12 million
Total	**$11.16 million**

YAP RENEWABLE ENERGY DEVELOPMENT PROJECT, PHASE 2

The project will install renewable energy capacity and support short-term electricity storage system.

Executing agency	Yap State Public Service Corporation
Project officer	Michael Trainor
Status	Proposed
Funding by Source	
Asian Development Bank Special Funds resources (grant)	$1.00 million
Government of Yap State	$2.00 million
Cofinancing (TBC)	$8.00 million
Total	**$11.00 million**

Investing in Crosscutting Solutions: Floating Solar Photovoltaic Will Conserve Water in the Federated States of Micronesia

Yap has experienced long periods of drought in recent years, plausibly attributable to the effects of climate change. The choice of floating solar photovoltaic will bolster Yap's water security. 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.

[6] An integration and control system has been included in the project to optimize system efficiency and resource use, maximize output from renewable resources, and reduce diesel consumption.

[7] This 18% renewable share includes 200 kWp of solar capacity installed during a grant funded by the Japan International Cooperation Agency titled Pacific Environment Conservation.

Nauru

Addressing reliability and efficiency shortcomings in Nauru's current diesel generation equipment can significantly improve service reliability and mitigate the risk of system failure. Enhancing system efficiency and amending tariff structures can also strengthen the long-term financial sustainability of the Nauru Utilities Corporation (NUC).

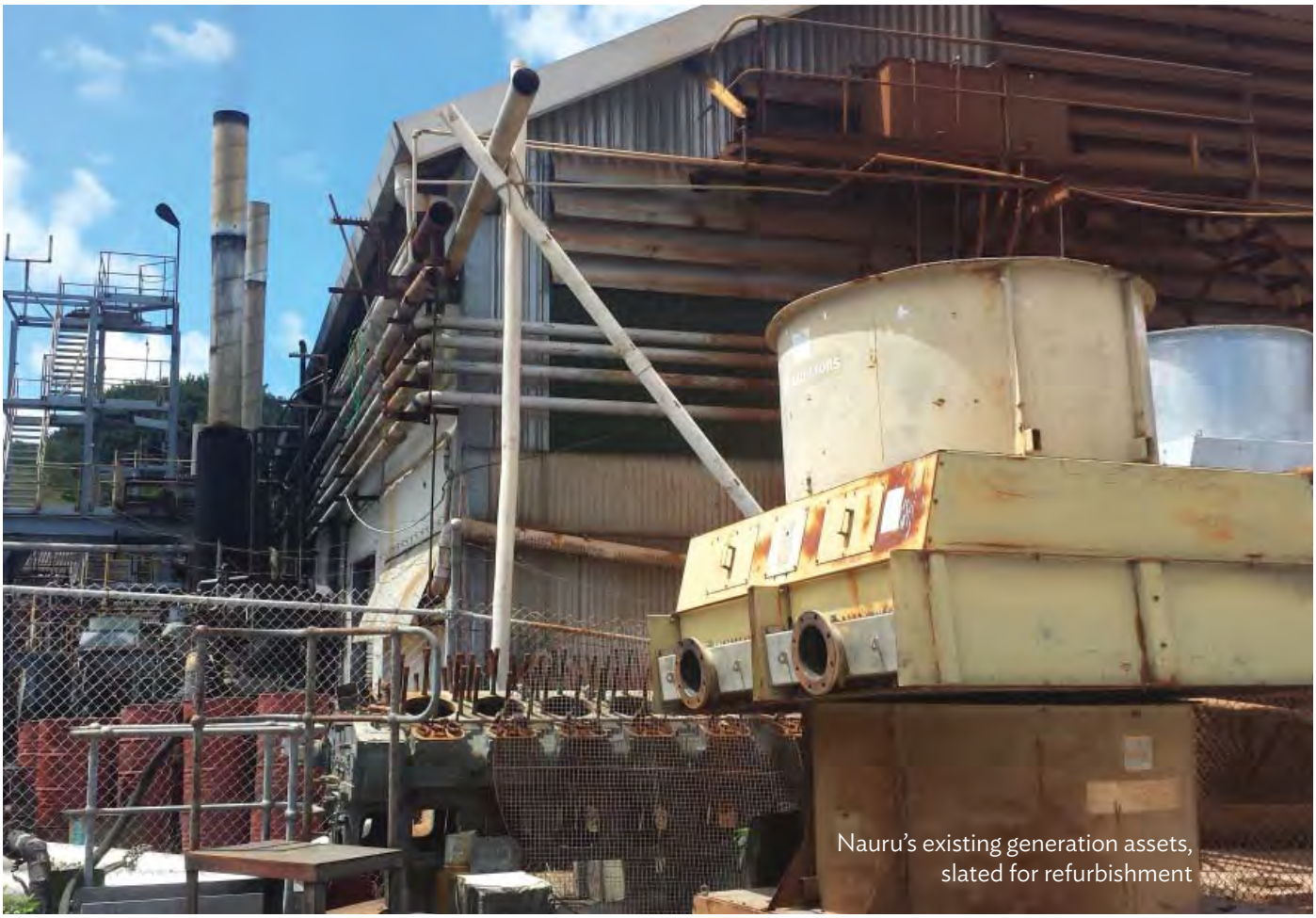
Access to grid electricity across Nauru's population is universal. However, lack of investment in, and limited maintenance of, existing assets have contributed to an available capacity (3.70 MW in 2014) that does not meet power demand (10.75 MW in the same year). Nauru is working to build generation capacity and refurbish existing equipment to provide more reliable power supply to its population. National development goals also prioritize restructuring Nauru's utility sector, and amending tariff structures to encourage cost recovery and strengthen NUC's financial sustainability.

The **Electricity Supply Security and Sustainability Project** is improving the quality and reliability of electricity services in Nauru by increasing generation capacity to supply base-load and by refurbishing degraded assets.

ELECTRICITY SUPPLY SECURITY AND SUSTAINABILITY PROJECT, AND TECHNICAL ASSISTANCE FOR TARIFF AND SUBSIDY REFORM

The project will improve power generation, transmission, and distribution services across Nauru; and the technical assistance will help the government to improve tariff structures.

Executing agency	Ministry of Finance
Project officer	Pivithuru Indrawansa
Status	Active
Funding by Source	
Asian Development Bank Technical Assistance Special Fund (for preparing the project)	$0.50 million
Asian Development Bank Technical Assistance Special Fund (for tariff and subsidy reform)	$0.30 million
Asian Development Fund (grant)	$2.00 million
European Union (grant)	$2.70 million
Government of Australia (grant)	$4.74 million
Government of Nauru	$2.70 million
Total	**$12.94 million**



ADB.Michael Trainor

Nauru's existing generation assets, slated for refurbishment

The project is supporting NUC with the installation of 6 MW of diesel-fired generation and replacement of 11 kilovolts (kV) switchgear, allowing the utility to retire older generation assets and perform scheduled refurbishments of existing units. This process is expected to increase generation efficiency by 20%—from 3.4 kWh per liter of fuel consumed to 4.1 kWh—and decrease power outages by more than 50%.

The project's impact will be increased economic activity; NUC customers will enjoy more dependable supply with fewer outages. The project's outcome will be increased reliability, lower cost, and greater sustainability of power generation in Nauru. In December 2016, repairs to the roof of NUC's powerhouse were completed—providing weatherproofing and safer working conditions for NUC employees. Installation and commissioning of the new generators will be completed by December 2017.

The attached **TA for Tariff and Subsidy Reform** is complementing investments in NUC's generation assets by assisting Nauru in gradually adjusting tariffs to support cost recovery and decrease subsidies.

The TA is helping to (i) analyze NUC's long-term marginal costs, (ii) identify the value of all existing subsidies provided to NUC by the Government of Nauru, (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.

Papua New Guinea

Providing more access to reliable electricity can drive economic growth and improve the quality of life across Papua New Guinea (PNG). Currently, about 12% of the total population is connected to the power grid, and outdated transmission and distribution infrastructures lead to frequent outages in urban centers. As PNG's economy and population continue to grow, the government is collaborating with donor partners and the private sector to scale up electrification rates and improve electricity services.

To achieve this, the Government of PNG, through its Department of Petroleum and Energy, has laid out three primary goals in its Electricity Industry Policy. The policy seeks to (i) improve access to electricity, (ii) improve the reliability of electricity, and (iii) ensure that power is affordable for consumers.

ADB is supporting these efforts with a number of TA and lending projects that aim to improve electricity services in urban centers and increase access to electricity in rural areas. These projects are improving living conditions and scaling economic activity.

The TA for **Implementation of the Electricity Industry Policy** assisted the Department of Petroleum and Energy and PNG Power Ltd to prepare the national Distribution Grid Expansion Plan, which was launched on 30 April 2016.

The plan forms part of PNG's National Electrification Rollout Plan, and details how the government will expand electricity grids to rural communities as it pushes to achieve 70% electrification by 2030. In line with the National Electrification Rollout Plan, a multitranche financing facility program was launched to support provincial grid connectivity and increase electrification rates.

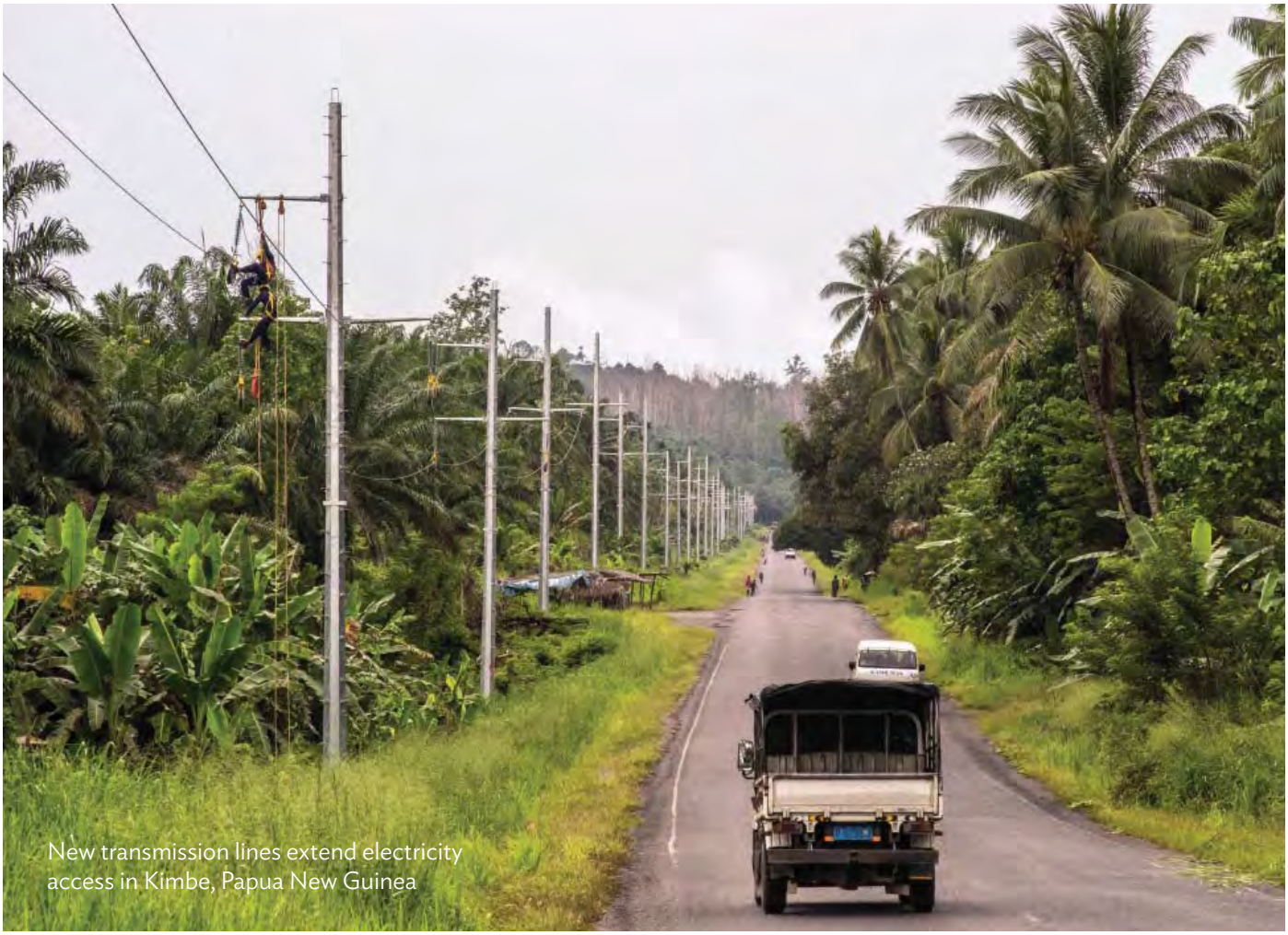
The **Town Electrification Investment Program**, under the multitranche financing facility, comprises two tranches, and is improving power supply in provincial urban centers by supplanting high-cost diesel generation with renewable energy sources, and extending the distribution network to more communities.

Tranche 1 comprises three subprojects and is being implemented to (i) construct transmission lines to connect provincial centers, (ii) replace diesel generators with hydropower plants, and (iii) build stakeholder capacity to support project sustainability.

IMPLEMENTATION OF THE ELECTRICITY INDUSTRY POLICY

The technical assistance built the Department of Petroleum and Energy's institutional capacity, and supported the implementation of its National Electrification Rollout Plan.

Executing agency	Energy Division, Department of Petroleum and Energy
Project officer	Anthony Maxwell
Status	Closed in June 2016
Funding by Source	
Asian Development Bank Technical Assistance Special Fund	$1.00 million
Total	$1.00 million



ADB Photo Library

New transmission lines extend electricity access in Kimbe, Papua New Guinea

TOWN ELECTRIFICATION INVESTMENT PROGRAM, TRANCHE 1

The investment program, under the multitranche financing facility, will construct and refurbish hydropower plants and distribution lines, which will increase access to clean and reliable power.

Executing agency	Energy Division, Department of Petroleum and Energy
Project officer	Hussain Haider
Status	Active
Funding by Source	
Asian Development Bank Ordinary capital resources (loan)	$37.90 million
Asian Development Fund	$16.40 million
Government of New Zealand (additional financing grant)	$4.77 million
Government of Papua New Guinea	$14.7 million
Total	**$73.77 million**

Construction of the 150 km of 66 kV transmission lines between Bialla and Kimbe in West New Britain province began in July 2016, and land acquisition for two run-of-river sites (Divune and Ramazon) is complete. Each hydropower plant will provide 3 MW of generation capacity, significantly increasing electrification rates and introducing clean and reliable power to the grid.

Construction of the Divune plant commenced in 2017, and construction of the Ramazon plant will be implemented under tranche 2. The implementing agency—PNG Power Ltd—and key project beneficiaries received capacity-building and gender training as a subcomponent of tranche 1.

Tranche 2 is slated for implementation in 2017, and will oversee the completion of the Ramazon plant, and the rehabilitation of two hydropower plants. Tranche 2 will refurbish (i) Yonki Toe of Dam plant and (ii) Warangoi, which are currently operating below their full capacities; and (iii) construct the 3 MW Ramazon hydropower plant. After rehabilitation, the Yonki Toe of Dam plant will be capable of operating at its rated capacity of 18 MW, while the Warangoi plant will operate at its rated capacity of 10 MW. The

Building Rural Economies with Access to Clean Power

The Government of New Zealand and the Japan Fund for Poverty Reduction are helping to extend the outcome of the Town Electrification Investment Program by increasing access to electricity and supporting community development in rural areas.

The $5 million grant for **Improved Energy Access for Rural Communities** will provide electricity to approximately 15,000 new users—extending power distribution to 1,782 households, 20 schools, and 20 medical facilities in rural communities. In order to help leverage social and economic benefits linked to energy access, the grant is supporting community-training initiatives that help families identify new opportunities for income generation, while teaching energy efficiency, household utility budgeting, and electricity safety.

Representatives from the local constituency thanked landowners, ADB, and the Government of New Zealand for their collaboration on the grant, during an inauguration "lights-on" ceremony held in Sorom Village in North Bougainville in February 2017. The Country Director for the Asian Development Bank's Papua New Guinea Resident Mission, as well as the Foreign Affairs Minister of New Zealand, and senior government officials from the Autonomous Region of Bougainville attended the ceremony.

"With electricity, there will be more development. I thank landowners and also the stakeholders involved for their generosity in developing the Autonomous Region of Bougainville".

—Joseph Watawi
Constituency Member
Autonomous Bougainville Government

In December 2015, the Asian Development Bank and the Government of New Zealand signed an additional cofinancing agreement, which is providing further support for increasing electrification rates by powering up an additional 2,500 households and rehabilitating the Lake Hargy Hydropower Plant in West New Britain Province.

Source: Author, based on input from Asian Development Bank's Papua New Guinea Resident Mission.

proposed rehabilitation will also extend the economic life of each plant by 20–25 years, and ensure that they are brought to current operational standards.

The investment program's improvements to grid connectivity and rural electrification rates will contribute to the impact of better economic conditions in provincial centers, and an outcome of improved utilization of clean and reliable power.

Improving power supply in urban centers will also play an important role in driving PNG's economic growth. PNG's capital, Port Moresby, has experienced a steady increase in electricity demand over the past decade. This growth, paired with poorly maintained transmission and distribution infrastructure, has led to increased power outages in the country's capital. The Port Moresby grid has historically been supplied by renewable energy from the Rouna Cascade 68.00 MW hydropower plant. However, degradation of this system—due to heavy demand and inadequate maintenance—has led

TOWN ELECTRIFICATION INVESTMENT PROGRAM, TRANCHE 2

The investment program, under the multitranche financing facility, will construct and refurbish hydropower plants, which will increase access to clean and reliable power.

Executing agency	Energy Division of the Department of Petroleum and Energy
Project officer	Woo Yul Lee
Status	Proposed
Funding by Source	
Asian Development Bank Ordinary capital resources (loan)	$55.90 million
Asian Development Fund	$5.00 million
Government of Papua New Guinea	$15.70 million
Total	**$76.60 million**

to unreliable power supply and increased dependence on diesel fuel for generation.

Considerable investment is required to renovate existing renewable energy generation assets and to improve transmission and distribution efficiency in the country's capital. These improvements are essential to supporting the capital's growing economy and population. The Port Moresby Power Grid Development Project is addressing these needs by (i) financing the rehabilitation of two existing hydroelectric plants (Rouna 1 and Sirinumu TOD), (ii) constructing new Kilakila substation and 66 kV transmission line, (iii) improving Port Moresby's transmission and distribution infrastructure, and (iv) providing project management support and capacity building.

The project will produce an outcome of better power supply for Port Moresby, and deliver the impact of increased economic activity among grid-connected residential and commercial consumers.

PORT MORESBY POWER GRID DEVELOPMENT PROJECT

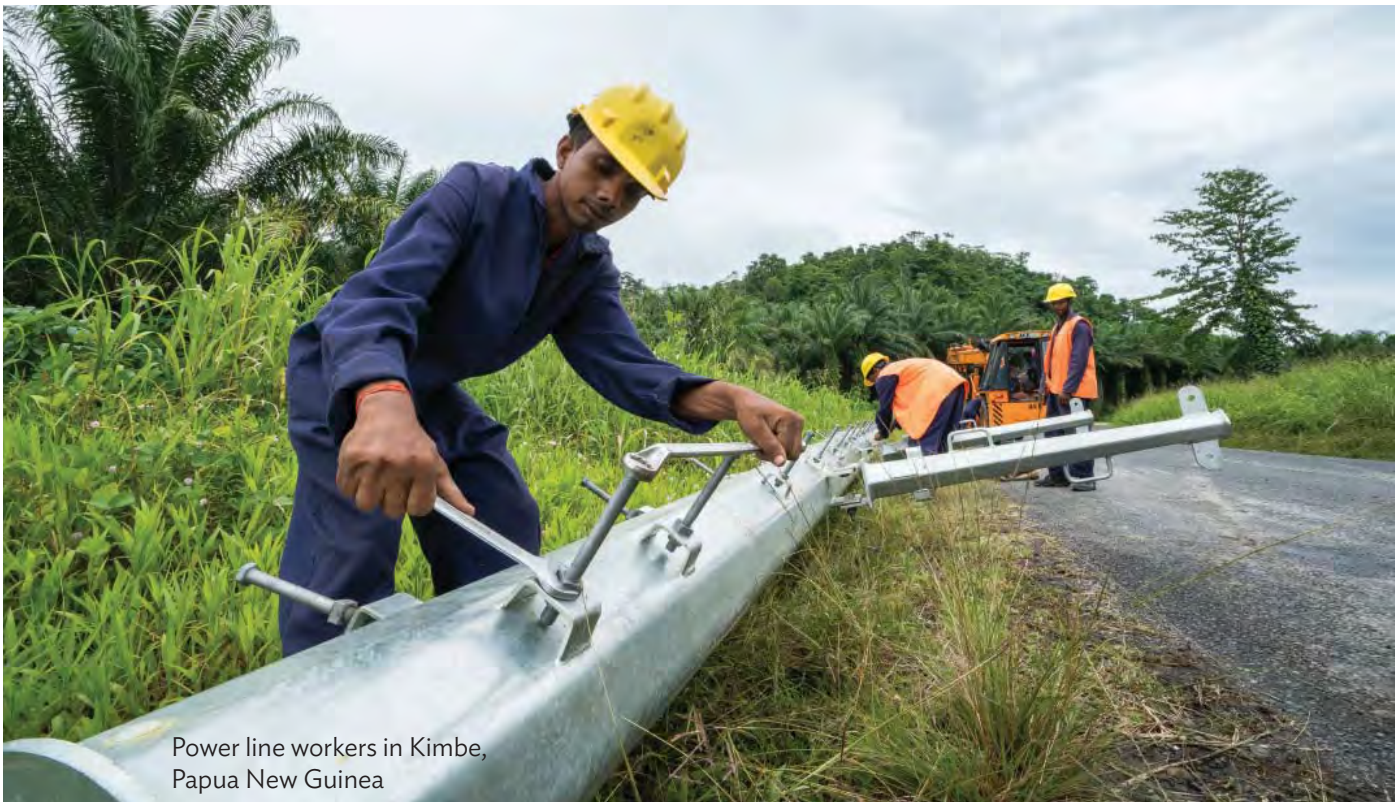
The project will improve key power infrastructure assets, which will enhance energy efficiency and provide access to renewable power.

Executing agency	Kumul Consolidated Holdings
Project officer	Hussain Haider
Status	Active
Funding by Source	
Asian Development Bank Ordinary capital resources (loan)	$51.70 million
Asian Development Fund	$15.00 million
Government of Papua New Guinea	$16.30 million
Total	**$83.00 million**

IMPROVED ENERGY ACCESS FOR RURAL COMMUNITIES

The grant will connect additional households, schools, and medical centers to power generated by subprojects of the Town Electrification Investment Program.

Executing agency	Energy Division, Department of Petroleum and Energy
Project officer	Hussain Haider
Status	Active
Funding by Source	
Government of New Zealand (grant)	$2.50 million
Japan Fund for Poverty Reduction (grant)	$2.50 million
Government of Papua New Guinea	$1.00 million
Total	**$6.00 million**



Power line workers in Kimbe, Papua New Guinea

ADB Photo Library

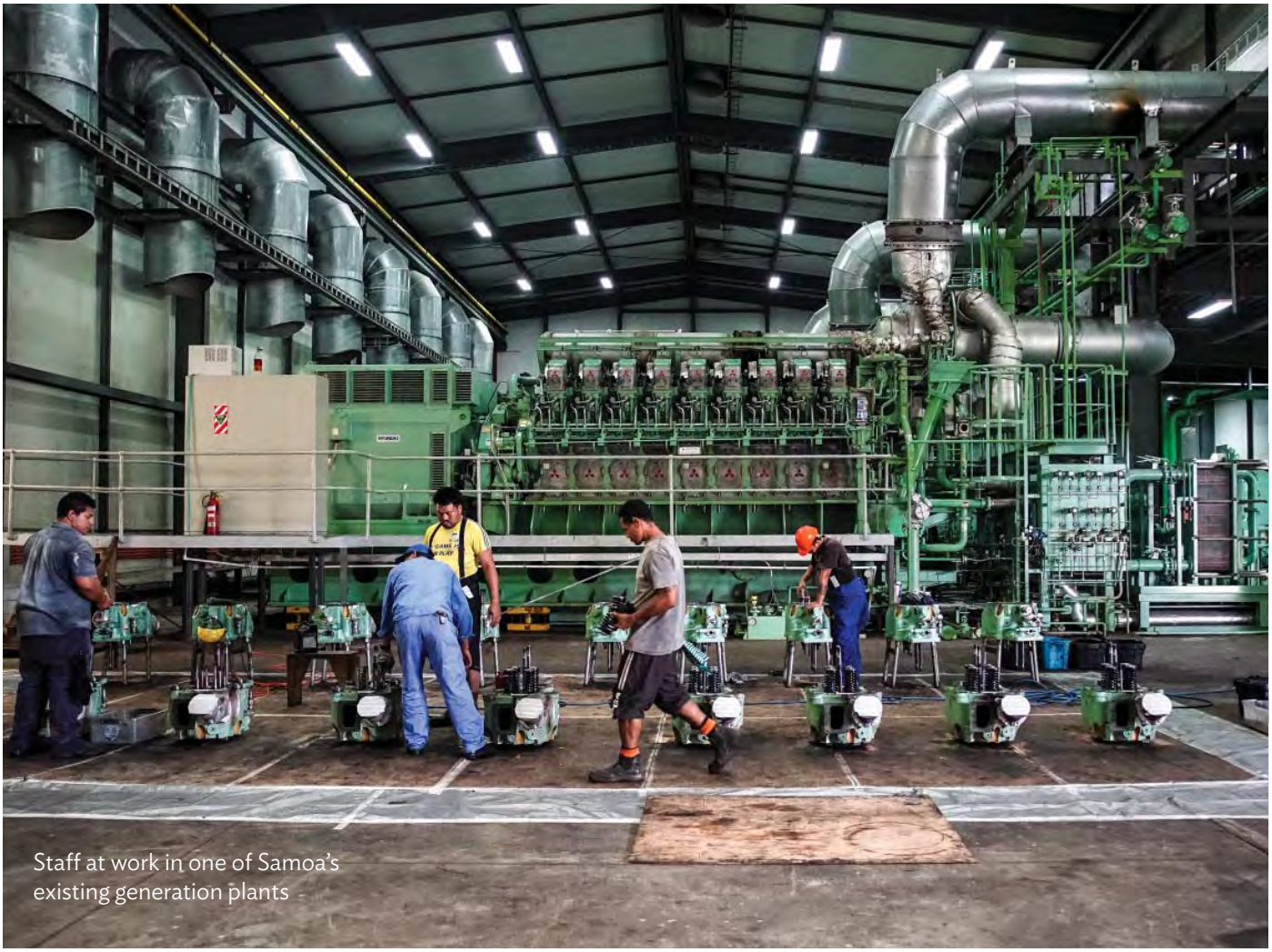
Samoa

Samoa's power grid serves 95% of its total population, with the remainder generating electricity from small diesel or solar systems. Reducing system losses and voltage drops can significantly increase the reliability and quality of electricity supply. Providing more reliable electricity services, in turn, can play a vital role in promoting private sector investments, diversifying Samoa's economy, and bolstering sustainable economic growth.

As peak demand grows at about 3% annually, Samoa's Electrical Power Corporation (EPC) is working to ensure sufficient generation and transmission capacity, while improving the quality and reliability of electricity supply. EPC has also set the goal of diversifying Samoa's energy mix and supplanting diesel generation with clean, indigenous renewable energy.

The **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. The project's outcome will be a higher share of electricity generated by hydropower; its impact will be greater energy security.

The project will achieve these results by assisting 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. Knowledge-sharing activities, including the publication of an operation and maintenance (O&M) manual and ongoing training for EPC staff, will support project sustainability with enhanced institutional capacity.



Staff at work in one of Samoa's existing generation plants

ADB Photo Library

RENEWABLE ENERGY DEVELOPMENT AND POWER SECTOR REHABILITATION PROJECT The project will increase access to renewable energy generation, and rehabilitate the power infrastructure.	
Executing agency	Ministry of Finance
Project officer	Maria Melei
Status	Active
Funding by Source	
Asian Development Fund (grant)	$18.21 million
Multi-Donor Clean Energy Fund (grant)	$1.00 million
European Union (grant)	$5.06 million
Government of New Zealand (grant)	$2.49 million
Government of Samoa	$5.83 million
Total	**$32.59 million**

POWER SECTOR EXPANSION PROJECT The project will implement subprojects and assist the Electrical Power Corporation in improving the financial performance and delivery of their electricity services.	
Executing agency	Ministry of Finance
Project officer	Grace King
Status	Active
Funding by Source	
Asian Development Fund	$42.00 million
Australia (grant)	$8.00 million
Japan Bank for International Cooperation	$38.00 million
Government of Samoa	$12.00 million
Total	**$100.00 million**

The **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. To achieve this, ADB is working with EPC to build institutional capacity, improve financial performance, and, ultimately, deliver a higher quality of services to consumers.

The key outputs of the project include:

(i) supporting EPC's investment plan to meet growing demand,
(ii) improving the operational efficiency of EPC,
(iii) improving the financial performance of EPC,
(iv) establishing effective regulation of the power sector,
(v) developing a demand-side management strategy to promote energy efficiency and conservation, and
(vi) developing clean energy resources through the establishment of innovative financing schemes.

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 project's overall impact will be access to sustainable and reliable electricity services at affordable prices; its outcome will be improved quality, reliability, and cost-effectiveness of Samoa's power supply.

Solomon Islands

Approximately 16% of Solomon Islands' total population is connected to the electricity grid, and nearly all grid-connected power is generated by diesel. Solomon Islands Electricity Authority (Solomon Power) is working with ADB to increase the uptake of grid-connected renewable power, and to extend access to modern electricity services. Increasing renewable energy generation capacity will enhance the country's energy security, reduce generation costs, and address key barriers to economic growth.

The province of Malaita houses around 25% of the national population, but has only about 2% of total generation capacity. The current power supply is unreliable, and suffers frequent outages due to geographical constraints to providing fuel and maintenance.

The **Provincial Renewable Energy Project** is increasing access to clean power in Auki—the provincial capital of Malaita. 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 project comprises four outputs:

(i) Fiu River Hydropower Plant, which will almost entirely supplant current diesel generation;[8]
(ii) extension of the distribution grid, which will increase Solomon Power's customer base in Auki by about 91%;

[8] The physical infrastructure will be sized for 750 kW capacity. However, initially, only two 250 kW generators will be installed. An additional 250 kW generator will be installed into the spare generator bay when load growth increases. The installation of two 250 kW generators is determined to be the most efficient sizing to meet the current 350 kWp as well as short-term anticipated demand growth. Backup diesel generation will be maintained, in case of disruptions to the hydropower supply, which will also operate periodically for maintenance purposes.

(iii) capacity building for Solomon Power staff, and education for newly connected residential stakeholders on electricity-based income generation, household budget planning, and electricity safety; and
(iv) establishment of a project management unit to support project efficiency.

Site preparation works and detail design are ongoing.

Solomon Power is leveraging the decreasing price of solar power generation—a levelized $0.41 per kWh with battery storage, compared with $0.50 per kWh for diesel—in order to overcome the geographical barriers to providing electricity access on provincial grids.

The **Solar Power Development Project** will support the installation of renewable energy in Solomon Islands in order to (i) decrease the cost of generating electricity (by replacing diesel generation with less expensive solar power), and (ii) reduce greenhouse gas emissions. The project's outcome will be increased supply of clean, reliable power; its impact will be increased use of renewable energy.

The project is installing a total of 2 MW of grid-connected solar power and building the capacity of Solomon Power staff, specifically in the O&M of small hybrid solar 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

SOLAR POWER DEVELOPMENT PROJECT

The project will install solar power systems in five provinces, which will supplant costly diesel generation.

Executing agency	Ministry of Mines, Energy and Rural Electrification
Project officer	Anthony Maxwell
Status	Active
Funding by Source	
Asian Development Fund (grant)	$2.00 million
Asian Development Fund (loan)	$1.00 million
Climate Investment Fund	$6.20 million
Government of Solomon Islands	$6.00 million
Total	**$15.20 million**

Community outreach to complement increased electrification in Solomon Islands

Tina River Hydro Project Office

Empowering Health Care, Education, and Economies in Rural Island Communities

The Solomon Islands Energy Authority is using solar power generation to overcome geographical and economic barriers to providing affordable electricity in remote communities. The corresponding increase in electrification rates will support a higher quality of education and health care, and empower local entrepreneurs.

The Solar Power Development project will enable Solomon Power to generate affordable electricity on Kirakira, Lata, Malu'u, Munda, and Tulagi—increasing electrification and reducing tariff prices. New electricity connections will allow students in these communities to access computers, thereby enhancing quality of education with improved resource availability. Solar power will also allow remote hospitals and medical facilities to refrigerate and store medicine.

In parallel, local entrepreneurs are beginning to use new connections to start microenterprises. One example is the establishment of food refrigeration facilities, which will allow fishermen to store their catch, while providing supplemental income for facility owners.

Source: Author, based on an interview with a representative from Solomon Island Energy Authority (Solomon Power).

the five provinces—Kirakira (320 kW), Lata (290 kW), Malu'u (140 kW), Munda (1,000 kW), and Tulagi (250 kW).

The project will also install battery systems to allow higher penetration rates of solar power, creating favorable conditions for future private sector investment in solar home systems.

The **Tina River Hydropower Plant Project** will increase the share of renewable energy supplying Honiara's electricity grid, and lead to a corresponding decrease in the cost of power generation on the country's capital. The 15 MW hydropower scheme will underpin a paradigm shift in power generation for Solomon Islands.

TINA RIVER HYDROPOWER PLANT PROJECT

The project will install a hydropower, which will increase the share of renewable energy generation capacity supplying the Honiara grid.

Executing agency	Ministry of Mines, Energy and Rural Electrification
Project officer	Anthony Maxwell
Status	Proposed
Funding by Source	
Asian Development Bank Ordinary capital resources (loan)	$18.00 million
Asian Development Fund (grant)	$12.00 million
Government of Australia	$11.00 million
Cofinancing loan (TBC)	$70.00 million
Cofinancing grant (TBC)	$16.00 million
IRENA/Abu Dhabi Fund for Development (loan)	$15.00 million
Korea Eximbank* (loan)	$31.60 million
K-Water	$25.30 million
Solomon Power	$1.50 million
World Bank International Development Association (credit)	$24.70 million
World Bank International Development Association (grant)	$8.90 million
Total	**$234.00 million**

*ADB recognizes "Korea" as the Republic of Korea.

The 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. Successful commissioning of the plant will contribute an estimated savings of 49,500 tons CO_2e per year—more than twice Solomon Island's commitment in its Intended Nationally Determined Contribution under the United Nations Framework Convention on Climate Change.

Timor-Leste

Timor-Leste prioritizes power sector development as a key driver of economic growth and poverty reduction. From 2003 to 2014, Timor-Leste successfully increased electrification rates from 22% to 71%, and currently possesses sufficient installed capacity to connect all households and meet peak residential, commercial, and industrial demand for the coming decade. Improvements to electricity services, however, levy considerable fiscal burdens on the state.

Since 2008, the Government of Timor-Leste, through its ministerial department responsible for electricity—Electricidade de Timor-Leste (EDTL)—has invested nearly $1 billion in the construction of two diesel power plants, and a countrywide 150 kV transmission and 20 kV distribution system.

In spite of these assets, considerable barriers and investment needs remain unmet. The cost of providing electricity is

extremely high—the government spends approximately $100 million per year to fund operating costs in the power sector—and about 60% of the electricity generated is not billed to consumers. Reducing network losses and ensuring that the installation of meters keeps pace with new connections will play an important role in addressing these challenges.

ELECTRICITY STRENGTHENING AND SUSTAINABILITY INVESTMENT PROGRAM

The program, which is under the multitranche financing facility, will invest in transmission and distribution infrastructure, and in improving metering services to support a financially sustainable power sector.

Executing agency	Ministry of Infrastructure, Transport, and Communication
Project officer	Michael Trainor
Status	Proposed
Funding by Source	
Asian Development Bank Ordinary capital resources (loan)	$30.00 million
Asian Development Bank Technical Assistance Special Fund	$1.00 million
Government of Timor-Leste	$20.00 million
Total	**$51.00 million**

ADB is working with the government to identify and finance investments that will reduce costs and improve EDTL's commercial performance. The planned **Electricity System Strengthening and Sustainability Investment Program** will provide targeted investments in the utility's transmission and distribution infrastructure, and improve the O&M of three power plants.

The program will make sequenced investments in the transmission and distribution 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 (all else 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 EDTL.

The investment program will accomplish these by (i) reengineering current business practices;[9] (ii) modernizing and extending the distribution network; (iii) installing meters at the feeder- and customer-levels; and (iv) reducing the use of diesel for power generation (to below 80%), by supplanting it with natural gas.

Hera power plant in Timor-Leste

ADB.Michael Trainor

[9] The Government of Timor-Leste is considering engaging an experienced utility operator to assume management responsibility for EDTL under a public–private partnership arrangement.

Climate Change in the Pacific: Risks, Resilience, and Adaptation

Pacific island countries are among the most vulnerable in the world to natural disasters and the effects of climate change. This is due to a combination of high exposure and susceptibility, and poor coping and adaptive capacities. As such, mitigating the factors that contribute to climate change and ensuring that communities, economies, and infrastructure follow a resilient development path are of particular relevance to the Pacific region. The Pacific community has made tremendous strides to become more resilient and to mitigate factors that contribute to climate change.

The Secretariat for the Pacific Community recently launched the Framework for Resilient Development in the Pacific 2017–2030, which identifies the three interrelated goals of (i) integrating resilience and adaptation planning into social and economic development; (ii) ensuring that development follows a low-carbon path; and (iii) strengthening disaster preparedness, response, and recovery.

ADB's operations in the Pacific are supporting each of these pillars. Infrastructure investments carefully consider climate resilience and environmental safeguards; energy development is increasing efficiency and the uptake of renewable energy resources; and technical assistance and grant assistance are directly supporting response and recovery to natural disasters.

Tonga

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.

On 11 January 2014, the most powerful storm ever recorded in Tongan waters passed directly over the northeast islands of Ha'apai, directly affecting about 5,000 people, or 66% of the local population. The cyclone is estimated to have caused $53 million in damage and losses, with the majority of damage levied against housing, business, agriculture, power infrastructure, and education facilities.

The state-owned electricity utility—Tonga Power Ltd.—estimates that 90% of Ha'apai's distribution lines, 40%–70% of electricity poles, 65% of transformers, 90% of transformer structures, and 95% of streetlights were damaged. Ha'apai was left almost completely without power.

ADB responded by helping the government to reconstruct and climate-proof the main electricity network and damaged school facilities, taking a "build back better" approach. **The Cyclone Ian Recovery Project** restored access to electricity and increased the power system's resilience to future climatic shocks.

Activities under the grant included (i) construction and upgrades of an above-ground and below-ground distribution system, (ii) construction and climate-proofing of underground networks to supply Ha'apai's hospital and high school, (iii) restoration and climate proofing of streetlights, and (iv) provision of solar lanterns and solar community chargers for residents on Ha'apai's outer islands. As a part of these works, the implementing agency trained and hired female employees to operate heavy machinery and support the installation of power lines, contributing to gender equality of the country's workforce.

Nearly all works under this initiative are complete, with the balance of funds allocated to reconstruct schools and lay an underground electricity supply cable for Ha'apai's new hospital. The remaining works are expected to be complete in December 2017.

The Government of Tonga has set a target of reducing fossil fuel imports for power generation by 50% by 2020, and defines a strategy for achieving this goal in the Tonga Energy Roadmap 2010–2020. Renewable energy and energy efficiency improvements are key elements of this strategy.

CYCLONE IAN RECOVERY PROJECT

The project will help rebuild and enhance the resilience of Tonga's power infrastructure.

Executing agency	Ministry of Finance and National Planning
Project officer	Vijay Narayan
Status	Active
Funding by Source	
Asian Development Fund	$4.52 million
Government of New Zealand	$4.27 million
Government of Tonga	$1.91 million
Total	**$10.70 million**

The Outer Island Renewable Energy Project is supporting this goal by constructing solar generation systems on nine of Tonga's outer islands, which will result in a preliminary capacity of 1.32 MWp.

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 knowledge among appropriate staff and institutions to strengthen capacity for the O&M of solar power and integrated diesel systems. Additional financing will be used to upgrade about 50% of the electricity grid on Vava'u.

The subprojects include

(i) on-grid: connecting photovoltaic generators to existing electricity distribution networks on 'Eua (0.2 MWp), Ha'apai (0.55 MWp), and repairing systems on Vava'u;
(ii) 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 kWp), Ha'ano (70 kWp), and Ha'afeva (150 kWp);
(iii) off-grid: expanding existing solar home system capacity in Niuafo'ou and Niuatoputapu (additional 0.18 MWp); and
(iv) energy efficiency: upgrading existing power distribution networks on 'Eua and Vava'.

OUTER ISLAND RENEWABLE ENERGY PROJECT

The project will deliver increased access to renewable energy on Tonga's outer islands, and increase system efficiency.

Executing agency	Ministry of Finance and National Planning
Project officer	David Fay
Status	Active
Funding by Source	
Asian Development Fund	$8.44 million
Government of Australia (grant)	$4.50 million
European Union	$3.57 million
Danish International Development Agency	$0.75 million
Government of Tonga	$1.57 million
Total	**$18.83 million**

As of May 2017, implementation was on schedule and within budget. Once complete, solar systems will supply environmentally sustainable power to households, schools, and other public facilities on the islands of 'Eua, Ha'apai, and Vava'u. The project is also being used to quantify solar resources and build capacity of Tonga Power Limited in the O&M of renewable energy resources.

The Outer Island Renewable Energy project will deliver the outcomes of optimized on-grid and off-grid generation

Solar panels in Ha'apai, Tonga

ADB.Michael Trainor

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. The project may be used as a model for replication through continued partnerships with national stakeholders and development partners.

Vanuatu

Vanuatu is an archipelago with a population of 234,000 people, spread across 83 volcanic islands in the West Pacific. As the country pushes to develop its tourism and commercial agriculture sectors, increasing access to affordable electricity can play a key role in generating new livelihoods and improving the quality of life.

Currently, the national household electrification rate is 33%, and varies widely between urban (82%) and rural (17%) areas. At the community level, delivering higher electrification rates can increase household income-generation opportunities, improve children's education, and reduce indoor health and safety issues associated with burning kerosene. At the macroeconomic level, more renewable power generation can help improve trade balances and energy security, while reducing greenhouse gas emissions.

The **Vanuatu Energy Access Project** 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 kW of renewable energy capacity, and is expected to account for more than 90% of the total generation mix on Malekula through 2040. A 72 km 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.

The project will also deliver training and capacity building for newly connected households, instructing new electricity users on options for electricity-based income generation, as well as electricity safety and household budget management. The project's impact will be improved livelihoods on Malekula and Espiritu Santo; its outcome will be an increased supply of electricity, generated by renewable resources on Vanuatu's two largest islands.

VANUATU ENERGY ACCESS PROJECT

The project will increase electrification rates on Vanuatu's largest islands through the installation of renewable energy and distribution assets.

Executing agency	Ministry of Finance and National Planning
Project officer	Anthony Maxwell
Status	Proposed
Funding by Source	
Asian Development Bank Special Funds resources (loan)	$2.50 million
Asian Development Bank Special Funds resources (grant)	$2.50 million
Asian Development Bank Strategic Climate Fund (grant)	$7.00 million
Government of Vanuatu	$3.10 million
Total	**$15.10 million**

Generating Impact in the Pacific

The Pacific approach of the Asian Development Bank (ADB) sets the goal of achieving sustained, resilient, and improved standards of living to support a region of peace, harmony, security, and economic prosperity. The work of ADB's Pacific Department in the energy sector advances this goal by increasing access to clean and reliable energy—a resource that is essential for low-carbon economic growth and improved living conditions.

Energy sector impacts in the Pacific include:

(i) enhanced energy security through the efficient use of domestic renewable energy resources,
(ii) increased access to affordable power generated by clean and sustainable resources, and
(iii) improved economic activity and effective governance of public and private sector institutions.

Over the past year, Pacific developing member countries have achieved considerable progress toward improving the quantity and quality of energy services. Energy management has improved, efficient and resilient infrastructure has been built, and communities are benefiting from greater access to clean power. However, further progress remains to be achieved. ADB will continue to work with its partners across the Pacific to advance regional goals and deliver lasting impacts.

Pacific Energy Update 2017

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 2017* 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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