PROJECT INFORMATION DOCUMENT (PID)
APPRAISAL STAGE

Report No.: PIDA59155

Project Name	Energy Resilience for Climate Adaptation (GEF/SCCF) (P149522)
Region	LATIN AMERICA AND CARIBBEAN
Country	Belize
Sector(s)	General energy sector (100%)
Theme(s)	Climate change (100%)
Lending Instrument	Investment Project Financing
Project ID	P149522
GEF Focal Area	Climate change
Borrower(s)	Government of Belize
Implementing Agency	Ministry of Finance, Public Service, Energy and Public Utilities, Belize Electricity Limited (BEL)
Environmental Category	B-Partial Assessment
Date PID Prepared/Updated	19-Jun-2016
Date PID Approved/Disclosed	21-Jun-2016
Estimated Date of Appraisal Completion	30-Jun-2016
Estimated Date of Board Approval	31-Aug-2016
Appraisal Review Decision (from Decision Note)	

I. Project Context

Country Context

1. Belize is an upper-middle-income country with a population of about 350,000 people, gross domestic product (GDP) of nearly US$4,850 per person, and a natural resource-based economy. It is a Caribbean nation that is part of the Small-Island Developing States group located on the Central American mainland. Belize's GDP, estimated at US$1.7 billion for 2014 is generated primarily through agriculture/agro-industries, tourism, fisheries, logging, and some oil production. Over the past decade, the tourism sector has emerged as a major economic driver, and the first commercial oil discovery was made in 2005, sparking an additional export industry albeit at a modest scale. The private sector accounts for two-thirds of Belize's economic activity.

2. The country's economic prospects are a concern because growth has fluctuated with a subdued trend more recently, placing the poor and the vulnerable at particular risk. Economic growth in Belize has averaged a modest 2.65 percent from 2004 to 2014, which is unable to keep up with the increase in population creating stagnant economic conditions. Based on available data, which is for 2009, it is reported that somewhere from 40 percent to 55 percent of the population in

Belize is poor or susceptible to falling into poverty. Given the modest economic growth since then, these conditions are likely to persist today. Therefore, a sizable segment of the population will be challenged to overcome poverty in the present environment, and may even regress if the country were to face external shocks given Belize's relatively open and export dependent economy. The elimination of preferential trade quotas, reduction in tourism revenues, and oil price shocks represent the types of risks that could impede growth and plunge more Belizeans deeper into poverty.

3. These economic vulnerabilities are intensified due to Belize's exposure to risks posed by extreme weather from tropical storms and hurricanes. Belize has a long history of experiencing hurricanes and tropical storms. They have severely affected Belize's economy and its citizen's well-being. In 1961, Hurricane Hattie, caused damages estimated at 600 percent of GDP and killed 400 people. More recently, Hurricane Keith in 2000 caused damage exceeding 45 percent of GDP; Hurricane Iris in 2001 submerged Belize City in storm surges that resulted in damages estimated at 25 percent of GDP; Hurricane Dean in 2007 led to an estimated US$80-100 million in damages (6-8 percent of GDP) and caused a near-countrywide power blackout; and Hurricane Richard in 2010 enveloped most of the country with heavy rainfall and flooding causing damages and losses estimated at about US$35 million (about 3 percent of GDP). Tropical storms, which typically cause less disruptions, impact Belize with even greater frequency. These extreme weather events cause casualties, damage property, and lead to disruptions in services. Their unpredictability poses a considerable development challenge, because it creates vulnerabilities for the economy, especially for the poor. The devastation from a hurricane can suddenly set back development gains and constrain growth, and recovery often takes time. Therefore, enhancing the resilience of the country to extreme weather events is a development imperative.

4. The extreme weather impacts in Belize are likely to be exacerbated because of climate change. The United Nations has identified Belize as being among the countries most vulnerable to the adverse impacts of climate change and a global index ranked 22 among 180 countries fr climate risk . This assessment for Belize is primarily because of (a) its long, low-lying coastline; (b) its over 1,060 small islands; (c) its second-longest barrier reef in the world and 17,276 km2 of forest cover supporting fragile ecosystems; and (d) it being prone to natural disasters, especially hurricanes. The major risks posed by climate change are rising sea levels, increased intensity of tropical storms and hurricanes, greater flooding, extended droughts, rapid shoreline erosion, saltwater intrusion, and changes in temperature. Due to this exposure, Belize has been included as one of the top ten countries in the world that is at a high risk to combined impacts of multiple hazards (climate-change- induced heat, drought, and floods and disaster-induced poverty). Estimates suggest that annual losses due to these impacts equate to about 7 percent of the county's GDP. As such, climate change is sure to test the resilience of Belize in the future, placing considerable importance and urgency on developing ways to better adapt to these challenges.

5. The infrastructure sector in Belize is highly exposed to extreme weather and climate risks. When these risks are manifested, the resulting damages to infrastructure and disruptions to services can be significant. For example, the increase in global temperatures that is leading to rising sea levels poses particular risks in the low-lying, flood-prone coastal areas in Belize. When combined with either high winds or intense rainfall from storms and hurricanes, it will lead to increasing levels of inundation, especially along coastal areas, that can damage residential and commercial buildings, roads and related transport infrastructure, power generation facilities and transmission/ distribution structures, and water supply equipment. These impacts can extend even beyond the

coastal areas and affect the entire country, as was the case in 2008, when heavy rains led to massive flooding, resulting in the economy being crippled for weeks, with over a sixth of Belizean citizens being affected. Because infrastructure is interdependent in facilitating economic development, it is vital to have a comprehensive approach to addressing adaptive capacity so that future weather impacts, which are likely to be exacerbated by climate change, can be withstood with minimal disruptions to services.

6. The GoB has progressively taken steps to enhance resilience and is seeking development partner assistance to improve and speed up implementation. The Disaster Preparedness and Response Act (2003) is the primary legislation governing disaster risk management (DRM) in Belize, which also led to the establishment of the National Emergency Management Organization (NEMO) as an institutional mechanism to coordinate responses during emergencies. In 2014, the GoB also adopted the National Climate Resilience Investment Plan (NCRIP) that takes a longer-term view to developing resilience and looks to mainstream climate adaptation investments in national planning. The Bank is already assisting the GoB implement parts of the NCRIP through the Belize Climate Resilience Infrastructure Project (BCRIP) that primarily focuses on roads. While the NCRIP also covers energy and stresses the need to mainstream climate change risk considerations in utilities, it is less explicit about the precise engagements in the sector. Therefore, the GoB has requested assistance from the Bank to develop specific priority interventions that will enhance energy resilience so that the country can better adapt to existing and emerging impacts from climate change. The proposed Energy Resilience for Climate Adaptation Project (ERCAP) will complement the actions supported by the BCRIP and reflects a comprehensive effort by the Bank to enhance infrastructure resilience in Belize.

Sectoral and institutional Context

Energy and Infrastructure Sectors

7. Primary energy demand in Belize has remained steady. In 2014, the total energy demand in Belize was 11,014 TJ, which has remained steady from 2010 when it was 10,946 TJ. The consumption is primarily from energy for transport, industrial use of liquid fuels and biomass, and power generation as well as the consumption of wood mostly for cooking. The primary energy supply is mostly through liquid fuels and electricity. Some significantly trending shifts from 2010 to 2014 include an over 50 percent increase in the use of biomass because of expanded power generation and nearly 50 percent increase in electricity imports.

8. Electricity demand is met mainly through hydropower generation and imports from Mexico. The installed domestic power generation capacity in the country is 110 MW, with an additional 50 MW of non-firm capacity made available through an interconnection with Mexico. Most of the domestic power generation facilities are privately owned independent power producers (IPPs), while the national power company owns several power plants that operate on diesel, which are primarily used as backup due to their high operational costs. Peak demand is around 86 MW, with demand growing at approximately 5 percent per annum. Majority of the domestic generation is from hydropower that is significantly supplemented by electricity imports from Mexico. However, because the availability of hydropower in recent years has been volatile due to significant variation in precipitation, some domestic generation has been supplanted through electricity produced from bagasse . Such uncertainties are predicted to last and can be attributed to modulations by global climatic phenomena where the intensities as well as frequencies are likely to increase.

9. Electricity in Belize is transmitted through a single-circuit radial transmission network, which feeds various distribution systems. It extends about 400 miles across the country at different voltage levels ranging from 115 kV in most of the country to a 34.5 kV undersea link to the island of San Pedro. The transmission interconnection with Mexico is also a 115 kV line with a rated capacity of 65 MW. The distribution networks operate at 22 kV, 11 kV, and 6.6 kV in various towns throughout the country. They mostly operate without stress although some of the 22 kV lines feeding distant areas are excessively long and lead to voltage drops. However, many distribution networks are dependent on a single grid substation with a single transformer, thus limiting the alternate supply possibilities in the event of a major failure.

10. A number of public and private stakeholders participate in Belize's energy sector. The overall responsibility for the energy sector rests with the Directorate of Energy in the Ministry of Finance, Public Service, Energy and Public Utilities (MFPSEPU). Liquid fuels are supplied primarily through two private companies and they are regulated by different GoB agencies. Electricity services are provided by Belize Electricity Limited (BEL), the national power company. BEL owns and operates all transmission and distribution assets that make up the national grid, while it primarily purchases electricity from IPPs and the CFE with the exception of 26 MW of diesel-based capacity it owns and utilizes for backup purposes. BEL is regulated by the PUC.

11. There are a number of risks posed by extreme weather that create vulnerabilities in the energy sector. A high-level analysis was carried out to map major climate-related risks that are likely to impact Belize and that will expose the vulnerabilities in the energy sector. A total of 23 risks were identified with 14 categorized as being very high or high.

- Rise in sea levels that results in storms surges and inundation makes energy infrastructure such as transmission lines, substations, fuel storage, and some generation vulnerable, particularly those in coastal areas including various islands and Belize City. A Bank study concluded that there could be more than a 40 percent increase in Belize's storm surge zone and that the related inundation risk could cover two-thirds of the country's wetlands.

- Increasing intensity of hurricanes and tropical storms can significantly damage energy infrastructure throughout the country, because of a variety of resulting factors including high winds, storm surges, and inundation. This includes damages to infrastructure such as ports, storage depots, and roads that facilitate the supply of fuel; faults in transmission and distribution lines that disrupt electricityservices due to fallen trees, damaged poles, and other operational challenges; and constrained access to critical energy facilities to carry out repairs and reconstruction. Climate models are predicting hurricanes and storms impacting the Caribbean region as becoming more intense in the future.

- Significant volatility in rainfall patterns leads to unpredictability in the availability of hydropower, while periods of intense rainfall coupled with deforestation will result in increased sedimentation in reservoirs.

- Increase in temperature and severity of droughts can lead to stresses on energy operations, gradual increases in demand, wild fires that damage energy infrastructure, and limited options that can be reliably cultivated for biomass/biofuels.

12. The power sector is particularly susceptible to extreme weather and therefore needs to strengthen its adaptive capacity. Analysis of several past extreme weather events and their impact on the power sector illustrate these vulnerabilities. The single-circuit radial transmission network is a reliability concern, because a fault or weather damage in one of its sections can compromise the integrity of the entire network. This was the case in 2007, during Hurricane Dean, when a fault in the CFE system in Mexico triggered a cascade of faults that led to a near-countrywide blackout in Belize. A similar incident occurred in 2010 during Hurricane Richard when a "trip" in the transmission line was not contained locally leading to a sequence of faults along the East-West transmission line that also cascaded through the southern line. It cut off hydro Becol from supplying key load centers, and affected over 18,000 customers (about 23 percent of BEL's customer base). Engineering inspections have also discovered several areas where transmission poles and associated structures are weakened because of decay and cracks in some wooden poles and corrosion in waterlogged and saline areas. BEL carries out an aggressive maintenance plan that has prevented a major collapse in the transmission infrastructure thus far. However, repeated storm impacts are progressively weakening some line sections that are more likely to experience a major "downing" of poles, especially during hurricanes with high winds. In addition, most of the service disruptions during extreme weather events are caused by damages to the distribution systems. For example, 12 of the 13 faults recorded during Hurricane Dean and 15 of the 17 faults recorded during Hurricane Richard affected the distribution network, which, according to BEL, were primarily due to heavy rains, winds, and lightning as well as fallen trees/branches damaging the distribution infrastructure.

13. BEL and the Belizean authorities are experienced at dealing with extreme weather given the country's history. Nevertheless, following Hurricanes Dean and Richard, the recovery in the power sector extended to 4-6 days and 2-4 days, respectively, affecting over 10,000 BEL customers in each instance. While BEL presently has a Hurricane Preparedness Plan, it does not include well-developed protocols for quick and efficient recovery. BEL appears to have adequate spare supplies to repair system damages, but its emergency response capabilities can be improved. This includes preventive measures such as better vegetation management, since fallen trees and branches are a significant reason for outages during storms. Planning and preparation are also challenged by the limited availability of data in Belize with regard to energy as well as localized impacts from a changing climate. Better weather information regarding precipitation, hydrology, flooding will improve ongoing sector operations and also help improve future decisions.

Public Disclosure Copy

II. Proposed Development Objectives

The development objective of the proposed Energy Resilience for Climate Adaptation Project is to demonstrate solutions that enhance the resilience of the energy system to adverse weather and climate change impacts.

This will be collectively achieved by implementing a wide-ranging and complementary set of activities that include pilot initiatives, infrastructure hardening, and analytical and planning efforts.

III. Project Description

Component Name

Component 1: Long-Term Energy Planning and Capacity Building for Climate Adaptation

Comments (optional)

Component Name

Component 2: Demonstration of Measures to Enhance Resilience of Energy Sector

Comments (optional)

Component Name
Component 3: Project Implementation Support and Information Dissemination for Knowledge Sharing
Comments (optional)

IV. Financing *(in USD Million)*

Total Project Cost:	11.98	Total Bank Financing:	0.00
Financing Gap:	0.00		

For Loans/Credits/Others	**Amount**
Borrower	3.98
Global Environment Facility (GEF)	8.00
Total	11.98

V. Implementation

18. The ERCAP is implemented by multiple agencies with a common thread of building resilience for climate adaptation in the energy sector. The multi-agency nature reflects the comparative advantage and responsibilities of each participating institution, which areneeded to achieve the project objectives. Due diligence confirmed that each agency has sufficient capacity commensurate with project implementation requirements.

19. MFPSEPU, through its Directorate of Energy, is responsible for overseeing the energy sector. It will also be responsible for overall implementation of the ERCAP. MFPSEPU will establish a PMU dedicated to the ERCAP, which, with the assistance of a project manager, will help implement activities that are directly under the MFPSEPU as well as coordinate ERCAP activities with the other implementing agencies. It will also establish a high-level, multi-stakeholder steering committee that will help guide the overall implementation of the ERCAP.

20. NMS is a department within the Ministry of Works, Transport, and National Emergency Management, which is the GoB authority on weather and climate. The NMS will be a sub-implementing agency in the ERCAP responsible for hydrological and meteorological data collection. The fiduciary functions for the NMS will be carried out by the MFPSEPU.

21. BEL, as the national power company, will be responsible for implementing all activities directly related to the power system under the ERCAP. Within BEL, the ERCAP activities will be managed by the Directorate of Systems Planning and Engineering in coordination with other relevant departments. BEL will also participate in the long-term energy planning activity.

VI. Safeguard Policies (including public consultation)

Safeguard Policies Triggered by the Project	**Yes**	**No**
Environmental Assessment OP/BP 4.01	×	
Natural Habitats OP/BP 4.04	×	

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

World Bank

Contact: Migara Jayawardena
Title: Senior Energy Specialist
Tel: 473-7436
Email: mjayawardena@worldbank.org

Borrower/Client/Recipient

Name: Government of Belize
Contact: Yvonne Hyde
Title: Chief Executive Officer
Tel: 510-822-2526
Email: ceo@med.gov.bz

Implementing Agencies

Name: Ministry of Finance, Public Service, Energy and Public Utilities
Contact: Peter Allen
Title: Chief Executive Officer
Tel: 510-822-2204
Email: ceo@mps.gov.bz

Name: Belize Electricity Limited (BEL)
Contact: Jeffrey Locke
Title: Chief Executive Officer
Tel: 5012270954
Email: Jeffrey.locke@bel.com.bz

VIII. For more information contact:

The InfoShop
The World Bank
1818 H Street, NW
Washington, D.C. 20433
Telephone: (202) 458-4500
Fax: (202) 522-1500
Web: http://www.worldbank.org/infoshop