

**PROJECT INFORMATION DOCUMENT (PID)
APPRAISAL STAGE**

Report No.: PIDA6640

Project Name	Energy Sector Development Project (P144573)
Region	EAST ASIA AND PACIFIC
Country	Tuvalu
Sector(s)	Other Renewable Energy (80%), Energy efficiency in Heat and Power (20%)
Theme(s)	Other rural development (50%), Other urban development (50%)
Lending Instrument	Investment Project Financing
Project ID	P144573
Borrower(s)	Tuvalu
Implementing Agency	Tuvalu Electricity Corporation
Environmental Category	B-Partial Assessment
Date PID Prepared/Updated	17-Nov-2014
Date PID Approved/Disclosed	17-Nov-2014
Estimated Date of Appraisal Completion	18-Nov-2014
Estimated Date of Board Approval	26-Jan-2015
Decision	

I. Project Context

Country Context

Tuvalu joined the World Bank Group (WBG) in June 2010, and is its smallest and second-newest member. Tuvalu is a group of nine inhabited islands (four reef islands and five coral atolls) with a land area of 26 km² and a maximum elevation of 4.5 meters. Few atolls are more than 800 meters wide. Roughly half the country's population of some 9,876 lives on the main atoll, Funafuti. This small group of atoll islands is particularly vulnerable due to its geographic isolation, lack of fertile land, susceptibility to the impacts of climate change, and inability to reap economies of scale in the provision of public goods and services.

Tuvalu's gross domestic product (GDP) was estimated at USD 39.7 million in 2013 and was the smallest of any independent state. GDP growth in the past was volatile and this is expected to continue into the future, due to Tuvalu's dependence on licensing fees, remittances and trust-fund returns, all of which are dependent on exogenous factors beyond the Government's control. Due to the small size of the population, lack of land area and resources, the scope for economic diversification, including for exports, is minimal. Nearly everything, including skilled services, is imported. Fuel and food constitute nearly half of total imports of goods. Tuvalu uses the Australian dollar as its currency and has no central bank. The main sources of foreign exchange have been the

earnings of Tuvaluans working abroad, particularly as seafarers, and development partners' (DPs) assistance. Absolute poverty is rare and access to primary education is effectively universal. Although the provision of health services is limited by the country's small size, the health targets of the Millennium Development Goals (MDG) are on track to be reached by 2015.

Deficits have been persistent even in good times. These are generally closed through DPs' support and disbursements from the country's budget support fund, the Consolidated Investment Fund (CIF). The country's external public debt was 35.3 percent of GDP in 2013. Including its roles in health and education, the public sector employs around one tenth of the country's population. Cash employment prospects outside of the public sector rely largely on employment opportunities abroad, especially as seafarers and seasonal laborers. Industry barely exists. Small numbers of Tuvaluans work in the services sector, including the retail and tourism industries.

Most crucially, climate change is a fundamental risk to the world's second lowest-lying country. Rising sea temperatures and irregular rainfall are already cited as reasons for declining income from fish and crops, and higher sea levels could render much of the country uninhabitable.

Subsistence farming is prevalent, and its productivity is low due to poor soils, limited use of fertilizers, small plot size, lack of access to credit, inadequate market infrastructure, and the lack of mechanization. Only coconuts and pandanus grow naturally. Banana, papaya and breadfruit are cultivated and a variety of taro is grown in pits excavated in coral rock. Reef fish and tuna are the main dietary proteins. Tuvalu is a net food importer and three-quarters of the food consumed on Funafuti is imported.

Owing to the introduction of the Vessel Day Scheme and the establishment of fishing joint ventures with Asian companies, both fishing exports and fishing license fees have more than doubled in just the last few years, with each accounting for about half of GDP in 2013. Almost all exports are fish as of 2013.

Tuvalu has continued to benefit from regional projects in the areas of economic management and governance, climate change, solid waste management, and support from the Pacific Infrastructure Advisory Center in the energy and utilities sectors.

Sectoral and institutional Context

Institutional arrangements: The energy sector is managed by the Department of Energy within the Ministry of Public Utilities. The Government established the Tuvalu Electricity Corporation (TEC) in 1991. In 2010 TEC became a fully State-Owned Enterprise (SOE), with the responsibility for managing and operating grid-connected systems on the eight islands.

Electricity use: Tuvalu has 1,764 households: 846 in Funafuti and 918 on the outer islands. Over 94 percent of Tuvaluans have access to electricity. The main electricity consumer is the Government, which accounts for approximately 27 percent of total electricity consumption. Residential users account for approximately 45 percent, while commercial users account for approximately 28 percent. TEC faces an issue with overdue payments, particularly from its largest customers.

Tariff structure: Because 98 percent of Tuvalu's generation is diesel based, power costs are very

sensitive to increasing fuel prices. Tuvalu's energy costs are above average for the region and in the top third of Pacific power utilities. The total electricity cost is around AUD 0.9/kWh (USD0.86) and the average fuel cost is AUD 0.59/kWh (USD0.56). Current tariffs for private use in Funafuti are set at AUD 0.30/kWh (USD0.28) for the first 50kWh ("lifeline tariff"), AUD 0.39/kWh (USD0.37) for the next 50kWh, and AUD 0.56/kWh (USD 0.54) thereafter. For commercial and government users, the rate is AUD 0.56/kWh (USD 0.54) in Funafuti and AUD 0.55/kWh (USD0.53) for the outer islands.

Electricity Systems

Fogafale system: The Fogafale system accounts for about 60 percent of the country's installed capacity. The generation system on Fogafale comprises a recently installed (Japan International Cooperation Agency [JICA] 2007) power station comprising three 0.6 MW diesel generators with an 11 kV/415 V/230 V distribution system. The total installed power capacity of these diesel generators is 1,800 kW. Since the new diesel power station was commissioned, the island of Fogafale has substantially reduced the number of power blackouts.

The generators are run using diesel fuel, which was substantially subsidized by approximately 37 percent of the cost of annual fuel consumption through the Japan non-project grant assistance for 2005–2012. The Japanese fuel subsidy assistance program of ¥100 million per year (~USD 0.97 million), which began in 2005, formally concluded at the end of 2013. However, the 2013 subsidy was not disbursed until January 2014 and was used to finance fuel purchases in 2014. TEC was forced to use its bank overdraft in order to finance the fuel in 2013 (approximately AUD 0.5 million overdraft to cover the AUD 3 million cost).

In 2008, the European Union (EU) and the Japanese Government, through the Kansai Electric Company (Japan), established a grid-connected 40 kWp solar system on Fogafale. This system contributes 1 percent of electricity production.

Fogafale has a peak demand of less than 1 MW. Residents demand an estimated 969 kWh of electricity per person per year. The bulk of electricity is utilized in refrigeration (34 percent) followed by air conditioning (30 percent). Electronics, mechanical and lighting requirements comprise the remaining demand (~12 percent each). For Fogafale, this results in an average total demand of 5.1 GWh during the last five years, with a peak of 5.6 GWh in 2011, well within TEC's supply envelope. With the small projected population growth (~2 percent), demand was expected to rise a modest 2 percent per year in the business-as-usual scenario. However, the energy-efficiency activities that form part of the Project are expected to keep total consumption growing at about 1 percent per year, with an average consumption of about 5.5 GWh in the near future.

Outer Islands: The outer islands have been prioritized in the strategy toward 100 percent renewable energy (RE) for Tuvalu due to the escalating costs of transporting diesel fuel to these remote locations. Their low electricity demands (20 to 39 kWp for Nukulaelae, Nukufetau, Nui, Niutao, Nanumaga and Nanumea, and 95 kWp for Vaitupu) make them suitable for small-scale RE projects.

Currently, seven of the eight outer islands are powered by 48–80 kW diesel generators, which are typically oversized. This makes them inefficient to operate and they use more diesel fuel than necessary. Blackouts are a regular occurrence, more often from a lack of diesel fuel and spare parts than from mechanical breakdown. The diesel generators run for 12 to 18 hours per day to save fuel

and maintenance, and are reported to be in reasonable condition, but they may require replacement by 2020.

The New Zealand Ministry of Foreign Affairs and Trade (NZMFAT) is currently implementing a solar photovoltaic (PV) project on Funafuti and the outer islands. The outer-island component consists of the installation 1,030 kW of solar PV, batteries and ancillary equipment on four outer islands (Nanumea, Nanumaga, Niutao and Vaitupu) that are currently 100-percent reliant on diesel gensets. When construction is expected to be completed in early 2015, the diesel gensets will only be used for standby power. On three of the other outer islands that are also currently 100-percent reliant on diesel gensets (Nukulaelae, Nukufetau and Nui), the European Union (EU) is financing 182 kW of solar PV, batteries and ancillary equipment, to be completed by mid-2015. The solar PV installations under this project will be capable of remote monitoring, but due to limited funding the EU will not be financing the communication equipment necessary to do so. This project will install necessary communications equipment to allow for remote monitoring of this PV installation from Funafuti.

Once both the NZMFAT and EU projects are completed in 2015, all the inhabited outer islands of Tuvalu (aside from Niulakita, population 42, which has no central grid) will be generating 100 percent of their electricity needs from renewable resources and saving more than 300,000 liters of diesel fuel per year, approximately.

Distribution system: Power generated from the diesel and solar generators is transmitted through an 11 kV underground ring main system before it is distributed at 415 V for the three-phase system and 230 V for single-phase users. The underground transmissions and distribution have recorded only 7 percent of system losses since the JICA upgrade (2007), according to a Keuring van Elektrotechnische Materialen te Arnhem (KEMA) study conducted in 2009. However, conflicting data exist for these results, with up to 17 percent reported by the 2012 Pacific Power Association (PPA) benchmarking study using 2011 data. Maintenance problems are still high due to saltwater corrosion at substations and in house connections. However, in general, Fogafale residents are provided with a high level of reliable electricity supply throughout the island. Outage data recording has improved dramatically since December 2012; this will allow fairly sound calculations of the System Average Interruption Duration Index (SAIDI) and System Average Interruption Frequency Index (SAIFI) to be made and monitored going forward.

Key issues and country strategies

Main electricity sector challenges: The major issues that the power sector currently faces include: (i) high dependency on costly imported fuels; (ii) TEC's insufficient revenues from tariffs to meet operating and maintenance (O&M) costs (thus requiring additional subsidies from the Government); (iii) the high maintenance cost of generation and distribution systems in a marine environment; and (iv) the need for capital to finance the power infrastructure requirements of Funafuti and the outer islands.

Energy policy and the renewable energy target by 2020: Tuvalu is addressing these issues through the formulation of a long-term energy policy and a master plan for implementing the policy targets. The Tuvalu National Energy Policy (TNEP), which was formulated in 2009, clearly defines and directs current and future energy developments. The TNEP highlighted an ambitious target of 100 percent RE for power generation by 2020. Seven strategic areas were identified as priorities to

ensure that the policy's objectives improve the people's livelihoods. TEC, with assistance from New Zealand's Ministry of Foreign Affairs and Trade (NZMFAT), published a Master Plan for Renewable Energy and Energy Efficiency (MPREEE) in 2013. This plan provides guidance to the sector on achieving the TNEP's 100-percent renewable energy target, and establishes a 30-percent energy efficiency improvement goal.

Initiatives underway and rationale for Bank involvement

New Zealand and other donors, including Australia, the European Union (EU), Japan and the United Arab Emirates (UAE), have various activities already underway to assist Tuvalu's energy development plan (see Annex 2). Most of these activities are focused on the replacement of diesel generation with renewable energy technologies. NZMFAT is providing funds for the installation of 650 kWp of grid-connected solar PV, starting with 150 kWp on Funafuti. The UAE, through its Masdar initiative, will finance the installation of an additional 350 kWp of solar PV. Both projects are expected to be commissioned by mid-2015. Between 2016 and 2020, TEC's plan is to install up to 750 kWp of extra renewable generation capacity each year.

In support of the Government's goals in the energy sector, as detailed in the Master Plan, the proposed Bank effort will provide additional energy generation from solar PV and will include investment in modest wind power capacity. The size and components of the RE investments proposed in the project are the result of extensive least cost optimization modeling. Even if, for various reasons, the role of wind in Tuvalu's future power mix is likely to be smaller than PV, it is important to begin to build TEC's capacity in this technology. The solar PV investment will provide sufficient battery storage and a power-conditioning system to ensure grid stability, as intermittent renewable energy sources become an increasingly dominant portion of Fogafale's power mix. In addition, the Project will finance strategic energy-efficiency investments in the largest electricity-consuming sectors. These investments could significantly reduce the need for future investments on the generation side.

The Bank's involvement will bring a longer term perspective on RE investments from all sources by including battery storage and grid forming inverters that represent major investments but critical for long term grid stability. Thus, this Project will facilitate the planned and other future incremental RE additions without leading to grid instability and other system problems that would seriously set back the country's plans towards achieving the goal of 100% penetration of renewable energy in the future.

II. Proposed Development Objectives

The project development objective is to enhance the energy security of Tuvalu by reducing its dependence on imported fuel for power generation, and improving the efficiency and sustainability of its electricity system.

III. Project Description

Component Name

Renewable Energy Investments

Comments (optional)

This component will finance the supply and installation of power generation and grid management

equipment to increase the contribution of renewable energy in Tuvalu's hybrid generation system and to reduce diesel generation.

Component Name

Energy Efficiency Investments

Comments (optional)

This component will complement Component 1 by reducing energy demand and postponing the need for more costly future investments in generation. It will finance: (i) the supply and installation of prepayment meters for all TEC consumers and smart meters in the largest electricity consumers. Besides helping consumers to more effectively manage their electricity use, this investment will help TEC's demand-side management (DSM) planning and considerably improve its revenue collection and overall financial status; and (ii) the implementation of selected energy-efficiency investments and measures in various large energy-consuming sectors that have been identified in energy audits and consultant studies as having the highest potential for electricity savings.

Component Name

Technical Assistance and Project Management Support

Comments (optional)

This component will finance training courses and other capacity-building activities for TEC and other GoT staff to strengthen their capability to manage and implement the various activities under the Project. A training needs assessment will identify the specific training and skills-enhancement activities. The component will also finance the establishment of an information system to improve TEC business management control and the conduction of technical and energy studies essential to the implementation of some of the Project's activities.

IV. Financing (in USD Million)

Total Project Cost:	9.10	Total Bank Financing:	7.00
Financing Gap:	0.00		
For Loans/Credits/Others			Amount
BORROWER/RECIPIENT			0.00
International Development Association (IDA)			7.00
Energy Sector Management Assistance Program			2.10
Total			9.10

V. Implementation

The Project will be implemented by TEC, with TEC's General Manager as the Project Manager. The existing Project Management Unit (PMU) within the Ministry of Transport and Communications managing the WB-supported Tuvalu Aviation Investment Project (TvAIP) has excess capacity, and a combined PMU will be established. The TvAIP PMU, which consists of a PMU Manager, a Finance and Contract Manager (FCM), a Bids Administrator (BA), and an Administration Assistant (AA) will continue to be funded from TvAIP.

The Energy Sector Development Project (ESDP) will fund a full-time Project Officer to support the Project Manager on day-to-day implementation, monitoring, and reporting of project activities, including: coordination with relevant national government institutions and development partners; procurement of goods and consultancies under the guidance of the BA and the FCM; and monitoring and reporting on results achieved by activities financed under the project.

The PMU Manager will take on additional responsibilities for the ESDP by providing oversight and support to ESDP's Project Officer. The TvAIP PMU Manager and the ESDP Project Manager will agree on the responsibilities of this additional staff member, based on need, and recruitment will be conducted jointly.

A RE Technical Specialist will support TEC during installation and commissioning stages of Project implementation as well as inputs on TORs and studies, and providing expert technical guidance as needed. A part-time Safeguards Advisor will assist TEC in implementing and monitoring the project's safeguard requirements. A part-time 'Procurement Advisor' will be hired to assist the PMU with procurement activities.

Although they have not previously worked with the Bank, TEC, the Ministry of Foreign Affairs, Trade, Tourism, Environment and Labour and the Ministry of Natural Resources' Department of Land are aware of the Bank's safeguard policies and are supportive, especially with reference to effective public consultation aimed at managing environmental and social risks, resettlement principles and impact monitoring.

VI. Safeguard Policies (including public consultation)

Safeguard Policies Triggered by the Project	Yes	No
Environmental Assessment OP/BP 4.01	x	
Natural Habitats OP/BP 4.04		x
Forests OP/BP 4.36		x
Pest Management OP 4.09		x
Physical Cultural Resources OP/BP 4.11		x
Indigenous Peoples OP/BP 4.10		x
Involuntary Resettlement OP/BP 4.12	x	
Safety of Dams OP/BP 4.37		x
Projects on International Waterways OP/BP 7.50		x
Projects in Disputed Areas OP/BP 7.60		x

Comments (optional)

VII. Contact point

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