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PROJECT PERFORMANCE ASSESSMENT REPORT

WHAT WORKS

NICARAGUA

Offgrid Rural Electrification (PERZA)

Report No. 127696
JUNE 28, 2018

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PROJECT PERFORMANCE ASSESSMENT REPORT

NICARAGUA

OFFGRID RURAL ELECTRIFICATION (PERZA) PROJECT

(IDA CREDIT 3760-NI)

(GLOBAL ENVIRONMENT FACILITY TRUST FUND GRANT TF051960)

June 28, 2018

Financial, Private Sector, and Sustainable Development
Independent Evaluation Group

Currency Equivalents (annual averages)

Currency Unit = Nicaraguan córdobas (C$)

2003	$1.00	C$15.22
2004	$1.00	C$16.05
2005	$1.00	C$16.85
2006	$1.00	C$17.69
2007	$1.00	C$18.58
2008	$1.00	C$19.41
2009	$1.00	C$20.38
2010	$1.00	C$21.40
2011	$1.00	C$22.49
2012	$1.00	C$23.59

All dollar amounts are U.S. dollars unless otherwise indicated.

Abbreviations

ATDER-BL	Asociación de Trabajadores de Desarrollo Rural—Benjamin Linder
BDS	business development services
CAS	country assistance strategy
CNE	Comisión Nacional de Energía
CPF	Country Partnership Framework
EIRR	economic internal rate of return
EMEEAW	Empresa Municipal de Energía Eléctrica Autónoma Wiwilí
ENATREL	Empresa Nacional de Transmision Eléctrica
ENEL	Empresa Nicaragüense de Electricidad
ESMAP	Energy Sector Management Assistance Program
FODIEN	Fondo para el Desarrollo de la Industria Eléctrica Nacional
GEF	Global Environment Facility
HISMOW	Hidroeléctrica Salto Molejones Wapi S.A.
ICR	Implementation Completion and Results Report
IDA	International Development Association (of the World Bank Group)
IFC	International Finance Corporation (of the World Bank Group)
INE	Instituto Nicaragüense de Energía
MEM	Ministerio de Energía y Minas
M&E	monitoring and evaluation
PERZA	Proyecto de Electrificación Rural para Zonas Aisladas
PLANER	Programa Nacional de Electricidad Rural
PMU	Project Management Unit
PNESER	Programa Nacional de Electrificación Sostenible y Energías Renovables
RAAN	Región Autónoma de la Costa Caribe Norte
RAAS	Región Autónoma de la Costa Caribe Sur
UNDP	United Nations Development Programme

Fiscal Year

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This report was prepared by Ihsan Kaler Hürcan (author), who assessed the project in February 2018. Ramachandra Jammi was the task team leader. The report was peer reviewed by Migara Jayawardena and panel reviewed by Fernando Manibog. Richard Kraus provided administrative support.

Principal Ratings

	ICR*	ICR Review*	PPAR
Outcome	Satisfactory	Moderately satisfactory	Moderately satisfactory
Risk to Development Outcome	Moderate	Moderate	Substantial
Bank Performance	Moderately satisfactory	Moderately satisfactory	Moderately satisfactory
Borrower Performance	Moderately satisfactory	Moderately unsatisfactory	Moderately satisfactory

* The Implementation Completion and Results (ICR) is a self-evaluation by the responsible World Bank Global Practice. The ICR Review is an intermediate IEG product that seeks to independently validate the findings of the ICR.

Key Staff Responsible

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IEG Mission: Improving World Bank Group development results through excellence in independent evaluation.

About this Report

The Independent Evaluation Group (IEG) assesses the programs and activities of the World Bank for two purposes: first, to ensure the integrity of the World Bank's self-evaluation process and to verify that the World Bank's work is producing the expected results, and second, to help develop improved directions, policies, and procedures through the dissemination of lessons drawn from experience. As part of this work, IEG annually assesses 20–25 percent of the World Bank's lending operations through fieldwork. In selecting operations for assessment, preference is given to those that are innovative, large, or complex; those that are relevant to upcoming studies or country evaluations; those for which executive directors or World Bank management have requested assessments; and those that are likely to generate important lessons.

To prepare a Project Performance Assessment Report (PPAR), IEG staff examine project files and other documents, visit the borrowing country to discuss the operation with the government and other in-country stakeholders, interview World Bank staff and other donor agency staff both at headquarters and in local offices as appropriate, and apply other evaluative methods as needed.

Each PPAR is subject to technical peer review, internal IEG panel review, and management approval. Once cleared internally, the PPAR is commented on by the responsible World Bank country management unit. The PPAR is also sent to the borrower for review. IEG incorporates both World Bank and borrower comments as appropriate, and the borrowers' comments are attached to the document that is sent to the World Bank's Board of Executive Directors. After an assessment report has been sent to the Board, it is disclosed to the public.

About the IEG Rating System for Public Sector Evaluations

IEG's use of multiple evaluation methods offers both rigor and a necessary level of flexibility to adapt to lending instrument, project design, or sectoral approach. IEG evaluators all apply the same basic method to arrive at their project ratings. Following is the definition and rating scale used for each evaluation criterion (additional information is available on the IEG website: http://ieg.worldbankgroup.org).

Outcome: The extent to which the operation's major relevant objectives were achieved, or are expected to be achieved, efficiently. The rating has three dimensions: relevance, efficacy, and efficiency. *Relevance* includes relevance of objectives and relevance of design. Relevance of objectives is the extent to which the project's objectives are consistent with the country's current development priorities and with current World Bank country and sectoral assistance strategies and corporate goals (expressed in poverty reduction strategy papers, country assistance strategies, sector strategy papers, and operational policies). Relevance of design is the extent to which the project's design is consistent with the stated objectives. *Efficacy* is the extent to which the project's objectives were achieved, or are expected to be achieved, taking into account their relative importance. *Efficiency* is the extent to which the project achieved, or is expected to achieve, a return higher than the opportunity cost of capital and benefits at least cost compared with alternatives. The efficiency dimension is not applied to development policy operations, which provide general budget support. *Possible ratings for outcome:* highly satisfactory, satisfactory, moderately satisfactory, moderately unsatisfactory, unsatisfactory, and highly unsatisfactory.

Risk to Development Outcome: The risk, at the time of evaluation, that development outcomes (or expected outcomes) will not be maintained (or realized). *Possible ratings for risk to development outcome:* high, significant, moderate, negligible to low, and not evaluable.

Bank Performance: The extent to which services provided by the World Bank ensured quality at entry of the operation and supported effective implementation through appropriate supervision (including ensuring adequate transition arrangements for regular operation of supported activities after loan or credit closing, toward the achievement of development outcomes. The rating has two dimensions: quality at entry and quality of supervision. *Possible ratings for Bank performance:* highly satisfactory, satisfactory, moderately satisfactory, moderately unsatisfactory, unsatisfactory, and highly unsatisfactory.

Borrower Performance: The extent to which the borrower (including the government and implementing agency or agencies) ensured quality of preparation and implementation, and complied with covenants and agreements, toward the achievement of development outcomes. The rating has two dimensions: government performance and implementing agency(ies) performance. *Possible ratings for borrower performance:* highly satisfactory, satisfactory, moderately satisfactory, moderately unsatisfactory, unsatisfactory, and highly unsatisfactory.

Preface

The Independent Evaluation Group (IEG) of the World Bank Group prepared this Project Performance Assessment Report (PPAR) on the Nicaragua Offgrid Rural Electrification Project (Proyecto de Electrificación Rural para Zonas Aisladas; PERZA; IDA-3760, GEF TF051960).

PERZA's development objectives were to support Nicaragua in increasing the sustainable provision of electricity services and associated social and economic benefits in selected rural sites in its territory; and strengthening its institutional capacity to implement its national rural electrification strategy. The World Bank's financing for the project was $13.47 million of the actual project cost of $26.26 million. The Global Environment Facility financed $3.94 million. The project was appraised on April 23, 2003, approved by the World Bank's Board on May 15, 2003, and declared effective on November 28, 2003. The project was designed for execution in five years, and the original closing date was December 31, 2008. The project closed on December 31, 2011 after two project closing date extensions of 18 months each and an implementation period of eight years.

This report is based on a review of all relevant project documentation, interviews with World Bank staff, and the findings of an IEG mission to Nicaragua during February 2018. The IEG mission conducted field visits to selected project sites and held discussions with the World Bank's staff at the country office, government officials, project staff, public and private companies engaged in rural electrification, and nongovernmental organizations (see appendix C for a list of persons met).

This project was selected for an in-depth PPAR for the following three reasons:

- The project would provide insights into the longer-term impacts, sustainability, and replicability of rural electrification projects, along with and the innovative use of microfinance and business development services to promote economic uses of electricity services.
- The PPAR would provide input to IEG's forthcoming major evaluation on renewable energy as part of a diverse set of project-level performance assessments and country case studies.
- The PPAR would build upon and expand the evaluative knowledge from earlier IEG studies on the impacts of rural electrification and electricity access.

IEG gratefully acknowledges the contributions of all respondents, including World Bank staff in Washington, DC and Managua.

Following standard IEG procedures, the draft PPAR was shared with relevant government officials and agencies for their review and comment, and no comments were received.

Summary

Nicaragua has a population of about 6 million and is a lower-middle income country with a gross national income per capita of $2,050 in 2016. As of 2014, about 50 percent of the rural population lived in poverty compared with 14.8 percent in urban areas. According to the World Bank and the International Energy Agency's Global Tracking Framework, rural access to electricity in Nicaragua was 56.6 percent in 2016 compared with 99.2 percent in urban areas. Therefore, poverty reduction and access to quality basic services—including access to electricity, especially in rural areas—form the two pillars of the Nicaraguan government's national development strategy.

When the Nicaragua Offgrid Rural Electrification Project (Proyecto de Electrificación Rural para Zonas Aisladas; PERZA) was appraised in 2003, only 11 percent of the rural population in Nicaragua had access to electricity. At that time, the National Rural Electrification Plan targeted rural electrification rates of 70 percent by 2005 and 90 percent by 2012, mainly through expansion of the electricity grid. However, in 2003, about 160,000 rural households (out of 400,000) were beyond economic grid-extension distances. Therefore, PERZA sought to provide off-grid electricity access to targeted rural communities where grid-based solutions for electrification were not economically viable because of their remoteness. The project was designed as a pilot to be replicated as appropriate at a national level.

The original project development objective statement translates to three closely related objectives that sought to support Nicaragua in the following three areas:

- Increasing the sustainable provision of electricity services in selected rural sites
- Increasing the social and economic benefits associated with such sustainable provision of electricity services
- Strengthening institutional capacity to implement its national rural electrification strategy

PERZA promoted off-grid rural electrification through small hydropowers with minigrids and household-level solutions through solar home systems and solar battery charging stations. The project aimed to attract private sector participation in rural electrification while engaging microfinance institutions to overcome financing barriers and affordability by the rural poor, and to promote productive uses of electricity supported by business development services (BDS).

Ratings

The relevance of project objectives is **substantial**. The project objectives are still relevant to country conditions. Nicaragua continues to face the challenging task of providing electricity to highly isolated communities. Furthermore, the promotion and facilitation of productive uses of electricity is still a poverty alleviation objective of the Nicaraguan government. The current World Bank Country Partnership Framework for FY2018–22 pays attention to disadvantaged groups and lagging territories in the central and

Caribbean regions where most of the poor and the extremely poor live, and who are mostly without access to electricity.

The relevance of project design is **substantial**. The project's results framework was logically robust, and an overall causal link could be established between the project's activities, outputs, and expected outcomes. The project was designed as a pilot to expand electricity services to selected rural communities and support the productive uses of electricity through innovative activities, such as microfinance and BDS. The project design was complex because of this holistic approach to rural electrification, consisting of numerous investment and technical assistance activities.

The achievement of the first project objective of increasing electricity services in selected rural sites is rated **substantial**. The construction of a small hydropower plant project and local distribution network in El Bote is a highly successful demonstration of rural electrification. Solar home systems proved to be a replicable solution for electrification of isolated communities, though they provide only basic electricity services for lighting and mobile phone charging, and their sustainability is concerning.

The achievement of the second objective of increasing social and economic benefits from electricity services is rated **substantial**. Especially in small hydropower plant with minigrid project sites, access to electricity services resulted in increased and diverse cash-generating economic activities. However, the social and economic impact of basic electricity services on dispersed rural communities, which had access to electricity for the first time through solar home systems, was limited to lighting, mobile phone charging, and some television and radio usage. Feedback from beneficiaries suggested that these impacts would have been greater with complementary infrastructure, especially improved roads for better access to local markets.

The achievement of the third objective of strengthening institutional capacity to implement the national rural electrification strategy is rated **substantial**. The project contributed to the establishment of a sound legal framework for rural electrification while increasing the institutional capacity of the project implementing agency, Comisión Nacional de Energía (later the Ministerio de Energía y Minas; MEM), which supported the development and implementation of the National Program for Sustainable Electrification and Renewable Energy (Programa Nacional de Electrificación Sostenible y Energías Renovables; PNESER) and other rural electrification projects.

The efficiency of the project is rated **modest**. The success of the El Bote small hydro with minigrid facility did not lead to the implementation of similar projects by concessionaires. This was because of a change in the government's policy that resulted in the use of grid extension rather than minigrid solutions and a lack of local technical and institutional capacity to run such small hydro with minigrid systems efficiently. Two small hydropower plants partially financed by PERZA (Wapi and Wiwili) could not become operational because of design and technical problems. The project closing date needed a three-year extension to complete project activities, which increased the total project implementation period to eight years.

Overall, the project's development outcome is rated **moderately satisfactory**.

Risk to development outcome is rated **substantial**. With a national electrification rate of 81.8 percent (as of 2016) and sufficient electricity generation capacity, the availability and sustainability of power supply does not pose a substantial risk to development outcome unless generation becomes more expensive and unaffordable because of high dependence on fuel oil. However, a gradual increase in end-user tariffs caused by the reduction of subsidies could have a negative impact on the electricity consumption of the poor, which would decrease the social and economic benefits of electricity services if their incomes do not increase. Financial sustainability of solar home systems also poses a risk to development outcome because of the low income levels of dispersed households, most of whom live at a subsistence level.

Bank performance is rated **moderately satisfactory**. The overall quality at entry was high with detailed institutional and implementation arrangements, though the project design and monitoring and evaluation (M&E) arrangements were complex. There were 45 performance indicators initially that were mostly aligned with project outputs rather than adequately capturing the achievement of the project outcomes. The World Bank closely supervised project implementation, which led to appropriate restructuring of the project activities, including the discontinuation of solar battery charging stations because of sustainability concerns. However, the World Bank's no-objection requirement for procurement processes—even for small amounts—created an unnecessary burden on both the World Bank project team and the project management unit.

Borrower performance is rated **moderately satisfactory**. The Nicaraguan government's support for project implementation was adequate even after the change of government in 2007. The government fulfilled its funding obligation and enacted relevant policies and regulations needed for rural electrification. However, the success in replicating solar home systems for rural electrification could not be achieved with small hydro with minigrid solutions because of the increased government control over the operators of such systems, and the lack of sufficient technical and institutional capacity at the local level. Despite an overall successful project implementation, the project implementing agency, Comisión Nacional de Energía (which later became MEM), appointed a dedicated environmental specialist only 18 months before the project closing date. MEM was also late in its requests for project closing date extensions.

Lessons

- **Complementary infrastructure development, especially road connectivity to local markets, can further increase the welfare impacts of electrification in rural communities**. PERZA helped provide social and economic benefits to selected rural and dispersed communities by providing them with electricity for the first time and supplementing this with microfinance and BDS. However, poor access to local markets—particularly when caused by a lack of proper road connectivity—limited the scope for more productive uses, especially in the small hydro with minigrid project sites.
- **Solar home systems can be a successful solution for the provision of basic electricity services to poor rural communities outside the reach of the grid if the initial investment cost is subsidized appropriately to make it affordable to the beneficiaries while promoting ownership**. PERZA was successful in

engaging microfinance institutions in the provision of subsidized loans to poor rural households to buy solar home systems. By doing so, it reduced the upfront cost and made the system more affordable to the rural poor. At the same time, beneficiaries were required to cover part of the initial cost from their own funds, increasing the ownership and likelihood of better operation and maintenance.

- **A pilot project consisting of numerous but well-integrated learning-by-doing project activities can improve a client institution's capacity to implement larger projects in the future successfully**. PERZA had a complex design because of its holistic approach to rural electrification. However, it was composed of well-integrated investment and technical assistance activities that provided MEM staff with a unique opportunity to build on its existing capacity and gain experience in implementing a complex project. This helped MEM develop and implement PNESER, a much larger program.

José Carbajo Martínez
Director, Financial, Private Sector, and Sustainable Development
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1. Background and Context

Project Context

1.1 Nicaragua has a population of about 6 million and is a lower-middle-income country with a gross national income per capita of $2,050 in 2016. As of 2014, about 50 percent of the rural population lived in poverty compared with 14.8 percent in urban areas. According to the World Bank and the International Energy Agency's Global Tracking Framework, rural access to electricity in Nicaragua was 56.6 percent in 2016 compared with 99.2 percent in urban areas. Therefore, poverty reduction and access to quality basic services—including access to electricity, especially in rural areas—form the two pillars of the Nicaraguan government's national development strategy.

1.2 When the Offgrid Rural Electrification Project (Proyecto de Electrificación Rural para Zonas Aisladas; PERZA) was appraised in 2003, only 11 percent of the rural population in Nicaragua had access to electricity. At that time, the National Rural Electrification Plan targeted rural electrification rates of 70 percent by 2005 and 90 percent by 2012, mainly through expansion of the electricity grid. However, in 2003, about 160,000 rural households (out of 400,000) were beyond economic grid-extension distances. Therefore, PERZA sought to provide off-grid electricity access to targeted rural communities where grid-based solutions for electrification were not economically viable because of their remoteness. The project was designed as a pilot to be replicated as appropriate at a national level. Therefore, poverty reduction and access to quality basic services form the two pillars of the government's national development strategy (World Bank 2018b, 1).

1.3 In late 1990s, Nicaragua unbundled its power sector and privatized distribution of electricity. Currently, the public generation company of the Empresa Nicaragüense de Electricidad (ENEL) generates only 9 percent of electricity, and independent power producers generate the remaining 91 percent. The public company Empresa Nacional de Transmisión Eléctrica (ENATREL) is responsible for the transmission of electricity in Nicaragua. DISNORTE-DISSUR is the largest electricity distribution concessionaire in Nicaragua, providing electricity to the country's Pacific region. DISNORTE-DISSUR's concession covers slightly less than half of the country.

1.4 In early 2000s, concessions were issued to private companies or local organizations for generation and distribution of electricity in rural areas outside of DISNORTE-DISSUR's concession area. With technical support from the United Nations Development Programme (UNDP) and the Global Environment Facility (GEF), the government of Nicaragua developed a small hydropower plant program that identified 30 small hydro sites. The government requested the World Bank's support to execute some of those projects and develop a rural electrification plan called the National Rural Electrification Program (Programa Nacional de Electricidad Rural; PLANER).

1.5 When PERZA was appraised in 2003, about 89 percent of rural areas in Nicaragua was without access to electricity. The targets set in PLANER were to reach rural electrification rates of 70 percent by 2005 and 90 percent by 2012, with the overarching goal of poverty reduction

through productive uses of electricity in the central and Caribbean regions of the country, where poverty and extreme poverty were more prevalent. However, until the start of PERZA, the country's strategy to increase electricity access in rural areas was predominantly through the extension of the national grid. In 2003, the number of rural households beyond economic grid-extension distances was estimated to be 160,000 out of 400,000 households without access to electricity nationwide. As a pilot project, PERZA targeted selected rural communities where grid-based solutions for electrification were not economically viable because of their remoteness.

1.6 At the time of project preparation, electricity generation in Nicaragua was almost entirely dependent on imported diesel. ENEL's 30 diesel plants provided rural electrification in limited areas, but those plants provided poor service and were a fiscal burden for the government. Therefore, rural electrification by small hydropower plants and minigrids was seen as a solution to reduce the country's dependence on foreign oil while providing environmental benefits. However, there were other barriers to address for rural electrification.

1.7 The lack of a sustainable financial mechanism was one of the main barriers for rural electrification in Nicaragua. The National Electricity Development Fund (Fondo para el Desarrollo de la Industria Eléctrica Nacional; FODIEN) was created in 2000 as the financing vehicle for rural electrification. The plan was to finance FODIEN from the privatization proceeds, which never materialized. FODIEN also lacked a sound legal framework to channel government funds for rural electrification.

1.8 Off-grid electrification outside of concession areas did not have a regulatory framework. The Nicaraguan Institute of Energy (Instituto Nicaragüense de Energía; INE) was responsible for reviewing and approving proposed tariff schemes in these areas, but there were no guidelines to form a basis. Major barriers to address included structural deficits (such as the high cost of providing electricity access to dispersed communities), the lack of private sector interest in investing in rural electrification because of rural communities' low purchasing power, insufficient funds, and the lack of technical and institutional capacity of government institutions responsible for the provision of rural electrification.

1.9 PERZA was designed as a pilot project with innovative futures to be replicated at a national scale in later stages to expand electricity access in Nicaragua's rural areas. PERZA aimed to attract private sector participation in rural electrification through the provision of grants and concessional loans while engaging microfinance institutions in the project to overcome the financing barrier for rural electrification and productive uses of electricity, which business development services (BDS) would also support. The establishment of a sound legal framework for sustainable rural electrification was also among the project's objectives.

2. Objectives, Design, and their Relevance

Objectives

2.1 According to the credit agreement (schedule 2, 25), the development objective of PERZA was "to support the [Republic of Nicaragua] in: (i) increasing the sustainable provision of electricity services and associated social and economic benefits in selected rural sites in its territory; and (ii) strengthening its institutional capacity to implement its national rural

electrification strategy." The objective defined in the GEF trust fund agreement (schedule 2, 22) was identical.

2.2 The project appraisal document states the project development objective as defined in the credit agreement with minor wording differences. However, it also includes a global environment objective "to achieve greenhouse gas (GHG) reductions through the reduction of policy, information, financing, and institutional capacity barriers that currently hinder renewable energy technology (RET) dissemination and market development in Nicaragua" (World Bank 2003, 3–4).

2.3 This report will assess the project based on the objectives defined in the credit agreement, according to Independent Evaluation Group guidelines.

Components and Costs

2.4 The project's components were as follows:

- **Component A: Rural electrification and renewable energy policies and strategies** (appraisal cost: $1.10 million; actual project cost: $1.20 million). This component includes the following:
    - Provide technical assistance to reform and strengthen FODIEN
    - Develop an overall energy sector policy, including general guidelines for a policy of rural electrification and service standards for the provision of electricity services in rural areas
    - Rationalize prices and subsidies through the provision of technical assistance to develop relevant pricing and subsidy policies
    - Elaborate a strategy by the National Commission of Energy (Comisión Nacional de Energía; CNE) to address the situation related to ENEL's off-grid, diesel-fueled plants
    - Conduct a wood fuel survey to analyze the environmental impact of this energy use
- **Component B: Rural electrification subprojects** (appraisal cost: $17.19 million; actual cost: $18.36 million). This component included the main project investment activities to increase electricity access in pilot project sites. These consisted of the construction of two small hydropower plant projects and local distribution networks in El Bote and El Ayote, the establishment of solar battery charging stations in the Caribbean side of the country, and the commercial dissemination and installation of affordable solar home systems to dispersed communities. Under this component, CNE would receive technical assistance to prepare prefeasibility studies for additional small hydropower plant and local distribution network projects, and to local communities and the private sector for the operation and maintenance of these power plants and distribution networks.
- **Component C: Microfinance services** (appraisal cost: $1.34 million; actual cost $1.90 million). This component was to support qualified suppliers of rural financial services (microfinance institutions) to maximize the development impact of the project by

facilitating productive uses of electricity. This was to be achieved mainly through the provision of the following:

  - Performance-based loans to microfinance institutions to be on-lent to low-income households in project areas to finance electricity connections and to purchase off-grid electrical systems and other machinery to facilitate productive uses of electricity
  - Institutional development matching grants to these microfinance institutions to improve their financial management systems and new product development and piloting

- **Component D: Business development services** (appraisal cost: $0.68 million; actual cost $0.56 million). To induce productive uses of electricity by micro and small businesses in the project areas, the development and provision of BDS (such as courses, consulting services, business management, market development, financial management, and the like) were to be introduced through the support of BDS providers. The activities were to include the following:

  - Matching grants to BDS firms to cover new business development costs
  - Declining subsidies to lower BDS service costs to clients
  - Market studies to enable BDS firms to determine the potential for specific types of services
  - Supervision and coordination of these services at the BDS provider and micro and small businesses

- **Component E: Project communication and social participation** (appraisal cost: $0.89 million; actual cost: $1.25 million). This component was to strengthen the social impact of the project and support the implementation of the Indigenous People Development Plan, which was prepared for selected communities in the Autonomous Region of the North Caribbean. Under this component, supporting community participation in the design and supervision of the project, meetings with local authorities, dissemination and promotion of the project through presentations and workshops, and conducting annual and final evaluations to assess the social impact of the project were to be implemented.

- **Component F: Project management and institutional strengthening** (appraisal cost: $1.78 million; actual cost $2.98 million). This component was intended to support the project management unit (PMU) through the acquisition of equipment and software; training for the PMU staff regarding project coordination, supervision, and management; and financial audits.

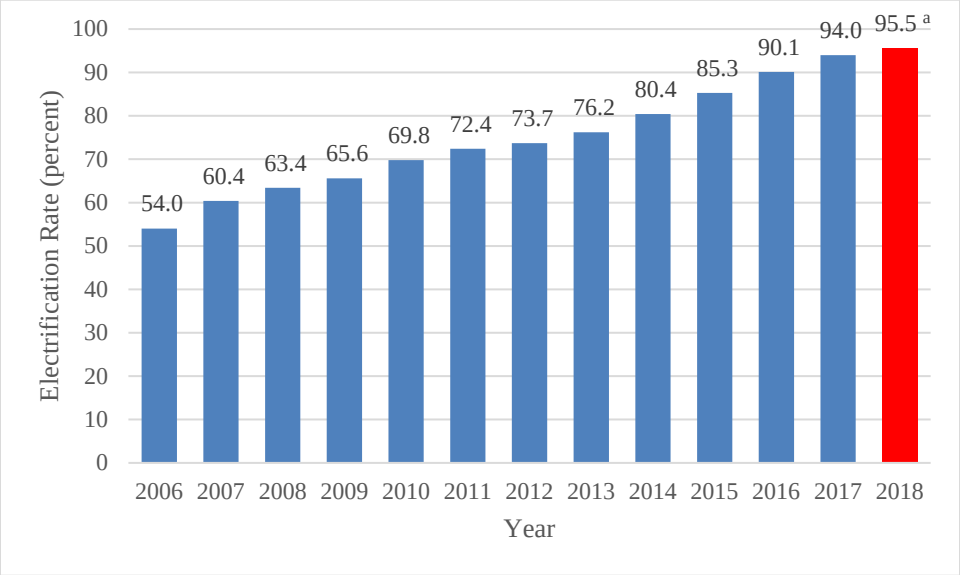
Relevance of Objectives

2.5 At the time of appraisal, broad-based economic growth with an emphasis on productive employment and rural development was one of the four pillars of the Nicaraguan government's *A Strengthened Growth and Poverty Reduction Strategy* (Nicaragua 2001, 27). Therefore, increasing access to electricity—especially in the rural areas where 89 percent of the population were without electricity in 2003—was a main goal of the government of Nicaragua to induce economic growth and alleviate poverty through productive uses of electricity. The World Bank incorporated the objectives of the Poverty Reduction Strategy Paper in the 2003–05 country

assistance strategy (CAS) backed by an IDA resource envelope of approximately $120 million, and PERZA was listed in the CAS with a strong focus on rural development and poverty reduction. Therefore, the project's objective was highly consistent with the country's development priorities and the World Bank's country assistance strategy at appraisal.

2.6 Before the completion of PERZA, the government embarked on implementing ambitious electrification projects, such as the Nicaragua Electrification Project (Proyecto de Electrificación de Nicaragua), the National Program for Sustainable Electrification and Renewable Energies (Programa Nacional de Electrificación Sostenible y Energías Renovables; PNESER), Rural Electrification Project Treasury Funds, and the Program for the Development of Renewable Energy in Rural Areas (Programa Desarrollo de Energía Renovable en Áreas Rurales). Consequently, the electrification rate in Nicaragua had increased from 50 percent in 2003 to 94 percent as of the end of 2017 (see Figure 1.1). However, there are still differences in electricity access rates among administrative regions, especially among the dispersed communities of the two autonomous regions of the Caribbean side and in rural areas in the central region of the nation.[1] The government has a target of increasing the electricity access rate to 99 percent by 2021 nationwide. However, despite the success in electrification rates, the promotion and facilitation of productive uses of electricity is still needed to alleviate poverty not only in those communities that have access to electricity at Tiers 1 to 3 according to the Sustainable Energy for All classification, but also throughout Nicaragua.[2] Therefore, the project objectives are still highly relevant to the country conditions in Nicaragua.

Figure 1.1. Electrification Rates in Nicaragua



Source: Ministry of Energy and Mines.
a. Target for 2018.

2.7 The project objectives are also relevant to the current World Bank Country Partnership Framework (CPF) for 2018–22. The CPF pays special attention to disadvantaged groups and lagging territories in the Caribbean and Central regions where most of the poor and the extreme poor (who are mostly without access to electricity) live (World Bank 2018b, 2). However,

because of the heavy involvement of the Inter-American Development Bank and other donors, the World Bank is not involved presently in financing these subsectors (World Bank 2018b, 13).

2.8 The overall relevance of objectives is rated **substantial** because of the high relevance of the project objectives to the current conditions in Nicaragua, especially regarding productive uses of electricity to alleviate poverty.

Relevance of Design

2.9 At the time of project appraisal in 2003, there was insufficient experience in off-grid electrification in Latin America. PERZA was designed as a pilot project to find solutions to rural electrification through a learning-by-doing approach and focusing on rural development and poverty reduction. The project was innovative because it included public-private rural electricity delivery solutions, microfinance for rural electrification, and BDS to facilitate productive uses of electricity in project areas. However, its design was complex, consisting of numerous investment and technical assistance activities.

2.10 Given the project's learning-by-doing approach, the project funds were sufficient to implement activities in selected pilot project areas where access to electricity was very low or nonexistent. There was a direct causal link between the investment activities (the construction of small hydropower plants and associated grids, distribution of solar home systems, and establishment of solar battery charging stations) and the achievement of the project objective to provide electricity services. The innovative microfinance and BDS components intended to facilitate and support the productive uses of electricity in project communities to maximize social and economic benefits, while the social strategy component intended to increase awareness among the project communities and strengthen these communities' ownership of the project to ensure the sustainability of the project outcomes. The technical assistance activities were expected to help the government develop and implement its rural electrification strategy, which was the project's third objective.

2.11 However, it was an ambitious objective to support the sustainable provision of social and economic benefits of electricity services to the dispersed communities through solar home systems and solar battery charging systems. Despite their apparent impact on isolated communities through the provision of a basic level of electricity (lighting or charging mobile phones, for example), these systems do not provide sufficient electricity for income-generating economic activities sustainably.

2.12 The relevance of project design is rated **substantial**.

3. Implementation

Planned versus Actual Expenditure

3.1 The actual project cost was $26.26 million compared with the estimated $22.99 million at appraisal. The increase resulted from exchange rate variations and private sector contributions that were higher than expected ($6.48 million compared with $4.74 million at appraisal).

3.2 The rural electrification subprojects component accounted for about 69.9 percent of total project expenditures ($18.36 million), and it was about 7 percent higher than the appraisal estimate of $17.19 million. The other five components had actual costs lower than $3.0 million each. The cost of the project management and institutional strengthening component was $2.98 million, which was 67 percent higher than the appraisal estimate because of the preparation costs of the canceled El Ayote project. The costs of the project communication and social participation component and microfinance services components were about 40 percent higher than their appraisal estimates. There was only a minor increase in the cost of the rural electrification and renewable energy policies and strategies component (9 percent), but the cost of the BDS component was lower by about 18 percent.

3.3 At project completion, the IDA financing was $13.47 million compared with $12 million at appraisal, and the GEF grants were $3.94 million compared with $4.02 million as appraised. The borrower's contribution was $2.36 million, which was slightly more than the $2.23 million estimated at appraisal. As noted, the contribution of the private sector was at $6.48 million, which was estimated at $4.74 million at appraisal.

Implementation Experience

3.4 The project was appraised on April 23, 2003, approved by the World Bank's Board on May 15, 2003, and declared effective on November 28, 2003. The project was designed for execution in five years, and the original closing date was December 31, 2008. After two project closing date extensions of 18 months each, the project closed on December 31, 2011 after an implementation period of eight years.

3.5 The government of Nicaragua was the borrower, represented by the Ministry of Finance and Public Credit. Both the IDA credit and the GEF grant were made available on a grant basis to CNE, the project implementing agency. The Ministerio de Energía y Minas (MEM) was created after the inauguration of the Sandinista government in January 2007, and MEM took over the CNE's functions.

3.6 Cancellation of the El Ayote small hydropower plant and its associated distribution network was the project's initial setback. Although the project was the most advanced in preparation and had been awarded after bidding, one of the participants took the bidding process to court, and the regulator refused to issue the license to the concessionaire. Consequently, the World Bank canceled this small hydro project.

3.7 A midterm review was conducted in July 2006, and the report noted the delay in project implementation that the El Ayote project caused (the Wapi small hydropower plant project replaced the El Ayote project). The other small hydro project with a rural grid (El Bote), solar house systems, and solar battery charging stations had progressed considerably, but the overall slow progress in rural electrification projects also delayed the implementation of other components, especially the implementation of BDS.

3.8 The project was restructured three times without any change to the project objectives. At the first restructuring on December 5, 2008, the project closing date was extended for 18 months because of delays in implementing the rural electrification projects. At the second restructuring

in June 2009 (which required the country director's approval), an additional IDA credit amount of $1.13 million was allocated among various components, and this credit became available because of the appreciation of special drawing rights against the U.S. dollar. The third restructuring on June 14, 2010 was needed for the following reasons: (i) the acquisition of some private and community lands under the project, which triggered OP 4.12 Involuntary Resettlement; (ii) the reallocation of credit and grant proceeds among project components; (iii) modification of project indicators; and (iv) a second 18-month extension of the project closing date to allow the completion of ongoing project activities. If an extension had not been approved, $1.85 million of the credit and $1.18 million of the grant would have been canceled.

Fiduciary Management

3.9 The World Bank supervised fiduciary management of the project closely by requiring no-objection to every expenditure, which ensured full compliance with the World Bank's fiduciary guidelines. However, this resulted in a slow procurement process and higher-than-normal supervision expenses for the World Bank. During project implementation, the implementing agency's performance related to timeliness and quality of financial information was satisfactory. Neither the credit agreement nor the grant agreement included any financial covenants. Independent audits were unqualified and accounted for all project funds.

Procurement

3.10 The PMU within MEM was staffed adequately to oversee the procurement activities from bidding to contract signing. The PMU's performance in procurement was satisfactory to the World Bank. However, delays in implementing annual procurement plans were the main reason for extending the project closing date by three years. In addition to the cancellation of the El Ayote project at the early stages of the project implementation, the main reasons for procurement delays included the following: (i) Underestimated initial budgets caused renewal of bids with revised budgets and technical specifications; (ii) Insufficient counterpart funds approved in the annual operation plan resulted in the postponement of the implementation of some procurement activities to the next year; (iii) Local companies faced difficulties in meeting the financial and technical requirements listed in the bidding documents; and (iv) The government announced requests for proposals on its website rather than in major newspapers, and responses were lower than expected.

Safeguards Compliance

3.11 At appraisal, the project was classified as category B under OP/BP 4.01 (Environmental Assessment), which triggered OP/BP 4.04 (Natural Habitats) and OP/BP 4.20 (Indigenous Peoples). During supervision in 2010, OP/BP 4.12 (Involuntary Resettlement) was also triggered, which led to a level 1 restructuring in the same year.[3]

Environmental Assessment (OP/BP 4.01)

3.12 An environmental framework, which was used to screen rural electrification projects, was discussed and agreed to with the government during appraisal. At appraisal, El Ayote, El Bote, and La Union small hydro with minigrid projects and the Francia Sirpi solar charging battery

station project in the Región Autónoma de la Costa Caribe Norte (RAAN) were screened, and environmental assessment documents were prepared that outlined environmental issues related to these projects, such as the location, site sensitivity, identification of possible environmental and social impacts, description of mitigation measures, and public consultation taken during the assessment process. Each new rural electrification project developed during project implementation required environmental and social screening before approval.

3.13 However, an environmental specialist was not assigned to the project until 18 months before the project closing date. Consequently, environmental and social documentation were not maintained properly, and recommendations in the Environmental Management Framework were not followed. The PMU assigned a full time environmental specialist after the supervision mission in 2010. There were no outstanding environmental safeguards issues at project closing.

Natural Habitats (OP/BP 4.04)

3.14 This safeguards policy was triggered at appraisal because the El Bote small hydropower plant is located in the buffer zone of the Bosawas Biosphere Reserve. The Wiwili small hydropower plant, selected in 2010 to receive PERZA funding, is also located in this buffer zone.

3.15 Watershed management plans were prepared for both projects. The various activities executed under the watershed management plans included purchase of lands for conservation, support for conservation, and support for sustainable agricultural practices. These activities were expected to contribute to the protection of the high watershed areas. The World Bank project team confirmed that neither one of the projects would cause significant negative environmental impacts that could harm the integrity of the watershed, and the projects would comply with OP/BP 4.04.

3.16 However, deforestation in the high watershed areas has accelerated steadily because of extreme poverty and the need for subsistence farming by local people. Burning and cutting, which require only machetes, fuel, and simple labor, are the methods that poor families apply to open new agricultural fields. The result is deterioration in the watershed and erosion, which is a major problem for the El Bote small hydropower plant because accumulation of sand in the reservoir of the power plant might affect electricity generation negatively if it is not cleared regularly.

Indigenous Peoples (OP/BP 4.20)

3.17 The project targeted the dispersed poor communities in the Caribbean side of the country, which is populated mostly by indigenous peoples. The project implementing agency prepared an Indigenous People Development Framework and corresponding Indigenous People Action Plan before appraisal. They were designed to help the indigenous people benefit from the project fully. These communities were to be provided with electricity for the first time by either solar battery charging stations or solar home systems.

3.18 Community land was used for housing a solar charging battery station in Francia Sirpi in RAAN, the location of which was decided after a participatory process. The entire process complied with the Indigenous People Action Plan. A written agreement was finalized with the indigenous community for the use of the communal land.

Involuntary Resettlement (OP/BP 4.20)

3.19 A supervision mission in 2010 found that this safeguard should have been triggered because of the small-scale acquisition of land under various projects, which did not require any human resettlement. A total of 17.3 hectares of land in Wapi, El Bote, Wiwili, and La Florida project sites was acquired from private owners who were duly compensated. The acquisition was completed in compliance with the Nicaraguan law without the World Bank's approved instrument. Therefore, the PMU was required to prepare an abbreviated resettlement plan, which the World Bank found acceptable.

4. Achievement of the Objectives

The project objective is to support Nicaragua in the following: (i) increasing the sustainable provision of electricity services and associated social and economic benefits in selected rural sites in its territory; and (ii) strengthening its institutional capacity to implement its national rural electrification strategy.

4.1 Although the project development objective consists of two subobjectives, the first objective—to support Nicaragua in increasing the sustainable provision of electricity services and associated social and economic benefits—can be evaluated as two separate objectives. Therefore, this report will assess the project development objective as consisting of three, closely related objectives to support Nicaragua in the following:

- Increasing the sustainable provision of electricity services in selected rural sites
- Increasing the social and economic benefits associated with such sustainable provision of electricity services
- Strengthening institutional capacity to implement its national rural electrification strategy

Objective 1: To support Nicaragua in increasing the sustainable provision of electricity services in selected rural sites

4.2 This objective was to be achieved through the construction of small hydropower plants with minigrids, distribution of solar home systems to dispersed communities, and the installation of solar battery charging stations, especially in the dispersed indigenous communities of the RAAN.

4.3 This section assesses the project outputs and outcomes related to this objective's achievement, discusses the sustainability of electricity services and the replicability of these rural electrification solutions, and presents the overall assessment of this objective.

Outputs

4.4 One of the project's output targets was to establish five private concessionaires in selected project sites to provide sustainable electricity services to rural communities. At project completion, three concessionaries with small hydro with minigrid and one concessionaire with minigrid were operational. One concessionaire was expected to complete the construction of a

small hydropower plant in 2016. Table 4.1 shows the status of the five concessionaires as of February 2018.

Table 4.1. Status of Small Hydropower and Minigrid Projects as of Febraury 2018

Project Name	Concessionaire	Location (Department, Town)	System	Installed Capacity (MW)	Current Status
El Bote	ATDER-BL	Jinotega, El Cua	Small hydro with minigrid	0.9	Operational
La Florida	Hidrokubali	RAAN, Kubali	Small hydro with minigrid	0.3	Operational
Wapi	HISMOW	RAAS, Wapi	Small hydro with minigrid	0.7	Small hydro is not operational. Concession is canceled. Minigrid is powered by ENEL.
La Union	Zelayaluz	RAA, La Union	Minigrid	n.a.	Operational
Wiwili	EMEEAW	Jinotega, Wiwili	Small hydro with minigrid	1.48	Construction could not be completed. Concession is canceled. Minigrid is powered by ENEL.

Note: ATDER-BL = Asociación de Trabajadores de Desarrollo Rural—Benjamin Linder; EMEEAW = Empresa Municipal de Energía Eléctrica Autónoma Wiwilí; ENEL = Empresa Nicaragüense de Electricidad; HISMOW = Hidroeléctrica Salto Molejones Wapi S.A.; MW = megawatt; n.a. = not applicable; RAAN = Región Autónoma de la Costa Caribe Norte; RAAS = Región Autónoma de la Costa Caribe Sur.

4.5 At project completion, 8,080 solar home systems with 468 kilowatt capacity were installed against a target of 7,000 solar home systems with 100 kilowatt capacity. There are no current data on how many of these systems are still operational. According to an unpublished study by the Energy Sector Management Assistance Program (ESMAP) conducted in February 2016, an estimated 90 percent of these solar home systems were operational. Information gathered during the site visit in February 2018 estimated that 80 percent of the solar home systems are still operational.

4.6 To provide electricity on a trial basis to a few indigenous communities in the RAAN, the project targeted installing six solar battery charging stations in Francia Sirpi, Awastingni, and Sangni Laya. At project closing, there were seven such battery-charging stations installed in the RAAN. PERZA did not continue replicating this technology because the government and the World Bank decided that implementing solar battery charging stations for rural electrification was not sustainable. Currently, the charging stations are poorly maintained and are abandoned in some places because of population displacement or the arrival of on-grid electricity.

Outcomes

4.7 Access to electricity in the sites increased where projects were completed successfully. As of 2017, the number of connections in these sites was estimated at more than 19,000 (see Table 4.2). At project closing, this number was reported as 10,500 against the target of 7,000 at appraisal.

Table 4.2. Number of Connections as of February 2018

Project	Number of Connections
El Bote	6,008
La Florida	2,415
Wapi	4,101
La Union	324
Solar home systems	6,464
Total	**19,312**

Source: Figures for El Bote, La Union, and Wapi are from Instituto Nicaraguense de Energia. The connections number for La Florida is from ESMAP 2016.
Note: Solar home system connections are calculated as 80 percent of the 8,080 systems originally installed.

4.8 The electrification rates in the project sites, where data are available, are as given in Table 4.3.

Table 4.3. Rate of Electrification, 2007 versus 2016 (percent)

Project Name	2007	2016
El Bote (El Cua)	14.9	51.8
La Florida (Waslala)	7.8	30.2
Wapi (El Tortuguero)	0.0	20.8

Source: Ministry of Energy and Mines

4.9 The dispersed communities, especially in the Caribbean side of the country, had access to electricity for the first time through the distribution of solar home systems and the installation of solar battery charging stations.

Sustainability of Rural Electricity Services

El Bote Small Hydro with Minigrid Project

4.10 El Bote is the most successful small hydro with minigrid project that PERZA financed. Having accumulated experience in rural electrification through small hydropower plants since the 1980s, Asociación de Trabajadores de Desarrollo Rural—Benjamin Linder (ATDER-BL), the concessionaire in El Cua municipality, has high technical and institutional capacity to construct and operate such integrated systems.

4.11 Regarding sustaining electricity services, ATDER-BL does not now face a supply bottleneck. However, given the rapid growth of electricity demand in the concession area (from about 60,000 kilowatt-hours per month in 2008 to 300,000 kilowatt-hours per month in early 2018), the system will need more generation capacity from either construction of additional small hydropower plants or improving the connection to the national grid. The electricity generation in this concession increased from 3,702 megawatt-hours in 2008 to 4,956 megawatt-hours in 2017 with the addition of small hydropower plants. In 2017, ATDER-BL purchased a net 319 megawatt-hours of electricity from DISNORTE.

4.12 Although there is no imminent risk to the availability and sustainability of electricity services in El Cua concession, there have been recurring problems with the reliability of power supply. Frequent power shortages are common in El Cua because of the integration problems with the national grid. The voltage fluctuations in the poorly maintained rural circuit that DISNORTE operates (to which the ATDER-BL minigrid is connected) causes El Bote and other micro-hydropower plants operated by ATDER-BL to trip offline frequently. The concessionaire installed a supervisory control and data acquisition system to monitor such interruptions and to put the system back online as quickly as possible.

La Florida Small Hydro with Minigrid Project

4.13 The La Florida small hydropower plant is located in Waslala in the remote rural area of RAAN. The power plant is operated by Empresa Hidroelectrica La Florida S.A. and powers an isolated 48.8-kilometer small grid. PERZA financed the civil works of the power plant, and the remaining funding came from other donors and the government.

4.14 In 2014, ENATREL required such small hydropower plant operators to sign a collaboration agreement, which included the transfer of the power plants to ENATREL after a 20-year concession period. According to government officials, some of these small hydropower plants could not be operated efficiently because of the lack of local technical and institutional capacity, and breakdowns were common. Therefore, such an agreement should create an environment for collaboration between ENATREL and small hydropower plant operators to operate these systems efficiently. However, operators of small hydropower plants do not believe that the government arguments are justified, and they feel that the government is making a case for taking over the small hydropower plants to meet its ambitious plan to extend the grid to rural areas. This conflict poses a risk to the sustainability of electricity services to the rural community.

Wapi Small Hydro with Minigrid Project

4.15 Construction of the small hydropower plant in Wapi was completed, but the power plant never became operational because of design problems, and it is now abandoned. The 49 kilometers of minigrid constructed under the project was energized by electricity from DISSUR at first, then from ENEL to provide electricity to El Tortuguero municipality.

4.16 In November 2015, the concessionaire Hidroelectrica Salto Molejones Wapi S.A. signed the collaboration agreement, and the shares of the concessionaire were transferred to ENATREL.

La Union Minigrid Project

4.17 The La Union project did not include a small hydropower plant component. The 23.4 kilometers of minigrid constructed under the project is energized by electricity from the national grid. The concessionaire, Zelayaluz, operates the system. There is no electrification data rate available for La Union community. However, at project completion, 278 connections were established. In 2017, the number of connections increased to 324, along with the modest population increase in the community caused by improved living conditions.

4.18 The concessionaire sells electricity to the end users with an incremental markup on the price of the electricity purchased from the distribution company DISSUR. Zelayaluz officials commented that the company revenues were just high enough to cover the system's operation and basic maintenance costs. Financial constraints are restricting grid expansion. In the medium term, the financial viability of the concessionaire can pose a problem for the sustainability of electricity services in the community.

Wiwili Small Hydro with Minigrid Project

4.19 UNDP and the government funded the Wiwili small hydropower plant project. PERZA funds financed the project's civil works component. However, the project could not be completed because of technical design problems.

4.20 On January 3, 2018, the government issued a ministerial decree canceling the Empresa Municipal de Energía Eléctrica Autónoma's Wiwilí concession contract, claiming that the operator was not compliant with the concession contract and did not provide sufficient evidence to justify the reason for its noncompliance. ENEL currently operates the system.

Solar Home Systems

4.21 Solar home systems provided electricity for the first time to the dispersed communities mostly in the central and Caribbean regions of Nicaragua. End users purchased these systems through microfinance, which was affordable because of PERZA's subsidy scheme. This also increased the end users' ownership of these systems.

4.22 The sustainability of the solar home systems depends on the end users' financial ability to pay for the cost of solar panel maintenance and battery replacement. Most of these dispersed communities live at subsistence level and are not involved in cash-generating economic activities. Therefore, the cost of maintenance and battery replacement is a serious financial burden to sustaining the operation of solar home systems. Reportedly, dead batteries that are not recycled are disposed haphazardly in rural areas.

4.23 Solar home systems distributors have established an after-sales service network in these remote areas. However, given the extremely poor condition of rural roads in these very remote areas, it could take days until a technician arrives to fix a broken solar panel component. If a community does not have access to mobile phone services, it might take even longer to have a broken solar home system fixed because the technician cannot be contacted.

Solar Battery Charging Stations

4.24 Despite a successful implementation start, the solar battery charging station activities suffered from category five Hurricane Felix in September 2007, which hit the RAAN and destroyed houses and the livelihoods of local communities. This resulted in a sharp decrease in these communities' ability to pay for the maintenance of the charging stations, battery charging, and the purchase of lighting kits. Economic recovery in these communities where people lived at subsistence level was slow. This further undermined the sustainability of the solar battery charging stations, and the government and the World Bank agreed not to scale up this technology, but rather maintain the operation of those already installed.

Replicability of Rural Electrification Solutions

4.25 Although PERZA financed El Bote (one of the most successful small hydr with minigrid projects), the other projects' success was limited, and two of them—Wapi and Wiwili—could not become operational. The El Bote project benefited from ATDER-BL's experience in small hydro project development. The developers of other small hydro with minigrid projects did not have the same level of expertise, which resulted in poor project design and implementation. Lack of local technical and institutional capacity is reported as a main barrier for the replication of small hydro with minigrid projects in Nicaragua.

4.26 Small hydro with minigrid projects can still be considered to provide electricity to rural communities with rich water resources, especially in the central regions of Nicaragua. However, it is uncertain whether the government will pursue the private concessionaire model to develop such projects because of priority placed on electrification through grid extension.

4.27 However, the solar home systems component proved to be a successful intervention, which was replicated after project completion not only in Nicaragua, but also in neighboring countries, such as Honduras. According to the companies active in the market, it is estimated that more than 120,000 solar home systems have been sold in Nicaragua since PERZA, and the government plans to expand the distribution of these systems by another 30,000 between 2018 and 2021.

Overall Assessment of Objective One

4.28 Given the learning-by-doing and demonstration aspect of PERZA, the project achieved its objective of rural electrification by testing innovative solutions through pilot projects. The successful implementation of the El Bote project clearly shows what is needed to achieve rural electrification through the application of the small hydro with minigrid solution.

4.29 Although only 8,080 systems were distributed (with some concerns about sustainability), solar home systems proved to be a successful solution to bring basic-level electricity services for the first time to dispersed communities in Nicaragua. Solar home system distributors that took part in PERZA continued to grow their business in Nicaragua and in neighboring countries. Solar home systems will continue to be the primary choice as Nicaragua strives to electrify the most dispersed communities where construction of grid is not economically feasible.

4.30 Overall, the achievement of this objective is rated **substantial**.

Objective 2: To support Nicaragua in increasing the social and economic benefits associated with sustainable provision of electricity services

Outputs

4.31 The achievement of this objective was dependent on the implementation of rural electrification projects explained in the previous section. Currently, a total of 1.2 megawatts capacity is still available in El Cua (900 kilowatts) and La Florida (300 kilowatts). The project target was 1 megawatt. There are 8,423 customers served in those two towns. Furthermore, the grid in La Union, which is connected to the national grid, provides electricity to 324 customers. Although the small hydro components of the projects in Wapi and Wiwili could not materialize, these minigrids are connected to the national grid supplying electricity to their respective communities.

4.32 Before PERZA, there was no microfinance institution active in project sites. At project closing, there were eight microfinance institutions offering loans for rural electrification or business development against a target of five at appraisal. Project site visits to El Cua and La Union confirmed that loans from microfinance institutions are still available, but with high interest rates. In addition, solar home systems distributors established their own microfinance schemes to extend loans to the end users, mostly involving end users paying the cost of the solar panels in installments, depending on their cash flow.

4.33 To promote productive uses of electricity, consulting services were provided in business and financial management, new market and product development, and technology. When PERZA closed, 45 companies had provided BDS against the target of 10 companies, and 517 micro and small businesses received technical assistance or training. The target for micro and small businesses was 320. However, it had become apparent, even during project implementation, that the program was not sustainable because of the low payment capacity of the customers for BDS, which required significant subsidies from the project to recover their costs. After projec**t closure, BDS providers stopped their services in project sites.**

Outcomes

4.34 The project was successful in facilitating loans to end users through microfinance institutions. These loans were for electricity connections and for micro and small businesses to purchase electrical equipment. The project benefited from the rapid increase of the microfinance market in Nicaragua between 2004 and 2009. However, customer complaints about high interest rates and fines on delayed credit payments charged by microfinance institutions led to the “No Pay” movement in 2009, and many customers nationwide stopped repaying their loans to microfinance institutions. This had a negative impact on microfinance institutions that took part in PERZA. Consequently, these institutions introduced an improved credit-screening process.

4.35 Selected dispersed communities in Nicaragua had access to electricity for the first time through the application of solar home systems,. As experienced in similar projects globally, first use of electricity was to replace candles and kerosene lanterns for lighting in those communities. In addition to some economic savings, the most important impact of this substitution has been

preventing fires and accidental burns, especially involving children. The quality of indoor lighting also improved.

4.36 Lighting has also extended the time available for work, studying, and social interactions in these communities. According to anecdotal evidence from nongovernmental organizations active in the RAAN, mobile phone usage has increased in communities where cellular services are available, even though the quality of coverage is poor in most places. Anecdotal evidence also shows that television and radio usage have increased.

4.37 However, there is no evidence to claim that solar home systems have led to income-generating economic activities in these dispersed communities in Nicaragua. Studies conducted on rural electrification projects in other countries also support this result (Stojanovski, Thurber, and Wolak 2017). Nonetheless, the impact of electrification by solar home systems on these dispersed communities has been substantial, even though the electrification level is basic.

4.38 Provision of electricity services had a more marked impact in small hydro with minigrid project sites. In addition to the immediate social and economic benefits of electrification, such as lighting, mobile phone charging, television, and extended daytime for work and social interactions, grid-connected electricity facilitated the use of refrigerators in these communities.

4.39 After the electrification of these communities, economic activity increased for micro and small businesses. Barbers, ice cream parlors, internet cafes, refrigeration for cold drinks, and arcade parlors were first to open. Carpentry, welding, and car body shops are now available in these communities, as well. El Cua now has five cellular towers providing services to the town and nearby communities, and these are the largest electricity consumers.

4.40 Access to cellular services also facilitated the use of credit cards and banking services, especially in El Cua. Kubali community in Waslala is now categorized as semi-urban instead of rural because of access to primary education, health clinics, and cellular services that became available after the La Florida project electrified the community (Waslala 2014, 21).

4.41 Other long-term impacts of electrification on these communities are extended schooling, evening courses for adults, increased security resulting from street lighting, and improved health services. Before electrification, La Union did not have a doctor, but the community now has two. According to local sources, schooling in El Cua has increased from four to seven years.

Overall Assessment of Objective Two

4.42 Communities in project-supported sites with minigrid or national grid started engaging in cash-generating economic activities because of electrification projects. The project was successful in engaging microfinance institutions. The availability of loans from microfinance institutions facilitated this process, whereas the impact of BDS was limited, and the services were not sustainable. Despite the project’s shortcomings, it was successful in creating the necessary power infrastructure for productive uses of electricity in minigrid project sites and in providing the dispersed communities with basic electricity services.

4.43 Overall, the achievement of this objective is rated **substantial**.

Objective Three: To support Nicaragua in strengthening its institutional capacity to implement its national rural electrification strategy

Outputs

4.44 The project supported the strengthening of the legal framework for rural electrification in Nicaragua through the issuance of the following executive decrees:

- The government issued Decree No. 61-2005 in September 2005 establishing the rural electrification policy for Nicaragua.
- Executive Decree No. 6-2006 adopted the Pricing and Subsidies Policy for the Electric Subsector in February 2006 by.
- The government passed Executive Decree No. 9-2006 in February 2006, reorganizing the FODIEN.

4.45 In addition to addressing policy and regulatory barriers for rural electrification, PERZA contributed to the revision of demand projection methodologies, development of quality of service norms for rural service, and the studies on distribution system losses.

4.46 Training in management, grid operation, customer service, internal controls, and foreign language was provided under the institutional strengthening objective to the 300 staff members from MEM and FODIEN. Furthermore, the objective supported the PMU in implementing the project according to the World Bank's procurement and fiduciary guidelines and safeguards policies.

Outcomes

4.47 PERZA also had a significant impact on MEM's institutional capacity by providing hands-on experience opportunities on various project activities, most of which had not been implemented in Nicaragua previously. Implementation of project activities also required frequent visits to project sites. The experience gained from PERZA significantly strengthened MEM's project implementation capacity. Most members of the PMU are still employed at MEM, and some are involved in ongoing national and rural electrification projects.

4.48 PERZA was a pioneer project in rural electrification that laid the groundwork for future programs. Project activities implemented under PERZA provided important lessons in learning and practice, which contributed directly to the future direction of national and rural electrification in Nicaragua. With the experience gained during the implementation of PERZA, MEM developed PNESER in 2010, a national electrification and renewable energy program with the objective of increasing the national electrification rate from 67 percent in 2010 to 84 percent in 2017, including on-grid and off-grid solutions. The second phase of PNESER was approved in 2013, and both projects closed successfully in 2017. As of the end of 2017, the electrification rate in Nicaragua had increased to 94 percent.

4.49 As of February 2018, FODIEN is reorganized under ENATREL and oversees electrification projects funded by treasury funds and other international donors.

4.50 The achievement of this objective is rated **substantial**.

5. Efficiency

5.1 Small hydro with minigrid projects were selected according to the financial and economic viability of each project. Subsidies were provided to cover part of the initial investment cost, and projects benefited from concessional loans. The concessionaires' contribution to the investment from their own funds was 18 percent for El Bote and 14.5 percent for La Union. The other three projects—Wapi, Wiwili, and La Florida—were financed without concessionaire contribution.

5.2 A detailed economic analysis was conducted for the El Bote project, the only one with reliable data available at project closing. The calculations yielded a 28 percent economic internal rate of return (EIRR) at project completion for an average client of El Bote compared with 40 percent estimated at appraisal. The difference in the EIRR calculations is explained by the high capital cost—$2.0 million at appraisal versus $3.0 million at project completion. Furthermore, benefits from carbon dioxide emissions were also considered at appraisal analysis, but were not included in postproject analysis.

5.3 PERZA financed 70 percent of the Wapi project and 45 percent of the Wiwili project. The small hydropower plants at these two sites did not become operational. The minigrids are energized by electricity from the national grid.

5.4 A separate economic analysis for a single solar home system user yielded an EIRR of 15 percent. The appraisal estimate recalculated for this report results in an EIRR of 32.2 percent. The difference in the EIRR calculations is explained by the cost difference of a solar panel. The price of solar panels was subsidized during project implementation, and this figure was taken as $407 at appraisal. At project completion, the price of a solar panel was taken at the unsubsidized cost of $970.

5.5 PERZA was designed as a learning-by-doing project. Therefore, implementation of solar battery charging stations in RAAN was not continued after the government and the World Bank decided that this was not a sustainable solution for rural electrification.

5.6 The project closing date was extended by three years because of project implementation delays. However, the experience gained during the implementation of PERZA helped the government embark on a more ambitious national electrification program, PNESER. In addition, PERZA succeeded in engaging microfinance institutions in rural electrification activities for the first time, and such institutions are still active in rural areas. At project appraisal in 2003, the market for solar home systems was estimated at about 144,000 users, and 46,000 of them were considered to have the financial means to afford a solar home system at PERZA's subsidy range. The current estimate of solar home systems sold in rural areas of Nicaragua is more than 120,000.

5.7 Small hydro with minigrid can still be a solution for rural electrification, especially in the water-rich regions of central Nicaragua. However, the success of the El Bote project did not lead to similar projects implemented by concessionaires because of the change in the government's rural electrification policy (extension of the national grid rather than minigrid solutions) and the

lack of local technical and institutional capacity to run such small hydro with minigrid systems efficiently.

5.8 Overall, efficiency is rated **modest**.

6. Ratings

Outcome

6.1 The overall project outcome is **moderately satisfactory**. Relevance of project objectives to country conditions, energy strategies, and priorities remains **substantial**. The project's results framework was logically robust, and a causal link could be established between project activities, outputs, and expected outcomes. The project design was rather complex because of its holistic approach to rural electrification, and the relevance of project design is **substantial**. The achievement of the three project objectives is **substantial**. The El Bote project is a highly successful demonstration of rural electrification through small hydro with minigrid solutions, even though this method could not be replicated on a national scale. Despite its provision of basic electricity services for lighting and mobile phone charging and concerns about its sustainability, solar home systems proved to be a replicable solution for electrification of isolated communities. More than 10,000 households started benefiting from electricity services because of the project's activities. The social and economic benefits of electricity services had a positive impact on people's lives, especially in small hydro with minigrid project sites. The project also contributed to the establishment of a sound legal framework for rural electrification while increasing the institutional capacity of the project implementing agency, which manifested itself in the development and implementation of PNESER. However, because of the failure of some small hydropower plant projects and an extended eight-year implementation period, the efficiency of the project is rated **modest**.

Risk to Development Outcome

6.2 The electrification rate in Nicaragua was 94 percent as of enf of 2017. The remaining 6 percent live mostly in rural areas. In addition to extending the grid nationwide, the government continues with the electrification of dispersed communities, especially in the Caribbean region of the country, through the distribution of solar home systems. Solar panel distributors are active in these regions and marketing other solar products, such as solar water pumps, solar fences, and so on, along with solar home systems. Users are expected to make considerable use of electricity generated by solar home systems when they experience their benefits, but the users' limited ability to pay for battery replacement is a major risk to the sustainability of electrification by solar home systems.

6.3 The risks to the development outcome of social and economic benefits of electricity services are **substantial**. Four minigrids—El Bote, La Union, Wiwili, and Wapi—are connected to the national grid, and El Bote benefits from its small hydropower plant. The government continues to expand and strengthen the national grid in these project sites and beyond. Nicaragua now has sufficient generation capacity to meet electricity demand, so electricity supply is not seen as a problem unless generation becomes costly and unaffordable because of high

dependence on fuel oil in operating the excess capacity. However, there are substantial risks to the sustainability of the small hydropower plants in La Florida and El Bote. For example, La Florida is facing legal disputes between the concessionaire and the government. Despite the efficient operation and maintenance of the El Bote power plant, extremely poor road conditions could make it impossible to bring the necessary heavy machinery to the power plant site if a major breakdown occurred.

6.4 In Nicaragua, electricity users with a consumption of less than 150 kilowatt-hours enjoy a subsidy of about 50 percent of the electricity tariff. The government announced a tariff reform that will gradually lower the subsidy level from 50 percent to 25 percent for these users between 2018 and 2022. Although such reform is necessary to lift the burden of subsidies on government finances, which almost doubled to $61.8 million in 2016 from $34.8 million in 2011, the increase in end-user tariff might have a negative impact on the electricity consumption of the poor, which would decrease the social and economic benefits of electricity services.

6.5 The risk to development outcome is rated **substantial**.

Bank Performance

Quality at Entry

6.6 The strategic relevance of the project to the conditions in Nicaragua was high. The project was prepared in full cooperation with the government to support its rural electrification program, PLANER. The project included innovative solutions, such as microfinance and BDS, to promote productive uses of electricity in the project sites with an overarching objective of reducing poverty. These innovative solutions were discussed at a stakeholder workshop hosted by the CNE and IDA’s ESMAP in Nicaragua in November 2000.

6.7 The project design integrated proven renewable energy technologies to be implemented as public-private rural electricity delivery mechanisms in selected pilot sites with the intention of replication on a national scale based on the lessons learned during project implementation. The financial and economic aspects were sound, and the risk assessment at appraisal was adequate. The project appraisal document provided highly detailed institutional and implementation arrangements. A project implementation plan and associated operations manual were prepared before effectiveness, which included, among other things, procurement and disbursement procedures, and criteria for the selection of pilot projects for rural electrification, microfinance, and BDS. Environmental issues were appraised as minimal because the electrification through minigrids, solar home systems, and solar battery charging stations were to replace kerosene and other polluting forms of power and light. An Indigenous Peoples Plan targeting the communities in the Caribbean region of the country was prepared, and proper consultation mechanisms were established.

6.8 However, the project design was complex because the project took a holistic approach to rural electrification. Each project, especially four small hydro projects, required the preparation of a technical and financial package, completion of necessary environmental studies, and issuance of permits from governmental agencies before the start of the procurement process. Therefore, the five-year implementation period was unlikely to be sufficient to complete the

project activities. This obstacle was addressed by initially focusing on two projects with advanced preparations: El Ayote and El Bote. The cancellation of the former project because of political issues that could not be foreseen at appraisal eventually led to a major delay in project implementation.

6.9 Additionally, monitoring and evaluation (M&E) arrangements were highly complex. There were 45 indicators initially that mostly aligned with project outputs rather than capturing the achievement of the project objectives adequately. Some indicators were not measurable during project implementation, such as the cost recovery of business development service providers.

6.10 The quality at entry is rated **moderately satisfactory**.

Quality of Supervision

6.11 Supervision missions were held regularly (two or more in each year). The midterm review was executed as planned, and the findings were incorporated in project implementation, which led to a gradual increase in the performance rating. The World Bank team established effective communication channels with the PMU, which manifested in the restructuring of the project activities according to lessons learned from project implementation. According to interviews with government officials and members of the PMU, the World Bank's guidance and technical advice during project implementation were considered highly invaluable.

6.12 However, the World Bank's supervision did not ensure the appointment of an environmental specialist to the PMU until 2010. Despite the World Bank team's efforts to accelerate project execution, the project closing date had to be extended by three years. The World Bank's no-objection requirement for procurement processes, even with lesser amounts, created an unnecessary burden on both the World Bank and the PMU. This was corrected only in 2010.

6.13 The quality of the World Bank's supervision is rated **moderately satisfactory.**

6.14 Overall, the World Bank's performance is rated **moderately satisfactory**.

Borrower Performance

Government Performance

6.15 The government requested support from the World Bank for its rural electrification plan, which resulted in the development and implementation of PERZA. The government developed and adopted relevant policies and regulations needed for rural electrification. The government's commitment to the project continued even after the change of government in 2007, but the El Ayote project was still canceled because of political issues when the government changed.

6.16 CNE was reorganized as MEM under the restructuring of governmental institutions. Based on lessons learned from PERZA, the government prepared PNESER to increase nationwide electrification through grid extension and off-grid solutions. As disclosed in the

PERZA project completion report prepared by MEM, the government fulfilled its funding obligation.

6.17 The government took the necessary measures to replicate solar home systems as a rural electrification solution because of the successful implementation of these systems in dispersed communities. In the 2018–22 electrification plan, the government plans to distribute 30,000 solar home systems. However, the small hydro with minigrid rural electrification solution did not achieve the same success as solar home systems did. The government increased its control over the concessionaires of these minigrids, arguing that they lacked local technical and institutional capacity to operate and maintain these systems efficiently. As discussed in the efficacy section, concessions of some of these operators were canceled.

6.18 Overall, government performance is rated **moderately satisfactory**.

Implementing Agency Performance

6.19 The CNE (which later became MEM) was the implementing agency for PERZA, and a separate unit was established within MEM for the implementation. The PMU was composed of highly qualified staff, and the project director was replaced only once during implementation. Each project component had a separate person in charge. Most PERZA staff remained at MEM after project closing. As indicated by both directors and staff, the PMU's ownership of the project and commitment to achieving development objectives was strong. During project implementation, staff (including directors) visited the project sites frequently to oversee project implementation, technical training of local people, and awareness activities, and to conduct beneficiary consultations, especially in the RAAN. MEM prepared quarterly financial monitoring reports and submitted them to the World Bank regularly. The quality of financial information provided was satisfactory, and there were no fiduciary problems. MEM prepared a project implementation report in May 2012 that was very detailed in documenting project implementation and the outputs and outcomes the project achieved.

6.20 However, there were some moderate shortcomings. A dedicated environmental specialist was not appointed to the PMU until 2010, only 18 months before project closing. Until then, MEM's Environment Management Unit had supported the project's environmental aspects. The PMU's reaction to project implementation delays was to prepare plans to achieve on-time delivery of project outputs even though the evidence showed that time extensions were needed. Therefore, the PMU's time extension requests were late and left very little time to process them.

6.21 Implementing agency performance is rated **moderately satisfactory**.

6.22 Overall, borrower performance is rated **moderately satisfactory**.

Monitoring and Evaluation

6.23 **Design.** The project objectives were specified clearly, but the M&E design was too complex. There were 45 indicators originally. Some indicators were not measurable during project implementation, such as increased living standards, improved environmental management through use of renewable energy technologies, lessons from pilot projects applied

to new off-grid projects, and replication of new, decentralized off-grid energy solutions and business models. Most of the measurable indicators were designed to monitor the achievement of project outputs rather than achievement of project objectives. Others were difficult to measure and did not reflect project objectives, for example, “75 percent of community leaders participate in follow ups and community training during the life of the project.”

6.24 **Implementation**. The complex M&E design was simplified in the 2010 restructuring, just 18 months before project closing date. The indicators that were not measurable during project implementation were dropped. Although it was included in the M&E design, no field surveys were conducted to measure client satisfaction with BDS. Data collection was conducted by resident engineers for small hydro projects and a nongovernmental organization for solar battery charging stations. An independent consultant evaluated the implementation of solar home systems activities. The PMU maintained the project documents properly, and M&E data were reported to the World Bank in project progress reports. The project completion report that MEM prepared was high quality.

6.25 **Utilization.** The findings of M&E mostly measured the progress in project activities per component because the project was designed as a pilot demonstration of innovative solutions for rural electrification and associated social and economic benefits. These findings led to reframing the project strategy related to the implementation of solar battery charging stations and BDS. The achievement of project objectives was monitored by the number of connections and the enactment of laws and regulations necessary for rural electrification. These findings led to the preparation of PNESER, which had a more ambitious nationwide electrification target through grid extension and off-grid solutions.

6.26 Although M&E design was complex (but subsequently simplified), M&E implementation was efficient and of high quality, and the strategic and operational utilization of M&E findings was extensive. M&E for the project is rated **substantial**.

7. Lessons

- **Complementary infrastructure development, especially road connectivity to local markets, can further increase the welfare impacts of electrification in rural communities**. PERZA helped provide social and economic benefits to selected rural and dispersed communities by providing them with electricity for the first time and supplementing this with microfinance and BDS. However, poor access to local markets—particularly when caused by a lack of proper road connectivity—limited the scope for more productive uses, especially in the small hydro with minigrid project sites.
- **Solar home systems can be a successful solution for the provision of basic electricity services to poor rural communities outside the reach of the grid if the initial investment cost is subsidized appropriately to make it affordable to the beneficiaries while promoting ownership**. PERZA was successful in engaging microfinance institutions in the provision of subsidized loans to poor rural households to purchase solar home systems. By doing so, it reduced the upfront cost and made the system more affordable to the poor. At the same time, beneficiaries were required to cover part of the

initial cost from their own funds, increasing the ownership and likelihood of better operation and maintenance.

- **A pilot project consisting of numerous but well-integrated learning-by-doing project activities can improve a client institution's capacity to implement larger projects in the future successfully**. PERZA had a complex design because of its holistic approach to rural electrification. However, it was composed of well-integrated investment and technical assistance activities that provided MEM staff with a unique opportunity to build on its existing capacity and gain experience in implementing a complex project. This helped MEM develop and implement PNESER, a much larger program.

Bibliography

Bacon, Robert, and Masami Kojina. 2016. "Energy, Economic Growth, and Poverty Reduction: A Literature Review." Working Paper 104866, World Bank, Washington, DC.

ESMAP (Energy Sector Management Assistance Program). 2016. "Assessment of Post-Implementation and Completion Results (ICR) of PERZA." Unpublished. Managua, Nicaragua, ESMAP.

Gorgan, Louise, and Asha Sadanand. 2013. "Rural Electrification and Employment in Poor Countries: Evidence from Nicaragua." *World Development* 43 (March): 252–265.

IFC (International Finance Corporation). 2013. *Access to Energy in Low-income Communities in the Latin America and Caribbean Region: Lessons Learned and Recommendations*. Washington, DC: World Bank.

MEM (Ministerio de Energía y Minas). 2012. "Informe Final PERZA." Managua, Nicaragua, MEM.

Nicaragua (government of). 2001. "A Strengthened Growth and Poverty Reduction Strategy." Government of Nicaragua, n.l.

Smart Villages. 2017. "Energy Access in Nicaragua: The Nexus between Financial Mechanisms and Energy Policies." Workshop Report 35, Smart Villages, Matagalpa, Nicaragua.

Stojanovski, Ognen, Mark Thurber, and Frank Wolak. 2017. "Rural Energy Access through Solar Home Systems: Use Patterns and Opportunities for Improvement." *Energy for Sustainable Development* 37 (April): 33–50.

Waslala (Municipio de). 2013. "Plan de Desarrollo Territorial del Municipo de Waslala." Waslala, Nicaragua, Municipio de Waslala.

World Bank. 2002. *Nicaragua—Country Assistance Strategy*. Washington, DC: World Bank.

———. 2018a. "Nicaragua—Completion and Learning Review for Country Partnership Framework FY13–17." Completion and Learning Review 123196, World Bank, Washington, DC.

———. 2018b. *Nicaragua—Country Partnership Framework for the Period FY18–22*. Washington, DC: World Bank.

[1] There are two autonomous regions on the Caribbean side of the country: the North Caribbean Coast Autonomous Region (Región Autónoma de la Costa Caribe Norte; RAAN) and the South Caribbean Coast Autonomous Region (Región Autónoma de la Costa Caribe Sur; RAAS).

[2] The Sustainable Energy for All initiative launched by the Secretary General of the United Nations in 2011 defines access to electricity in seven tiers. Tier 0 means no access to electricity. Basic electricity services, such as lighting, are classified under Tiers 1 and 2. For more information, visit http://www.seforall.org.

[3] Level 1 restructurings require the approval of the World Bank Group's Board of Directors.

Appendix A. Basic Data Sheet

OFFGRID RURAL ELECTRIFICATION PROJECT (IDA 3760, GEF TF051960)

Table A.1. Key Project Data ($, millions)

Category	Appraisal Estimate	Actual or Current Estimate	Actual as Percentage of Appraisal Estimate
Total project costs	22.99	26.25	114.20
Loan amount	12.00	13.47	112.30
Global Environment Facility	4.02	3.94	98.00
Private sector	4.74	6.48	136.70
Government of Nicaragua	2.23	2.36	105.80

Table A.2. Cumulative Estimated and Actual Disbursements (including the GEF grant)

Category	FY04	FY05	FY06	FY07	FY08	FY09	FY10	FY11	FY12
Appraisal estimate ($, millions)	6.13	11.30	14.11	15.39	15.98	15.98	15.98	15.98	15.98
Actual ($, millions)	1.19	3.56	5.44	7.13	10.80	12.34	13.70	15.81	17.44
Actual as percent of appraisal	19.40	31.50	38.50	46.30	67.60	77.20	85.70	98.90	109.10
Date of final disbursement									May 7, 2012

Note: GEF = Global Environment Facility.

Table A.3. Project Dates

Category	Original	Actual
Concept review	—	12/18/2001
Appraisal	—	12/09/2002
Board approval	—	05/15/2003
Effectiveness	06/20/2003	11/28/2003
Midterm review	02/15/2007	07/10/2006
Closing date	12/31/2008	12/31/2011

Table A.4. Staff Time and Cost for IDA Credit (P073246) and GEF Grant (P075194)

Stage of Project Cycle	Staff Time and Cost (World Bank budget only)	
	Staff Weeks (number)	**$, thousands** (including travel and consultant costs)
Lending		
FY02	26	-
FY03	49	-
FY04	4	-
FY05	-	-
Total	**79**	-
Supervision/ICR	-	-
FY04	16	-
FY05	28	-
FY06	28	-
FY07	22	-
FY08	24	-
FY09	9	-
FY10	-	-
FY11	-	-
FY12	-	-
Total	**127**	-

Note: GEF = Global Environment Facility; ICR = Implementation Completion and Results Report; IDA = International Development Association.

Table A.5. Task Team Members

Names	Title	Unit
Lending		
Clemencia Torres De Mastle	Senior Regulatory Economist	LCSEG
Kilian Reiche	Energy Specialist	LCSEG
Ernesto Terrado	Energy Specialist	LCSEG
Michael Goldberg	Senior Private Sector Development Specialist	LCSDE
Eduardo Zolezzi	Senior Energy Specialist	LCSEG
Vladimir Jadrijevic	Senior Energy Specialist	LCSED
Juan David Quintero	Senior Environment Specialist	
Supervision/ICR		
Alberto Didoni	Operations Officer	CLALA
Amit Burman	Consultant	CICSA
Augusto Garcia	Operations Officer	LCSAR
Carlos Francisco Siezar	Consultant	LCCNI
Eduardo H. Zolezzi	Consultant	LCSEG
Enrique Antonio Roman	Financial Management Specialist	LCSFM
Ernesto N. Terrado	Consultant	MNSSD
Fabienne Mroczka	Financial Management Analyst	LCSFM
Fabio Arjona	Consultant	LCSEG
Fernando Lecaros	Consultant	LCSEG
Irani G. Escolano	Consultant	LCSPT
Juan Miguel Crivelli	E T Consultant	LCSEG
Karen Bazex	Energy Specialist	LCSEG
Kilian A. Reiche	Consultant	LCSEG
Luis R. Prada Villalobos	Senior Procurement Specialist	LCSPT
Manuel Antonio Vargas Madrigal	Senior Financial Management Specialist	LCSFM
Manuel Sevilla	Consultant	LCCSV
Maria E. Castro-Munoz	Senior Social Scientist	LCSSO
Michael J. Goldberg	Senior Private Sector Development	LCSPF
Patricia Maria Rodrigues	Consultant	LCSEG
Violeta Granera	Consultant	LCSEG
Vladimir T. Jadrijevic	Consultant	LCSEG
Xiaoping Wang	Senior Energy Specialist	LCSEG

Appendix B. Project Costs and Financing

Components	Sources ($, millions)					
		IDA	GEF	Government	Private	Total
Component A	PAD Estimate	0.63	0.37	0.10	0	1.10
	Actual	0.86	0.25	0.10	0	1.21
Component B	PAD Estimate	8.78	2.85	0.82	4.74	17.19
	Actual	8.56	2.72	0.59	6.49	18.36
Component C	PAD Estimate	1.17	0	0.17	0	1.34
	Actual	1.25	0	0.65	0	1.90
Component D	PAD Estimate	0.47	0	0.21	0	0.68
	Actual	0.53	0	0.03	0	0.56
Component E	PAD Estimate	0.30	0.36	0.23	0	0.89
	Actual	0.59	0.56	0.10	0	1.25
Component F	PAD Estimate	0.65	0.44	0.70	0	1.79
	Actual	1.68	0.41	0.89	0	2.98
Total at December 31, 2011	PAD Estimate	12.00	4.02	2.23	4.74	22.99
	Actual	13.47	3.94	2.36	6.49	26.26

Note: Data are from the project implementation completion report prepared by the Ministerio de Energía y Minas, "Informe Final PERZA," May 2012. GEF = Global Environment Facility; IDA = International Development Association; PAD = project appraisal document.

Appendix C. List of Persons Met

Managua

Ministry of Finance and Public Credit
Jose Adrian Chavarria Montenegro, Vice Minister
Roga Vega, Director General of Public Investment
Norman Rodriguez, Coordinator of Multilateral Organizations

Ministry of Energy and Mines
Salvador Mansell Castrillo, Minister
Indiana Leon Medrano, Director General of Policies and Planning
Carlos Sanchez, Director of Energy Planning

Empresa Nacional de Transmision Eléctrica
Horacio Guerra Wheelock, Director of Planning

Instituto Nicaragüense de Energía
Jose Antonio Castaneda Mendez, President

Fondo para el Desarrollo de la Industria Eléctrica Nacional
Elba Mendoza Danales, Engineer
Alexis Vega, Electrical Engineer
Luis Zambrana, Civil Engineer

Proyecto de Electrificación Rural para Zonas Aisladas Team
Herminia Martinez, Director
Francis Davila, Director
Gloria Maria Mendoza Cantillo, Manager of Rural Electrification Component
Doris Lupez Funez, Manager of Microfinance Component
Harold Somarriba Aguirre, Social Participation
Ruben Mario Smart Reyes, Social Participation

Other Interviewees
Vladimir Delagneau, President and General Manager, TECNOSOL
Suyen Cordoba, Director of Alternate Sources of Energy, National University of Engineering
Luis Wilson Guill, Executive Director, PANA
Ray Hooker, President, FADCANIC

World Bank
Raul Antonio Barros, Senior Country Operations Officer

El Cua

Isidro Irias Herrera, Mayor of El Cua
Rebecca Leaf, Director, Asociación de Trabajadores de Desarrollo Rural—Benjamin Linder

La Union

Bladimir Duran, Manager of Coopleche
Miguel Morales, Zelayaluz
Residents of La Union

Washington, DC

Xiaoping Wang, Senior Energy Specialist stationed in Kathmandu
Juan Carlos Pereira, Principal Investment Officer, IFC
Niki Angelou, Consultant, ESMAP