Report Number: ICRR0024859

1. Project Data

Project ID P149522	**Project Name** Belize - ERCAP (GEF/SCCF)
Country Belize	**Practice Area(Lead)** Energy & Extractives

L/C/TF Number(s)	**Closing Date (Original)**	**Total Project Cost (USD)**
WBTF-A2887,WBTF-A2888	31-Jul-2020	7,964,605.23
Bank Approval Date	**Closing Date (Actual)**	
12-Sep-2016	30-Nov-2024	

	IBRD/IDA (USD)	Grants (USD)
Original Commitment	0.00	8,000,000.00
Revised Commitment	0.00	7,964,605.23
Actual	0.00	7,964,605.23

Prepared by	Reviewed by	ICR Review Coordinator	Group
Ihsan Kaler Hurcan	Avjeet Singh	Avjeet Singh	IEGSD (Unit 4)

2. Project Objectives and Components

a. Objectives

According to the global Environment Facility (GEF) Grant Agreements with grant numbers TF0A2887 and TF0A2888 (p.6) dated September 22 and September 27, 2016, respectively, and the Project Appraisal Document (p.7), the project objective was “to demonstrate solutions that enhance the resilience of the energy system to adverse weather and climate change impacts.”

b. Were the project objectives/key associated outcome targets revised during implementation?

No

c. Will a split evaluation be undertaken?

No

d. Components

The project consisted of three components structured around an integrated disaster risk management (DRM) framework comprising enhance system resilience and rapid response and recovery (ICR, pp.3-4):

A. Long-Term Planning and Capacity Building for Adaptation. (*Appraisal cost: US$2.794 million; actual cost: US2.548 million)*

This component was to finance three groups of activities aimed at strengthening Belize's ability to plan for and manage climate risks in the energy sector. Under three sub-components, first, it was to support development of national capacity for long-term energy and climate-adaptation planning through the collection of detailed meteorological, hydrological, socioeconomic, and energy data, and the development and periodic updating of a predictive planning model to assess the impacts of energy policies and investments. Second, it was to enhance the country's collection of weather and hydrological information by financing the installation of 23 meteorological and 6 hydro-meteorological monitoring stations and the hydrological modeling of the Macal Catchment Area where hydropower plants are located. Last, it was to finance the design and implementation of an emergency response and recovery plan for the energy sector, including reviewing Belize Electricity Limited's (BEL) Hurricane Preparedness Plan, establishing improved operational protocols for rapid response and reconstruction, and strengthening BEL's institutional capacity to implement these procedures.

B. Demonstration Measures to Enhance the Resilience of the Energy Sector. (*Appraisal cost: US$8.435 million; actual cost: US$14.050 million)*

The component was to finance the demonstration of a set of physical and operational measures aimed at strengthening the resilience of Belize's electricity transmission and distribution system to extreme weather and climate impacts under six sub-components. First, it was to support segmentation of the transmission network by upgrading two key substations with protection systems that would isolate faults and prevent cascading outages. Second, it was to finance the strengthening of vulnerable transmission structures, including evaluating materials suitable for Belize's varied terrain and rehabilitating or replacing transmission poles and related infrastructure along weak line segments. Third, it was to enhance the resilience of distribution substations by improving damaged control buildings and relocating or securing battery banks at substations susceptible to flooding. Fourth, the component was to improve BEL's system operations and adaptive management capacity by establishing a backup load control and dispatch center, developing an outage management system, piloting Advanced Metering Infrastructure (AMI), and enabling access to real-time meteorological and hydrological data produced under the first component. Fifth, it was to strengthen BEL's communication network by upgrading to a digital very-high-frequency (VHF) system and installing additional relays to achieve full coverage across the transmission and distribution network. Finally, it was to support the development of a vegetation management plan to introduce improved practices for reducing damage from fallen trees and branches and improving access to sites during storms and emergencies.

C. Project Implementation Support and Information Dissemination for Knowledge Sharing. (*Appraisal cost: US$0.586 million; actual cost: US$0.359 million)*

This component was to finance activities to strengthen project management and promote broad dissemination of lessons on enhancing energy resilience. It was to support citizen and stakeholder engagement and knowledge-sharing by organizing outreach activities and national and regional workshops to communicate the project's approaches, findings, and potential for replication across Belize and the wider Caribbean region. Additionally, this component was to provide project implementation support to both the government and BEL, including financing for audits, financial management, procurement, and safeguards compliance, as well as eligible operating costs necessary to carry out their respective responsibilities under the project.

e. Comments on Project Cost, Financing, Borrower Contribution, and Dates

Project Cost: At appraisal, the total project cost was estimated at US$11.975 million. At project closing, the ICR reports a total actual project cost of US$7.97 million, reflecting the GEF financing amount only. The project team informed in their email dated February 23, 2026, that the total project cost was US$17.003 million because of the increased costs of project activities fully financed by the borrower's contribution.

Financing: At appraisal, the total GEF Special Climate Change Fund (SCCF) financing for the project was estimated at US$8.00 million, consisting of US$2.38 million under Grant TF-A2888 and US$5.62 million under Grant TF-A2887. There were no changes to the GEF financing amounts during implementation. According to the ICR (p. ii), the project disbursed US$2.345 million from TF-A2888 and US$5.620 million from TF-A2887, for a combined total disbursement of US$7.965 million. An undisbursed balance of approximately US$35,307 was returned by the implementing agency prior to closing. (ICR, p.29).

Borrower's contribution: At appraisal, the borrower's contribution was estimated at US$3.975 million, comprising US$3.575 million in cash contributions from BEL and US$0.400 million in in-kind contributions from the Government of Belize through the Ministry of Finance, Public Service, Energy and Public Utilities (MFPSEPU) and the National Meteorological Service (NMS). The ICR does not report on the borrower's actual contribution. The project team later informed that the borrower's cash contribution was US$8.806 million and in-kind contribution US$0.232 million.

Project Restructuring: The project was restructured three times.

- **First Project Restructuring (December 20, 2018 – Level 2):** The first restructuring transferred overall project coordination and fiduciary responsibility from MFPSEPU's Directorate of Energy (DoE) to BEL, after the DoE failed to establish the required project management unit (PMU) with personnel who met the qualification required for a World Bank-financed operation (including a mutually acceptable project manager), leaving the project with zero disbursement and 27 months of implementation delay. BEL committed to staff and fund the PMU and assume procurement management for activities under both grants, while DoE and NMS were to provide focal points. The restructuring also updated procurement plans, the disbursement schedule, and proposed revisions to selected results indicators. The project's closing date remained unchanged.
- **Second Project Restructuring (August 31, 2020 – Level 2):** Despite substantial progress after the 2018 restructuring, the second restructuring extended the project closing date by 22 months, from July 31, 2020 to May 31, 2022, to allow completion of activities delayed by late procurement launch

and significant disruptions caused by the COVID-19 pandemic, including constraints on fieldwork, approvals, and contractor mobilization. It reworded two intermediate indicators, revised the vegetation-management indicator, and introduced a new indicator on adoption of BEL's emergency preparedness and recovery plan.

- **Third Project Restructuring (June 1, 2022 – Level 2):** The third restructuring extended the closing date by 30 months, from May 31, 2022 to November 30, 2024, to allow completion of key activities delayed by COVID-19, land-acquisition challenges, and the complexity of investments under the second component. The restructuring also triggered OP 4.11 (Physical Cultural Resources) and OP 4.12 (Involuntary Resettlement) for the construction of two transmission lines requiring land acquisition for right-of-way.

Dates: The project was approved on September 12, 2016, and became effective on December 6, 2016. A Mid-Term Review was conducted in January 2021. The original closing date of July 31, 2020 was extended by 4 years and 4 months, due to delays associated with the late establishment of the PMU, the impacts of COVID-19 on upstream design and fieldwork, and land-acquisition issues that slowed civil works. The project closed on November 30, 2024.

3. Relevance of Objectives

Rationale

The project objective was highly relevant to the country context and the country's development challenges. As a small, climate-vulnerable state with an electricity system exposed to hurricanes, flooding, and storm-related disruptions, Belize faced systemic risks that threatened the reliability and resilience of its power supply. The development problem centered on the acute vulnerability of the transmission and distribution network and the limited institutional capacity to plan for, anticipate, and respond to climate-related hazards due to gaps in long-term planning tools, climate-informed data systems, and emergency preparedness. To address this problem, the project aimed to strengthen national capacity for climate-resilient energy planning, improve meteorological and hydrological data collection, enhance emergency response readiness in the energy sector, and pilot targeted resilience measures to demonstrate practical approaches for reducing the vulnerability of Belize's electricity system to extreme weather and climate change.

The project's objectives were also highly aligned with the World Bank Group's Country Partnership Framework (CPF) for Belize FY18–22 in effect at project closing, which was extended through FY24. The project objective corresponded to the Focus Area 1: Fostering Climate Resilience and Environmental Sustainability, which prioritizes support for Belize's efforts to strengthen resilience to natural hazards and climate change. Within this focus area, the CPF includes an explicit objective to strengthen the resilience of select road and energy infrastructure and improve disaster and climate-risk management capacities. The project objective was to directly support the achievement of this objective. At the time of this review, a new CPF covering FY25-35 was being prepared but was not formally adopted yet.

The project objective had a clear outcome orientation, focusing on demonstrating solutions that would enhance the resilience of the electricity system rather than simply delivering discrete outputs. Its emphasis on improved planning capacity, better climate-relevant data, strengthened emergency preparedness, and piloted infrastructure upgrades represented a meaningful shift toward climate-informed sector performance.

Although the project's small financing envelope meant that it could only demonstrate resilience measures, rather than scale them, this level of ambition was appropriate for Belize's institutional capacity and for a first-of-its-kind engagement in the sector in the Caribbean. At the same time, the later implementation challenges associated with the project's complex design indicate that the modest size alone did not ensure simplicity. Nonetheless, the objective itself was pitched at a realistic and achievable level, focusing on institutional strengthening and demonstration effects rather than system-wide transformation. Despite delays and implementation issues, the project objective remained relevant and did not require modification.

The project objective was grounded in Belize's acute climate-vulnerability context and aligned with the National Climate Resilience Investment Plan (NCRIP), which identified the energy sector as a critical yet under-developed area for climate-risk integration (PAD, p.4). Because the project was the Bank's first energy-sector resilience operation in the Caribbean, it did not draw on prior regional energy-resilience experience but instead served as a pilot to demonstrate approaches for integrating climate adaptation into energy planning and infrastructure. This pioneering role meant that the project was to provide an initial platform for developing sector-specific methodologies, institutional practices, and technical demonstrations that had not been previously applied in the region.

Overall, the Relevance of Objectives is rated High.

Rating
High

4. Achievement of Objectives (Efficacy)

OBJECTIVE 1

Objective
To demonstrate solutions that enhance the resilience of the energy system to adverse weather and climate change impacts.

Rationale
Theory of Change

The project inputs were to finance institutional capacity-building, enhanced meteorological and hydrological data systems, and selected demonstration-scale investments to strengthen the resilience of Belize's electricity system. These activities were to generate outputs such as climate-informed planning tools developed, new hydro-meteorological stations installed, and modeling capacity developed, emergency-response protocols established, segmentation upgrades at key substations completed, communications systems installed, resilient transmission-pole technologies identified, and vegetation management plan developed. These outputs were expected to provide the analytical, operational, and physical basis needed to demonstrate feasible options for reducing vulnerability to adverse weather and climate impacts.

The outputs were expected to lead to project outcomes such as improved ability to isolate faults and avoid cascading outages, greater generation capacity available during weather events, more adaptive operations informed by real-time data, and faster restoration following storms. Demonstration of resilient pole technologies was to inform future hardening of vulnerable line segments. Importantly, the theory of change correctly positioned the project as demonstrative, with expected outcomes assessed through evidence of adoption, institutionalization, and operational readiness rather than full infrastructure rollout.

The theory of change rested on several typical assumptions for disaster risk management and resilience projects: (i) institutional commitment to adopt and use planning tools and data systems; (ii) BEL's operationalization of segmentation and emergency protocols; (iii) availability of land for transmission works; and (iv) adequate operation and maintenance (O&M) resources for hydro-meteorological and resilience assets. These assumptions provided a reasonable basis for expecting that the project's interventions would contribute to the intended outcomes.

Overall, the theory of change was coherent and realistic for a small, demonstration-oriented disaster risk management operation. The causal links from activities to outputs and from outputs to expected outcomes were direct and technically sound. The achievement of the outcomes and the project objective could be attributed to the project's intervention.

Outputs

- **Training sessions on energy-sector long-term planning conducted:** The project delivered four training sessions for DoE's planning team, covering use of the energy planning model and data systems, compared to a target of eight sessions. The project financed on-the job training of an energy planner and a research assistant.
- **Methodologies and procedures to incorporate climate resilience in long-term planning developed and adopted:** The project developed climate-informed planning methodologies, updated data systems, and supported institutional training, resulting in formal adoption of the planning framework by the responsible ministry.
- **Weather monitoring stations installed and functioning:** The project financed the installation and commissioning of 25 meteorological weather stations, 6 hydro-meteorological stations, and 6 rainfall stations in September 2024 exceeding the target of 25 stations. These stations significantly improved availability of real-time meteorological and hydrological data.
- **Transmission network segmented and protected against cascading line faults:** The project upgraded BEL's BAPCOL substation (named after the Blair Athol Power Company Limited, which operates a power plant connected to the substation) through construction of a new switching station and 3.8-mile 69 kV line, and upgraded the Belcogen substation (named after the Belize Cogeneration Energy Limited, which operates a power plant connected to this substation), though full looping of the Belcogen line remains pending. The project team informed that BEL would complete the full looping of the line by the end of 2026 pending the solution of land acquisition for right of way.
- **Appropriate technologies identified for transmission-line design for different terrain types:** A detailed engineering study examined material options for vulnerable transmission segments and identified fiber-reinforced polymer (FRP) poles as the optimal climate-resilient technology.
- **Weak transmission sections reinforced to be more resilient:** The pilot reinforcement activity targeted 130–160 new poles installed in the most vulnerable transmission segments; at closing no poles were installed, while by May 2025, 87 FRP poles had been procured and stored for installation

during the dry season in 2026. The poles will strengthen the flood-prone 34-mile 115 kV transmission line segment between Westlake and Maskal substations.

- **Vegetation-management plan informed by industry good practice:** The project supported preparation of an integrated vegetation-management plan aligned with international best practices, providing BEL with options to reduce vegetation-related outages; the plan was completed, as planned.
- **Comprehensive emergency-preparedness and recovery plan adopted:** BEL adopted a full Emergency Response and Recovery Plan incorporating improved protocols and institutional measures for rapid storm response, as planned.
- **Regional stakeholder and citizen-engagement conferences held:** The project organized one regional dissemination event (GEF Adaptation Workshop, March 2024) to share lessons on energy-system resilience, meeting the target of 1 event.

The results framework did not include indicators to capture the following project outputs reported by the ICR:

- **Hydrological model for the Macal River Basin completed:** The project developed a hydrological model integrated with NMS weather forecasting systems to support BEL's hydropower dispatch and long-term planning.
- **Operational and communication systems strengthened:** Upgrades included digital VHF communication, establishment of backup control-center capability in Belmopan with satellite centers, and components of outage-management and AMI pilots to enhance system operation and emergency response.

Outcomes

- **Generation sources available for dispatch despite line faults:** Segmentation works were intended to allow two generation sources to remain online during line faults. As a result of the full segmentation of the BAPCOL substation, one generation source became available for dispatch in case of faults in the system. The second generation source will become available for dispatch upon the completion of the Belcogen substation's full segmentation following the construction of the looping line.
- **Generation capacity available for dispatch despite line faults:** Improved substation protections and segmentation were expected to increase the amount of generation capacity accessible during outages; against a target of 110 MW, 82.5 MW were available at closing m(baseline), rising to 97.5 MW by May 2025 following completion of BAPCOL segmentation. The generation capacity available for dispatch will increase to the target 110 MW upon the completion of Belcogen substation's looping line. This indicator and the previous indicator measure the same outcome.
- **Electricity consumers with enhanced security of supply despite weather events**: Segmentation was expected to improve continuity of service for 274,000 consumers; at closing no consumers were recorded as benefiting, but by May 2025, approximately 247,333 consumers were estimated to benefit from the segmentation of BAPCOL substation.

Additionally, the ICR reports the following outcomes that are not captured by the Results Framework:

- **Institutionalization of climate-informed energy planning into sector policy and pipeline:** The planning work fed directly into the update of the National Energy Policy (2022–2040) and into drafting of the Energy Act to operationalize that policy. The parliament is expected to pass the act in the third quarter of 2026.

- **Operational collaboration and data-sharing protocols between NMS, the Hydrology Service, and BEL:** The ICR (p.9) notes formalized real-time data flows and joint use of the Macal hydrological model for dispatch and planning decisions. This is an operational outcome that resulted in system management improvement.
- **Strengthened emergency preparedness translating into utility operational readiness:** The ICR (pp. 10-11) states that the establishment of a central control center in Belmopan and upgraded digital communications have improved the coordination capabilities and operational readiness of the utility during emergencies.
- **Early reliability gains associated with vegetation management reforms:** The integrated vegetation-management plan (partly project-financed, further developed with BEL funds by hiring an international consultancy company) is implemented. The ICR (p.11) notes that the implementation of the vegetation management plan contributed to a decline in vegetation-related outages and long-term contracting of a firm for vegetation control rather than ad-hoc contracting after every emergency.

The project substantially demonstrated viable technical and institutional solutions for enhancing energy-system resilience. It produced credible evidence that climate-informed planning tools, improved hydro-meteorological data systems, strengthened emergency-response protocols, and selected segmentation works can be adopted and operationalized in Belize's electricity system. The project's demonstration value was reinforced by institutional uptake, such as integration of climate-informed planning into national energy policy, and by the government's decision to pursue a follow-on investment operation building directly on the project's approaches.

Several factors, however, constrained the depth and completeness of demonstrated resilience outcomes. Key physical pilots (especially the Belcogen transmission loop and installation of hardened pole structures) were delayed by land-acquisition challenges, upstream design dependencies, and pandemic-related disruptions, limiting the project's ability to fully test its resilience logic within the project period. The project's complex design bundling numerous technical pilots and institutional reforms into a small financing envelope also created sequencing and coordination challenges that reduced the timeliness of demonstration effects. These limitations, while significant, were largely external to the validity of the resilience solutions themselves.

Despite these gaps, the project generated meaningful intermediate resilience gains, including partial segmentation benefits, strengthened operational readiness, and improved real-time data integration. These effects, combined with strong institutional adoption and clear potential for scaling, indicate that the project largely achieved its demonstration-oriented objective. Overall, the project's efficacy in achieving the project objective to demonstrate solutions that enhance the resilience of the energy system to adverse weather and climate change impacts is rated Substantial.

Rating
Substantial

OVERALL EFFICACY
Rationale

The project delivered most of its planned outputs, demonstrated viable resilience solutions, contributed to significant institutional strengthening, and realized partial but meaningful outcome-level improvements in system resilience. Although some physical works were incomplete at closing, the evidence indicates that the project largely achieved its objective of demonstrating solutions that enhance energy-system resilience, warranting a Substantial overall efficacy rating.

Overall Efficacy Rating

Substantial

5. Efficiency

Economic Analysis

The PAD did not include a quantitative economic analysis, reflecting the project's demonstration-oriented nature. Instead, justification relied on the expectation that improved planning capacity, enhanced hydrometeorological information, strengthened emergency response, and pilot resilience investments would reduce weather-related outages, minimize system losses, and inform future cost-effective investments in grid resilience. This qualitative justification was reasonable given the project's objective to demonstrate resilience solutions rather than deliver system-wide physical upgrades.

Consistent with the design, the ICR did not undertake an ex-post economic analysis. It notes that the project introduced operational efficiencies, such as improved situational awareness, segmentation allowing continued dispatch from some generation sources during faults, and better data for hydropower dispatch, but these benefits could not be reliably quantified due to short post-completion observation periods, partial completion of works, and the absence of comparable storm events during the project window. While these constraints limited the ability to measure avoided outage costs or reduced restoration times, the project plausibly created the enabling conditions for longer-term economic gains, particularly through planning tools, meteorological and hydrological data systems, and emergency-response improvements.

Operational and Administrative Efficiency

Operational and administrative efficiency was constrained by significant implementation delays and coordination challenges. The most prominent shortcoming was the failure to operationalize the PMU within the ministry at the start of implementation, resulting in 27 months with no disbursement and requiring a major restructuring to shift implementation responsibility to BEL. This delay materially reduced efficiency by compressing implementation time and contributing to cost increases due to inflation and repeated procurement cycles.

The project's design complexity stemming from nearly 50 planned contracts, substantial upstream design dependencies financed by BEL, and multi-agency coordination further strained implementation capacity and created bottlenecks. These design and readiness weaknesses significantly elevated transaction costs relative to the project's small size.

Implementation efficiency was further affected by exogenous shocks, particularly COVID-19, which delayed fieldwork, consultant mobilization, and procurement. In parallel, land-acquisition challenges that were

unanticipated at appraisal substantially slowed key civil works and necessitated additional restructuring. Although procurement processes remained compliant and predominantly competitive, frequent repackaging, contract extensions, and delayed upstream works reduced overall timeliness and raised coordination costs. Because several GEF-financed civil works depended on BEL-financed upstream design and procurement, delays in these precursor tasks created structural bottlenecks that the PMU could not mitigate, further reducing operational efficiency. Only in the later stages, after BEL strengthened the PMU with dedicated procurement support, did implementation accelerate.

Although the project's administrative performance improved following the first restructuring, operational and administrative inefficiencies continued through to project closing. Given the prolonged early implementation delays, compounded by coordination burdens and sequencing failures, and in the absence of a quantitative economic analysis, the overall efficiency of the project in achieving its objective is rated Modest.

Efficiency Rating

Modest

a. If available, enter the Economic Rate of Return (ERR) and/or Financial Rate of Return (FRR) at appraisal and the re-estimated value at evaluation:

	Rate Available?	Point value (%)	*Coverage/Scope (%)
Appraisal		0	0 ☐ Not Applicable
ICR Estimate		0	0 ☐ Not Applicable

* Refers to percent of total project cost for which ERR/FRR was calculated.

6. Outcome

The project's objective was highly relevant to Belize's climate-resilience priorities and to the World Bank's country strategy, given the country's extreme vulnerability to weather-related disruptions and the need to strengthen planning capacity, operational readiness, and targeted grid resilience measures. The project's efficacy is rated substantial. The project successfully demonstrated a set of institutional, operational, and technical solutions for strengthening energy-system resilience. While some physical works remained incomplete due to land-acquisition challenges and COVID-19 disruptions, the solutions demonstrated were technically sound, institutionally adopted, and already contributing to improved operational readiness. The project's efficiency is rated modest, reflecting early implementation delays, coordination challenges, and complex design relative to the project's small size. Because of high relevance of objectives, substantial achievement of the project's demonstration-oriented objective, and modest but acceptable efficiency of the project in achieving the project objective, the outcome of the project is rated Moderately Satisfactory in accordance with the Bank guidance.

a. Outcome Rating
Moderately Satisfactory

7. Risk to Development Outcome

Technical and Operational: The project's resilience gains depend on completing the remaining infrastructure works. A key risk is the unresolved land acquisition for the Belcogen transmission segment, which has delayed construction and limited the full realization of segmentation benefits; if negotiations continue to stall or fail, operational improvements will remain partial and reduce the value of investments already made. Similarly, the pilot strengthening of weak transmission sections, such as the installation of new poles in swamp-prone areas, remains incomplete, and although materials have been procured and installation is planned for the 2026 dry season, any delays or inadequate maintenance could erode the intended resilience benefits.

Financial: The sustainability of the project's analytical and meteorological systems, (including the 37 weather stations, hydrological model, and forecasting tools) depends on adequate and recurring budget allocations to NMS and the Ministry of Public Utilities. The ICR (p.17) notes that Belize's fiscal space is constrained by high public debt, raising concerns about sufficient funding for the operation and maintenance of these assets and the risk that declining resources could lead to equipment deterioration, reduced data quality, and weakened climate-informed planning. Similarly, BEL must ensure ongoing maintenance of upgraded substations, the new switching station, and communication systems; financial pressures such as storm-related recovery costs or inflation in equipment prices could lead to deferred maintenance and diminish the resilience gains supported by the project.

Institutional Capacity: The project strengthened the long-term planning capacity of the DoE and improved BEL's operational preparedness, but the continued effectiveness of these gains depends on sustained institutional capacity. The ICR (p.17) states that Belize's institutions remain resource-constrained, making outcomes vulnerable to staff turnover, shifting political priorities, or reduced government commitment, all of which could slow the adoption of planning tools and weaken support for climate-resilient investment. Likewise, the enhanced coordination established between NMS, the National Hydrological Service, and BEL for real-time data sharing and modeling requires ongoing institutional backing; any weakening of these arrangements would undermine the long-term value of the project's investments in meteorological, hydrological, and operational data systems.

Climate and Environmental: Belize's high exposure to hurricanes, flooding, and sea-level rise compounds the technical risks associated with the project's incomplete infrastructure works. Even once the remaining transmission-line segmentation and installation of poles in swamp-prone areas are finalized, extreme weather events may damage substations, transmission lines, and communication systems, including those upgraded under the project. While ERCAP's segmentation and hardening measures enhance resilience, they cannot fully eliminate climate-related vulnerability. If severe storms cause major system damage or if remaining works face delays, the resilience gains supported by the project could be diminished or require significant reinvestment to restore or sustain their intended benefits.

8. Assessment of Bank Performance

a. Quality-at-Entry

Project preparation demonstrated strong analytical underpinnings and alignment with national and sectoral priorities. The project objective was clearly formulated, directly linked to Belize's NCRIP and consistent with the country's disaster risk management and climate-adaptation agenda. The design appropriately combined long-term planning support, system-hardening measures, and operational preparedness activities as a demonstration project. Industry practice and engineering assessments adequately informed the technical approaches adopted by the project, such as grid segmentation, improved meteorological monitoring, and enhanced emergency response. However, the design was ambitious relative to the modest grant size and institutional capacity available. The second component bundled numerous complex physical interventions (such as transmission segmentation, structural rehabilitation, substation upgrades, communication systems, and emergency planning) requiring extensive sequencing and coordination. The risk assessments acknowledged capacity constraints but did not fully anticipate the implementation burden associated with nearly 50 planned contracts, the need for BEL co-financing and upstream design work, or the transaction costs of coordinating three entities. These factors contributed to the implementation bottlenecks and delays (ICR pp. 18–19).

Several important risks were underestimated at entry. The multi-agency implementation structure placed the PMU within the MFPSEPU, even though BEL was responsible for most project-financed activities and had significantly greater technical and implementation capacity. The PAD (p.11) states that a PMU under MFPSEPU was established, but in practice it was never operationalized, contributing to a 27-month delay before implementation could begin. The ICR (pp.13-14) notes that this misalignment in institutional arrangements was a central factor behind early implementation failures and ultimately required the first restructuring to reassign overall coordination and fiduciary responsibility to BEL.

In addition, land acquisition was not identified as a potential risk at entry. However, land-related constraints eventually prevented timely construction of the Belcogen looping line and triggered Involuntary Resettlement and Physical Cultural Resources safeguard policies during the third restructuring. Earlier screening would likely have improved implementation readiness and reduced delays related to right-of-way acquisition.

Overall, project preparation integrated key elements of good practice, such as a clear results chain, a coherent M&E framework linked to the project objectives, a sound rationale for climate-resilience investments, and strong engagement with sector institutions and development partners. The technical design, policy alignment, and early analytical work were robust. However, significant gaps in project's implementation readiness, weaknesses in institutional arrangements, overly optimistic implementation assumptions, insufficient attention to sequencing and co-financing dependencies, and gaps in safeguards readiness reduced overall quality at entry and contributed to later implementation challenges.

Overall, the Quality at Entry is rated Moderately Unsatisfactory.

Quality-at-Entry Rating

Moderately Unsatisfactory

b. Quality of supervision

The project team conducted eight formal supervision missions during project implementation, complemented by regular virtual engagement, especially during the COVID-19 period when travel restrictions prevented field missions. This sustained engagement helped maintain implementation momentum despite capacity constraints, procurement challenges, and supply-chain disruptions. However, early supervision did not fully anticipate the depth of institutional weaknesses that ultimately delayed the operationalization of the PMU for more than two years. Earlier intervention at this stage could have prevented the prolonged inactivity that characterized the early project period.

The project team demonstrated growing proactivity as systemic issues became clearer. When the originally designated PMU failed to operationalize, the project team moved to restructure the project and reassign implementation leadership and fiduciary responsibilities to BEL. This was a necessary institutional correction that enabled the project to launch core activities after the long start-up delay. The project team's guidance also helped address recurring procurement bottlenecks and supported the sequencing of complex activities under the second component that depended on BEL-financed upstream work. However, some of these issues had been visible during preparation and early implementation, suggesting that earlier escalation and stronger supervision pressure might have mitigated later implementation delays.

Supervision played a central role in strategic course-correction as the project progressed. The project team used the Mid-Term Review to reassess risks, recalibrate implementation expectations, and agree on a revised implementation plan with detailed milestones, later formalized in the Project Implementation Plan. The team also responded when land-related risks materialized, helping the client prepare the required social instruments and strengthening the project's grievance redress capacity. Nonetheless, the need to activate land acquisition safeguards arose late in the project cycle, indicating that closer supervision of safeguards readiness earlier in implementation could have surfaced these issues sooner and reduced the subsequent delays.

The project team maintained a strong focus on development impact. The Implementation Status and Results Reports and ratings were candid, and supervision emphasized the need to complete the technical pilots and data-driven planning tools essential to demonstrating the project's resilience objectives. The establishment of a Post-Closure Action Plan further reflected the project team's commitment to ensuring that environmental and social obligations and remaining works would be completed safely after the project closing.

Overall, supervision was highly engaged, adaptive, and increasingly hands-on, with multiple strategic course corrections, strong technical support, candid reporting, and sustained focus on development impact. The project team's interventions were instrumental in resolving institutional design failures, addressing safeguards gaps, and helping the project navigate COVID-related constraints. However, earlier escalation of the non-functional PMU and the need to activate land-related safeguards might have reduced the depth of the implementation delays. Despite these substantial shortcomings, the quality of supervision is rated Moderately Satisfactory because of the project team's strong mid-to-late supervision performance and successful steering of the project toward substantial achievement.

Quality of Supervision Rating

Moderately Satisfactory

Overall Bank Performance Rating
Moderately Satisfactory

9. M&E Design, Implementation, & Utilization

a. M&E Design
The project's M&E design was broadly adequate for a demonstration-oriented operation. The Results Framework appropriately tracked key outputs (such as weather and hydrometeorological stations, planning tools, and emergency-response protocols), and responsibilities for data collection were clearly assigned, with the PMU overseeing overall reporting and BEL responsible for technical data.

However, the framework did not fully capture all project outputs, and outcome indicators focused mainly on infrastructure segmentation and reinforcement. While the absence of indicators measuring actual post-storm system performance is understandable (given the unpredictability of weather events in a demonstration project), the design could have incorporated additional operational or institutional indicators to more fully reflect the breadth of resilience-enhancing activities.

The PAD also assumed an operational PMU within MFPSEPU, an institutional arrangement that did not materialize and weakened early M&E coordination and data consolidation. Despite these limitations, the Results Framework included reasonable outcome proxies, such as adoption of climate-informed planning methodologies and progress on system-resilience measures, which were sufficient to assess the project's demonstration impact on strengthening energy-sector resilience.

b. M&E Implementation
Once BEL assumed project implementation responsibilities, M&E practices improved significantly. The BEL-led PMU produced required semiannual progress reports and IFRs, and technical departments supplied timely data for indicators related to weather-station installation, transmission-network segmentation, and reinforcement activities. The improved internal coordination and dedicated staff strengthened data collection discipline and allowed the monitoring system to function more reliably during the latter half of implementation.

The Mid-Term Review further strengthened M&E implementation by prompting a structured assessment of indicator definitions and baselines. This led to revisions in the wording of several intermediate indicators and the addition of a new indicator on the adoption of BEL's emergency preparedness and recovery plan. These adjustments enhanced the technical clarity and accuracy of the Results Framework and partially addressed the weaknesses identified in the original M&E design, particularly by better aligning indicator definitions with actual project activities and data availability.

Overall, M&E implementation improved substantially once BEL assumed responsibility and was further reinforced through the Mid-Term Review and subsequent restructuring adjustments. While these measures did not fully overcome all design limitations, they strengthened the system's functionality and enabled adequate tracking of project outputs and demonstration-focused outcome proxies during the latter stages of the operation.

c. M&E Utilization

The PMU communicated M&E findings regularly to stakeholders through supervision missions, semiannual progress reports, and Project Steering Committee meetings, ensuring that both BEL and the World Bank maintained a shared understanding of implementation progress and emerging risks. At project closing and after, the M&E system was functioning adequately and provided sufficient data to assess the achievement of the project development objective.

M&E findings were also used constructively beyond project implementation. As the first energy-sector climate-resilience operation in the Caribbean, the project's M&E data on transmission-network segmentation, hydrometeorological systems, and pilot hardening measures served as an initial benchmark for subsequent regional operations, including the preparation of the Dominica Geothermal Risk Mitigation II Project. The project's cost and implementation experience informed advanced procurement and design parameters.

In addition, several M&E findings under the first component (including the long-term energy-planning model, expanded hydrometeorological data systems, and the Macal Basin hydrological model) directly informed the preparation of the Belize Renewable Integration and Resilient Energy System Project (P179520), which builds on the project's institutional and operational foundations and continues the shift toward climate-informed energy-sector planning.

While the original M&E design had significant weaknesses (most notably incomplete institutional arrangements due to the absence of an operational PMU and gaps in output coverage), the M&E system as implemented and utilized was ultimately sufficient to assess the achievement of the objective for this demonstration project. Following restructuring, improvements in institutional arrangements, indicator definitions, and data consolidation, as well as refinements introduced during the Mid-Term Review and subsequent restructurings, strengthened the Results Framework and ensured reliable tracking of key outputs and outcome proxies. M&E findings also informed follow-on interventions and sector planning. Taken together, the system provided enough evidence to test the links in the results chain and credibly assess project objective achievement. Overall, M&E quality is rated Substantial despite early-stage design and implementation shortcomings.

M&E Quality Rating

Substantial

10. Other Issues

a. Safeguards

At appraisal, the project was classified as Category B under Environmental Assessment (OP/BP 4.01) and triggered Natural Habitats (OP/BP 4.04), Pest Management (OP/BP 4.09), and Projects in Disputed Areas (OP/BP 7.60). Two additional safeguard policies, i.e., Physical Cultural Resources (OP/BP 4.11) and

Involuntary Resettlement (OP/BP 4.12), were triggered later during the third restructuring to address risks associated with transmission-line works requiring land acquisition and excavation.

Environmental Assessment (OP/BP 4.01): The project was classified as Category B because it was to finance physical works and technical activities that could generate site-specific, not significant, and temporary environmental impacts requiring mitigation. The Resilience Environmental Management Plan (EMP) for most infrastructure strengthening measures and the Replacement EMP for specific transmission-line works outlined screening procedures, mitigation measures, and environmental supervision requirements. They were publicly disclosed in Belize and through the Bank's external disclosure system before appraisal.

During implementation, the project applied the three Environmental Codes of Practice (ECOPs) to manage the localized, reversible risks associated with transmission and substation works. Environmental and OHS requirements were integrated into bidding documents and contractor obligations, ensuring mitigation of typical construction impacts such as noise, dust, vegetation clearing, and traffic safety. Supervision reports consistently found environmental compliance satisfactory, with no significant incidents and risks rated Low to Moderate. At closing, safeguards remained in compliance; however, because some unfinished civil works and pending land issues were covered under a Post-Closure Action Plan (PCAP), the overall safeguards rating was formally downgraded to "Unsatisfactory" as required for projects with a PCAP.

Natural Habitats (OP/BP 4.04): The project triggered this safeguard policy because planned activities were expected to affect natural ecosystems, particularly in forested or riparian areas, such as vegetation management, transmission-line rehabilitation, and installation of meteorological and hydrological stations. To manage these risks, the environmental management instruments included measures to avoid sensitive habitats, minimize vegetation clearing, and ensure that contractors adhered to environmentally responsible construction practices.

The ICR confirms that the project implemented the ECOPs as intended and that environmental management responsibilities were carried out by BEL and the National Meteorological Service with adequate capacity. It reports that no significant adverse impacts on natural habitats occurred during implementation.

Pest Management (OP/BP 4.09): The possibility that vegetation-management activities could involve the use of chemical herbicides or require oversight of contractors' vegetation-clearing practices triggered this safeguard policy The environmental management instruments included guidance on safe handling, storage, and disposal of any chemical agents, and emphasized reliance on mechanical and non-chemical methods wherever feasible to minimize environmental and health risks.

Vegetation-management activities associated with substation upgrades and line-corridor clearing were carried out under the ECOPs, which required safe handling and disposal of any chemical agents and prioritized mechanical clearing methods. The ICR does not report the use of chemical pesticides or any pest-management incidents.

Physical Cultural Resources (OP/BP 4.11): The project triggered this safeguard policy at the third restructuring because the construction of new transmission lines and associated excavation works presented a possibility of encountering previously unknown cultural resources. To address this risk, chance-find procedures were incorporated into the project's environmental management instruments and were required to be included in all construction contracts.

The chance-find procedures were followed in relation to the new transmission lines and substation-related works that involved excavation. The ICR reports no cultural-heritage incidents, and environmental supervision confirmed that contractors followed screening and chance-find protocols without any issues.

Involuntary Resettlement (OP/BP 4.12): The project triggered this safeguard policy at the third restructuring because new transmission lines and the construction of a switching station required land acquisition and created potential economic impacts for project-affected persons (PAPs). An Abbreviated Resettlement Action Plan (ARAP) was prepared to guide land acquisition, compensation, and livelihood-related measures prior to the commencement of construction works.

The implementation of ARAP began prior to closing and involved five PAPs. Although agreements were reached with four of the five PAPs, land acquisition for one remaining parcel adjacent to the Belcogen substation was not completed by closing. As a result, the ARAP remained partially implemented and became part of the PCAP, with BEL financing outstanding compensation and completion activities after the project's closing. The safeguard rating was formally downgraded due to these outstanding obligations, even though no physical displacement occurred.

Grievance Redress Mechanism (GRM): During implementation, a formal, project-level GRM was established in February 2022 to manage complaints related to environmental and social impacts, including land acquisition. Before that, the project relied on the World Bank's Grievance Redress Service and Inspection Panel mechanisms. The GRM remained operational until closing and is part of the PCAP for continued use while outstanding ARAP activities are completed. Only one grievance was recorded under the project, and it was fully resolved and closed.

Projects in Disputed Areas (OP/BP 7.60): The project triggered this safeguard policy because some project activities were located in areas that may fall within the long-standing territorial dispute between Belize and Guatemala. As noted in the PAD (p.15), the project was to finance technical assistance and small-scale investments primarily aimed at upgrading existing energy infrastructure, and these activities did not prejudice the position of either country regarding the disputed territory. The PAD emphasizes that, by supporting the project, the World Bank did not make any judgment on the legal status of the territories concerned or on the parties' claims. In line with OP/BP 7.60, the Bank determined that the planned activities would not have been harmful to the territorial interests of Guatemala and ensured compliance with all policy requirements.

b. Fiduciary Compliance

Financial Management

Financial management (FM) risk was assessed as Substantial at appraisal and remained a concern throughout implementation because of the implementing agency's limited experience with Bank-financed operations and the complexity of coordinating FM across multiple agencies. Once the first restructuring centralized FM responsibilities at BEL, the PMU established the required arrangements but faced capacity gaps, including the absence of a dedicated FM officer and reliance on inexperienced staff. These constraints led to recurrent delays in submitting Interim Financial Reports, audited financial statements,

and annual budgets for approval by the Steering Committee, reducing the timeliness of financial oversight and resulting in slow use of grant funds.

Independent external audits issued clean opinions, but they identified internal-control weaknesses, including late reporting and approximately US$230,000 in expenditure paid outside project accounts, which may have understated project spending. Infrequent Project Steering Committee meetings further weakened project's financial management oversite. Despite these shortcomings, all project funds were accounted for at project closing, and no misuse or irregularities were reported.

Overall, FM arrangements met World Bank requirements, but persistent delays, staffing constraints, and internal-control issues limited efficiency and weakened the project's FM performance.

Procurement

Procurement was conducted in accordance with World Bank Guidelines and generally complied with required processes, with two post-review assessments confirming adherence and no evidence of fraud or corruption. Implementation, however, faced significant delays because of procurement-related issues. Early procurement was slowed by repeated cancellations, re-packaging of activities, and COVID-19 travel restrictions, which prevented key consultants preparing designs and bidding documents for transmission works from conducting essential fieldwork.

The project's procurement workload was substantial relative to its size. While 50 contracts were initially planned, about 34 were ultimately awarded. Progress under the second component was further constrained by the project's reliance on BEL-financed upstream design and equipment procurement. When these precursor tasks fell behind, downstream GEF-funded civil works were delayed consequently. Despite these challenges, competitive procurement was widely used, documentation was well maintained, and BEL strengthened PMU capacity by engaging dedicated procurement support, which helped accelerate processing in later stages of project implementation.

Overall, procurement processes remained compliant, though affected by capacity limitations, upstream–downstream interdependencies, and pandemic-related disruptions.

c. Unintended impacts (Positive or Negative)

None.

d. Other

None.

11. Ratings

Ratings	ICR	IEG	Reason for Disagreements/Comment

Outcome	Moderately Satisfactory	Moderately Satisfactory	
Bank Performance	Moderately Satisfactory	Moderately Satisfactory	
Quality of M&E	Modest	Substantial	The ICRR rates M&E quality Substantial, because the strengthened M&E arrangements and clarified indicators after restructuring provided a sufficient evidence base to credibly assess the results chain and project objective achievement for this demonstration project despite early-stage M&E system weaknesses.
Quality of ICR	---	Substantial	

12. Lessons

This review has drawn three lessons based on the information in the ICR.

Early institutional-arrangement decisions can have long-lasting consequences for implementation efficiency and project momentum. The project's initial decision to anchor the PMU in the ministry, despite clear capacity limitations, resulted in a 27-month period with no disbursement and stalled activity. This reflected an overestimation of the ministry's readiness to recruit qualified staff and lead procurement-intensive operations. Because the PMU was never operationalized, the project required a major restructuring that transferred leadership to BEL, after which implementation finally accelerated. This experience shows how early misjudgments in institutional arrangements can cascade into prolonged delays, elevate administrative costs, and compress the timeline for technically complex activities, especially in small demonstration projects where sequencing is critical.

Without robust upstream readiness and realistic sequencing, complex and interdependent technical designs can cause significant implementation bottlenecks in small operations. The second component bundled numerous physical and operational upgrades, such as segmentation of key substations, rehabilitation of substations, transmission hardening, communication systems, AMI pilots, vegetation management, many of which depended on BEL-financed upstream designs, land acquisition, or non-project preparatory works. When these precursor tasks lagged, GEF-financed downstream activities stalled, regardless of PMU performance. The scale of coordination required was high relative to the project's small envelope. Delays in engineering design, procurement, and land acquisition ultimately constrained the timely completion of key pilots, including the Belcogen loop and FRP pole installation. This demonstrates how overly integrated designs in demonstration-oriented adaptation projects can generate systemic implementation friction if readiness conditions are not fully secured prior to launch.

Demonstration-oriented resilience investments can generate meaningful institutional and operational gains even when physical works face delays or remain incomplete. Although major works such as FRP pole installation and full transmission looping were incomplete at closing, the project still achieved significant adoption of climate-informed planning tools, strengthened BEL's emergency response and control-center functions, expanded Belize's hydrometeorological monitoring infrastructure, and institutionalized real-time data flows between NMS and BEL. These gains improved operational readiness and have already informed national energy policy and a follow-on investment project. Experience shows that in pilot resilience operations, institutional strengthening and operational reforms can advance independently of physical delays and may even constitute the strongest and most sustainable elements of the demonstration effect.

13. Assessment Recommended?

No

14. Comments on Quality of ICR

The ICR provides a clear and comprehensive account of project design, implementation, achievements, and challenges. It offers candid reporting on delays, capacity constraints, safeguards issues, and the rationale for restructurings, and it documents both planned and post-closure progress in a transparent manner. The report largely follows Bank guidance. Its narrative is internally consistent, technically detailed, and aligns project results well with the theory of change. It also captures several outcomes not included in the formal Results Framework, thereby strengthening the evidence base and presenting a fuller picture of the project's contribution. Although the lessons lean more toward findings, they are coherent with the narrative and offer useful, actionable insights.

However, the ICR does not report actual component costs or the borrower's contribution. While the safeguards and fiduciary sections are detailed, they provide limited evaluation of how observed issues influenced implementation performance or outcomes. Finally, although the narrative is informative, it tends to be more descriptive than evaluative.

Given its clarity, completeness, and generally strong alignment with the Bank guidance, despite a few minor shortcomings, the overall quality of the ICR is rated Substantial.

a. Quality of ICR Rating
Substantial