PROJECT INFORMATION DOCUMENT (PID)
CONCEPT STAGE

Report No.: PIDC965

Project Name	Energy Sector Development Project (P144573)
Region	EAST ASIA AND PACIFIC
Country	Tuvalu
Sector(s)	Other Renewable Energy (40%), Transmission and Distribution of Electricity (30%), Energy efficiency in Heat and Power (30%)
Theme(s)	Infrastructure services for private sector development (100%)
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	03-Oct-2013
Date PID Approved/ Disclosed	24-Oct-2013
Estimated Date of Appraisal Completion	07-Feb-2014
Estimated Date of Board Approval	22-Jul-2014
Concept Review Decision	Track I - The review did authorize the preparation to continue

I. Introduction and Context

Country Context

Tuvalu is the World Bank Group's second newest member, joining in June 2010. Tuvalu is a group of nine inhabited islands (4 reef islands and 5 coral atolls) with a land area of 26 km2 and maximum elevation of 4.5 meters. Few atolls are more than 800 meters wide. Roughly half the country's population of some 9,847 lives on the main atoll, Funafuti. On the outer islands three-quarters of the people still live in traditional-style housing. This small atoll group of 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 is around US$35 million a year and is the smallest of any independent state. Tuvalu has no foreign debt and is financially sound due to fiscal prudence, aid, remittances, and a series of unique monetary arrangements. The Government employs some 40.7%

of the work force, retail trade 5.6% and construction 5.5%. The unemployment rate was 6.5% in 2002 (latest official data). Tuvalu's gross domestic product (GDP) was US$ 35,804,372 in 2011 and was the smallest of any independent state. GDP growth in Tuvalu is highly volatile and may not return to historical levels before the global financial crisis without a significant effort to improve macroeconomic management, the business climate and human capital. Donor assistance can help growth and resilience, by building policymaking capacity and by supporting infrastructure investment. Due to the small size of population, the scope for economic diversification, including for exports, is minimal. Nearly everything, including skilled services, is imported, with fuel and food constituting about half of total goods imports. 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 donor assistance. Absolute poverty is rare and access to primary education effectively universal. Though provision of health services is limited by the country's small size, Millennium Development Goals health targets are on track to be reached by 2015.

Including its roles in health and education, the public sector employs around a tenth of the country's population, and deficits have been persistent even in good times. These are generally closed via donor support, but also via disbursements from the country's budget support fund, the Consolidated Investment Fund (CIF). The country's external public debt was 14 percent of GDP in 2011. The unemployment rate was 7% in 2005 . Industry barely exists. There is small-scale processing of timber (sourced locally or from New Zealand) and handicrafts. Small numbers of Tuvaluans work in the tourism industry. Tuvalu's economy is highly dependent on remittances and is considered one of the most economically and environmentally vulnerable countries in the world.

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.

Farming is subsistence and productivity is low due to poor soils, limited use of fertilizer, 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 from coral rock. Reef fish and tuna are the main dietary protein. Tuvalu is a net food importer and three-quarters of the food consumed on Funafuti is imported. Food, alcohol and tobacco are the major imports (32%) followed by fuel (18%). Imports reached US $20.2 million in 2011 but exports are usually around half a million dollars annually, (US$0.6 million in 2011), mainly copra and handicrafts. Exports are smaller than most other small countries, while imports are very large.

Tuvalu will continue 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

Main electricity sector challenges: The major issues presently facing the power sector include: (i) the high dependency on imported fuels, (ii) TEC's insufficient revenues from tariffs to meet operating and maintenance costs (requiring additional subsidies from the Government), (iii) the high cost of generator maintenance in a marine environment, and (iv) the need for capital to finance the outer island power infrastructure requirements.

Energy Policy and the Renewable Energy Target by 2020: Tuvalu has a policy to provide adequate, efficient and cost effective economic infrastructure to its population, including electricity. It aims to improve the provision and quality of services to the outer islands, and ensure more efficient and less subsidized services overall. The Tuvalu National Energy Policy (TNEP) was formulated in 2009 which clearly defines and directs current and future energy developments. The TNEP highlighted an ambitious target of 100% renewable energy (RE) for power generation by 2020. Seven strategic areas were identified to ensure that the objectives of the policy improve the livelihood of the people. In implementing the TNEP, an Energy Strategic Action Plan was developed as a guide to ensure that the target of TNEP can be achieved by 2020. A detailed renewable energy master plan has been recently developed with assistance from New Zealand's Ministry of Foreign Affairs and Trade (NZMFAT) to guide and facilitate the development of the sector towards the 100% renewable energy target. The report was completed in December 2012.

Institutional arrangements: The energy sector is managed by the Department of Energy within the Ministry of Public Utilities. The Government established the TEC in 1991 and in 2010 TEC became a fully State Owned Enterprise (SOE), with the responsibility for managing and operating grid connected systems on eight islands. At the end of 2011, the Government began to re-nationalize TEC due to concerns over security of power supply. In December 2012, during an energy sector scoping mission, the World Bank was informed that the Government's intention to de-corporatize TEC has been dismissed. This is also evidenced in the 2013 Budget that was passed in December 2012 that does not indicate funding for a nationalized entity.

Electricity use: Tuvalu has 2010 households; 880 in Fogafale and 1,130 on the outer islands. Over 98% of Tuvaluans have access to electricity. The main electricity consumer is the Government, accounting for approximately 27% of the total electricity consumption. Residential users account for approximately 45%, while commercial users account for approximately 28%. TEC faces an issue with overdue payments particularly from its largest customers. Due to failure of large customers the debtor days for accounts receivable have risen from 55 in 2011 to 105 in 2012.

Tariff structure: With 98% of Tuvalu's generation being diesel based generation, power costs are very sensitive to increasing fuel prices . Tuvalu's energy costs are above average for the region at 57c/kWh 3This places them in the top third of Pacific power utilities. . Current tariffs for private use are set at $0.29/kWh for the first 50kWh ("lifeline tariff"), $0.38/kWh for the next 50kWh, and $0.55/kWh thereafter. For commercial and government users the rate is $0.56/kWh in Funafuti and $0.55/kWh for the outer islands.

Electricity Systems

Funafuti system: The Funafuti system accounts for about 75% of the country's installed capacity. The generation system on Funafuti comprises a recently installed (JICA 2007) power station comprising three 0.6MW diesel generators with an11kV distribution system. Total power output is 1,800kW. This is backed up by aged 415V output generators that have remained offline (1,920kW), but are still able to be used as necessary provided a step up transformer is installed to connect to the 11kV distribution network.

The generators are run using diesel that is substantially subsidized by approximately 40% of the annual fuel consumption through the Japan Non-Project Grant Assistance. This assistance has

recently concluded, but the Government is currently negotiating for its continuation. There is also a grid-connected 40kW solar system established by the European Union (EU) and Japanese Government through Kansai Electric Company (Japan) in 2008 on Funafuti that also contributes 1% of production. Since commissioning the new diesel power station, the island of Funafuti has reduced the number of power blackouts.

Power generated from the two systems (diesel generators and solar) is transmitted through an 11kV underground ring main system before distributing it to homes at 415V for three phase system and 230V for single phase users. The underground distribution network has recorded only 7% system losses since the JICA upgrade (2007) and provide reliable electricity throughout the island. Maintenance problems are still high due to saltwater corrosion at substations and house connections.

Funafuti has a peak demand of 1MW and residents have been estimated to demand 969kWh of electricity per person per annum . The bulk of electricity is utilized on refrigeration (34%) followed by air conditioning (30%). Electronics, mechanical and light requirements equally (~12% each) comprise the remaining demand. For Funafuti this results in a total demand in 2010 of 4.7MWh, well within the supply envelope of TEC (5.0MWh). With the small projected population growth (~2%), demand is expected to rise a modest 3-5% per year.

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

Currently, seven of the eight outer islands are powered by 48-80 kW diesel generators, which are typically oversized, using more diesel fuel than necessary and making them inefficient to operate. Blackouts are a regular occurrence, more often from a lack of diesel fuel and spare parts than mechanical breakdown. The diesel generators run for 12-18 hours per day to save fuel and maintenance, and are reported to be in reasonable condition, but may require replacement by 2020. If the RE target of 100% renewable energy on the outer islands by 2015 is achieved, replacement of the generators may not be necessary. Niulakita, the smallest of the outer islands, with 41 inhabitants5, is powered by individual DC home solar systems.

Relationship to CAS

The Tuvalu CAS, presented to the Bank's Board on November 4, 2011, identifies "building resilience against exogenous shocks" as a major theme of the World Bank's engagement. Reducing Tuvalu's dependence on imported diesel fuel will reduce their exposure to oil price shocks, such as the one that severely affected the region in 2008.

II. Proposed Development Objective(s)

Proposed Development Objective(s) (From PCN)

The project development objective is to support Tuvalu enhance its energy security by improving the efficiency and sustainability of the electricity system.

Key Results (From PCN)

The project is expected to produce the following results:

i) Reduced outstanding accounts/debtor days.

ii) Increased labor productivity.
iii) Increased renewable energy to grid (%).
iv) Increased staff capacity to implement and manage the technologies.

These key result areas will form the basis of the performance indicators by which the project will be monitored. Results monitoring and evaluation will be conducted as a part of the project implementation.

III. Preliminary Description

Concept Description

The project will consist of three components to be implemented by TEC.

Component 1: Improving the efficiency of TEC's electricity system (estimated cost: $0.8M). This component will involve two subcomponents:

Pre-payment meters (estimated cost: $0.4M): TEC has a high level of outstanding debtors, with accounts receivable standing at over 100 debtor days, i.e. over 3 months. The project will finance the procurement and installation of pre-payment meters on all accounts, with Smart meters being considered for large accounts. The project will also include a capacity building program for TEC staff and a program to raise awareness of consumers.

Communications system, data and voice communications (estimated cost: $0.4M): Poor communications between Funafuti and the outer islands is an impediment to utility operations and customer service, and the current communications system is highly unreliable. The project will finance the installation of a satellite and wireless communication system to facilitate voice and data communications between the outer islands and the head office in Funafuti.

Component 2: Renewable Energy and Energy Efficiency (estimated cost: 5.9M, depending on total grant allocation). In line with the Energy Master Plan and TEC's vision for 100% renewable energy generation by 2020, this component will focus on improving Tuvalu's renewable energy penetration in Funafuti. By carrying out energy and power system modeling for the system, a best solution for increase RE penetration will be proposed. Applying a process of grid integration and enabling technologies, and combining with energy efficiency measures, significant improvements can be made, increasing the overall RE penetration by up to 25%.

Key elements of the process involve:

-Power System Modeling: By carrying out power system modeling for the system, a best solution will be proposed for increasing RE penetration. The modeling will factor in the renewable energy plans of other development partners, such as NZ's plan for 618kWp solar and 299kWp wind energy and build upon the existing system.
-Generation Economic Load Dispatching System: With fuel accounting for the majority of costs for Tuvalu's power generation, more efficient use of the generators will bring about savings in fuel consumption. Installation of a generator load dispatch system at the Funafuti power generation plant will lead to improved fuel efficiency of the operations, translating into direct cash savings for TEC.
-Load control and automated demand side management: Load control and load shifting initiatives can reduce reliance on diesel generation by matching demand more closely to the supply profile for

RE. Energy efficiency initiatives will reduce overall demand, hence enhancing overall RE penetration of the network.
-Grid stabilization: Managing the active and reactive power will improve efficiency of the system, minimizing network losses, and protecting against equipment damage and outages caused by overloading and voltage fluctuations.
-Energy Storage: Combined with the initiatives implemented above, assessments will be made on the cost benefit of adding storage to the Funafuti grid.

This is a layered process, and greater funding will enable greater gains to be made towards achieving the 100% RE target for Tuvalu.

Component 3: Technical Assistance to TEC (estimated cost: $0.3M). This component will support project implementation and build capacity to operate, manage and maintain systems. This also includes collecting electricity data and statistics, and development of information management system.

Gender screening analyses will be conducted during project preparation. Depending on results, appropriate gender actions, and monitoring and evaluation will be conducted accordingly.

IV. Safeguard Policies that might apply

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

V. Financing (in USD Million)

Total Project Cost:	7.00	Total Bank Financing:	7.00
Financing Gap:	0.00		

Financing Source	Amount
BORROWER/RECIPIENT	0.00
International Development Association (IDA)	7.00
Total	7.00

VI. Contact point

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