

DOCUMENT OF THE INTER-AMERICAN DEVELOPMENT BANK

PARAGUAY

**REHABILITATION AND MODERNIZATION PROGRAM FOR THE
ACARAY HYDROELECTRIC POWER PLANT**

(PR-L1156)

LOAN PROPOSAL

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ABBREVIATIONS

ANDE	Administración Nacional de Electricidad [National Electricity Administration]
CHA	Central Hidroeléctrica Acaray [Acaray Hydroelectric Power Plant]
CO ₂	Carbon dioxide
EIRR	Economic internal rate of return
ESMR	Environmental and Social Management Report
kW	Kilowatt
kWh	Kilowatt hour
MW	Megawatt
MWh	Megawatt hour
PCU	Program Coordination Unit
PMU	Program Management Unit

PROJECT SUMMARY

PARAGUAY REHABILITATION AND MODERNIZATION PROGRAM FOR THE ACARAY HYDROELECTRIC POWER PLANT (PR-L1156)

Financial Terms and Conditions						
Borrower: National Electricity Administration (ANDE)			Flexible Financing Facility^(a)			
			Amortization period:	24 years		
			Disbursement period:	6 years		
Guarantor: Republic of Paraguay (financial obligations) Executing agency: ANDE			Grace period:	6.5 years ^(b)		
			Interest rate:	LIBOR-based		
Source	Amount (US\$)	%	Credit fee:	(c)		
IDB (Ordinary Capital):	125,000,000	86.1%	Inspection and supervision fee:	(c)		
			Weighted average life:	15.25 years ^(d)		
Local counterpart:	20,200,320	13.9%	Approval currency:	U.S. dollars from the Bank's Ordinary Capital		
Total:	145,200,320	100%				
Project at a Glance						
Project objective: The program's general objective is to help modernize Paraguay's electricity sector by financing investment to rehabilitate ANDE's electricity infrastructure. The specific objective is to assist ANDE in rehabilitating and modernizing the Acaray Hydroelectric Power Plant in order to: (i) extend its useful life; (ii) enhance its availability and reliability; and (iii) boost its generation capacity.						
Special contractual conditions precedent to the first disbursement of the loan proceeds: (i) the approval and entry into force of the program Operating Regulations under the terms previously agreed upon with the Bank (paragraph 3.4); and (ii) the creation of a Program Management Unit under ANDE's Technical Office and appointment of its key staff (paragraph 3.1). Also, see Annex B of the Environmental and Social Management Report (ESMR) for the environmental contractual condition precedent to the first disbursement of the loan proceeds.						
Special contractual conditions for execution: See the special contractual conditions for execution in Annex B of the ESMR .						
Exceptions to Bank policies: A partial exception to the policy on guarantees required from the borrower (document GP-104-2) is requested, so that the sovereign guarantee of the Republic of Paraguay be applicable only to the borrower's financial obligations (including payments of principal, interest, and fees) and not to its obligations to perform or the local counterpart contributions (paragraph 3.3).						
Strategic Alignment						
Challenges: ^(e)	SI	<input type="checkbox"/>	PI	<input checked="" type="checkbox"/>	EI	<input checked="" type="checkbox"/>
Crosscutting themes: ^(f)	GD	<input checked="" type="checkbox"/>	CC	<input checked="" type="checkbox"/>	IC	<input checked="" type="checkbox"/>

^(a) Under the Flexible Financing Facility (document FN-655-1), the borrower has the option of requesting changes to the amortization schedule, as well as currency and interest rate conversions. The Bank will take operational and risk management considerations into account when reviewing such requests.

^(b) Under the flexible repayment options of the Flexible Financing Facility, changes to the grace period are permitted provided that they do not entail any extension of the original weighted average life of the loan or last payment date as documented in the loan contract.

^(c) The credit fee and inspection and supervision fee will be established periodically by the Board of Executive Directors as part of its review of the Bank's lending charges, in accordance with applicable policies

^(d) The original weighted average life may be lower depending on the date on which the loan contract is signed.

^(e) SI (Social Inclusion and Equality); PI (Productivity and Innovation); and EI (Economic Integration).

^(f) GD (Gender Equality and Diversity); CC (Climate Change and Environmental Sustainability); and IC (Institutional Capacity and Rule of Law).

I. DESCRIPTION AND RESULTS MONITORING

A. Background, problem addressed, and rationale

- 1.1 Paraguay's electricity generation capacity is 8,814 megawatts (MW), while maximum demand is 3,135 MW.¹ Out of this total capacity, 7,000 MW are from Itaipú (binational hydropower plant shared with Brazil), 1,600 MW, from Yacyretá (binational plant shared with Argentina),² and 214 MW, from the Central Hidroeléctrica Acaray [Acaray Hydroelectric Power Plant] (CHA) owned by the National Electricity Administration (ANDE). Practically 100% of the electricity consumed in the country is from hydropower, which by definition is renewable.³ The National Interconnected System receives 73.2% of its supply from Itaipú, 20.7% from Yacyretá, and 6.1% from Acaray (2017).⁴
- 1.2 Electricity demand is concentrated primarily in residential customers (43.8%) and commercial, general, and municipal customers (35%), with the remainder distributed among industrial consumers, public lighting, and other sectors. Demand has grown at an average of 5.2% per year over the last five years, reaching 15,575 gigawatt hours in 2017. Peak demand has climbed at an annual average of 5.6%.⁵ Electricity losses are high, i.e., 25.6% in 2017,⁶ out of which 5.7% occurred during transmission, and 19.9%, during distribution.⁷ Paraguay's electricity coverage is extensive at 99.1% (99.6% in urban areas and 96% in rural areas).
- 1.3 **ANDE**, which provides electricity service nationwide, is a decentralized, autarkic entity in the public administration system with legal status and its own assets. Governed by [Law 966 of 1964](#), its founding charter, the institution is responsible for electricity generation, transmission, and distribution in Paraguay. ANDE purchases energy from Itaipú and Yacyretá, both binational independent entities.⁸ It also performs sector functions related to investment planning and programming.
- 1.4 The Vice Ministry of Mines and Energy, under the Ministry of Public Works and Communications, is responsible for proposing policies, regulations, and applications for the energy sector. The rate policy for public utilities is set by the National

¹ [ANDE 2017 Annual Report](#).

² Paraguay receives 50% of the installed capacity of the binational power plants (14,000 MW from Itaipú and 3,200 MW from Yacyretá).

³ ANDE has some rather small isolated systems, like Bahía Negra (0.2 megawatts) in the north, that still use diesel generation.

⁴ Hydropower accounts for 60.9% of the gross primary energy supply, including the 50% share of energy from Itaipú and Yacyretá. However, looking at domestic energy demand, 44.2% is for biomass energy, 40.1% is for petroleum derivatives, and only 15.7% is for electricity. [National Energy Balance Sheet for 2017. Vice Ministry of Energy and Mines. August 2017.](#)

⁵ [ANDE 2017 Annual Report](#).

⁶ Average electricity loss in Latin America and the Caribbean is 17%. [Latin American Energy Organization \(OLADE\) Energy Statistics Report 2016.](#)

⁷ Nearly half of distribution losses are estimated to be nontechnical. The Bank has supported actions to reduce the rate of electricity loss, which was 32.6% in 2007 when Phase I of ANDE's Multi-Phase Power Transmission Program (loan 1835/OC-PR) began. Also, through Phase II of the program (loan 2891/OC-PR) losses were lowered to current levels.

⁸ Private participation is very limited given the sector's structure. For distribution, there are two smaller areas covered by the Compañía de Luz y Fuerza, S.A., (in Villarrica) and the Cooperativa Eléctrica Menonita (in Chaco Central).

Economic Team, consisting of the Ministers of Finance, Public Works and Communications, Agriculture and Livestock, and Industry and Commerce, as well as the president of the Central Bank of Paraguay.⁹ Since 2008, energy policy has been discussed at an Energy Roundtable presided over by the president of Paraguay and led by the Vice Ministry of Energy and Mines, with other ministries participating.¹⁰

- 1.5 **The Acaray Hydroelectric Power Plant.** The CHA is on the Acaray River near Ciudad del Este (330 km east of Asunción). It was built with support from the Inter-American Development Bank (IDB) in the 1960s and 1970s. The plant has two power houses: Power House I, operating since 1968, with two groups of Francis turbine generators, each one with 47 MW of nominal power (called Group 1 and Group 2); and Power House II, operating since 1977, with two groups of Francis turbine generators, each with 60 MW of nominal power (Group 3 and Group 4). There are two dams regulating the flow of the river: the Acaray (near the plant), which controls the height of the reservoir that provides water to the plant; and the Yguazú (100 km upstream from the plant), which does not have a power generation facility but helps accumulate water and control the river's volume to optimize water resources (see Figure 1).¹¹ The Acaray dam, measuring 154 meters in length, is made out of concrete and has 7 spillways with radial arm gates. It is complemented by a 420-meter long earthfill dam. The Yguazú regulation dam has two spillways with radial arm gates and one open gate spillway. The plant also has a substation with 6 transformers, each with 25 megavolt-amperes of single-phase power. It has been supplying the demand from the Paraguayan market and, to a lesser degree, the Brazilian and Argentine markets, over different periods and through various electrical interconnections.
- 1.6 **Diagnostic assessment of the CHA.** According to the [comprehensive diagnostic assessment](#) funded by the IDB (operation ATN/OC-15910-PR), the CHA requires immediate intervention to mitigate its growing deterioration and avoid a future shutdown. The main causes of this situation are the following: (i) Power House I has not received major maintenance in over 25 years,¹² and its equipment is reaching the end of its useful life and needs to be replaced; (ii) control and monitoring instruments throughout the plant are obsolete and must be upgraded; (iii) the mechanical and electrical auxiliary systems in the Acaray and Yguazú dams need to be replaced with equipment that meets international quality standards and practices; (iv) the maintenance management system should be improved; (v) the civil infrastructure requires repairs to enhance security and extend its useful life; and (vi) high-, medium-, and low-voltage equipment in the elevating substation is near the end of its useful life and needs replacing.

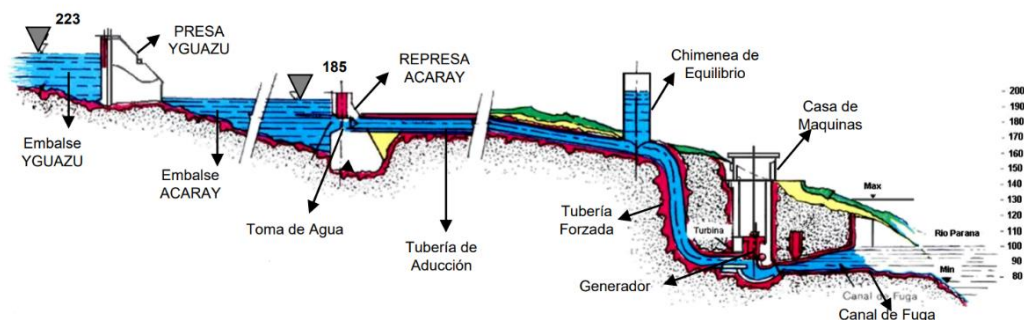
⁹ ANDE conducts rate studies and suggests adjustments, but the government ultimately makes the decision. According to Law 966, rates must cover costs and generate revenue equivalent to 8% of assets.

¹⁰ The possibility of creating a Ministry of Energy is currently being discussed.

¹¹ The Yguazú dam, built in 1976, serves as a regulation dam to control the water flow to the Acaray dam.

¹² Turbine generator Groups 1 and 2 underwent major maintenance from 1987 to 1989.

Figure 1. Cross-section of the Acaray dam water system



Source: <http://www.ande.gov.py>

- 1.7 In terms of Power House II, ANDE worked on Group 3 and 4 turbines in 1999, replacing their original impellers with the current higher power ones, while the generators are now being renovated to make them compatible with those impellers.¹³ This program complements that work, focusing solely on replacing the auxiliary and control equipment for Groups 3 and 4.
- 1.8 The CHA has been found to lack effective control mechanisms and physical barriers to demarcate its premises (for example, a perimeter fence), as well as security systems for protection and surveillance of the dam and plant. An unrecorded number of persons that travel along the road adjacent to the plant occasionally enter the premises of the dam for recreational purposes, which creates a contingent risk for them and for the facilities. The diagnostic assessment also found that visitors to the plant do not receive a safety orientation, which is needed to brief them on the inherent risks of a hydropower plant with heavy rotary machinery, high voltages, and high currents. Visitor interest shows that the Acaray dam is a tourist attraction in and of itself, but it lacks appropriate visitor facilities.¹⁴ To mitigate these issues, the assessment suggests that adequate security systems, including perimeter fences and entrance management systems, need to be installed to improve the overall safety of the facilities for ANDE staff and visitors who wish to see the dam and power plant. Supplementary civil works such as a visitor's center are also needed to capitalize on and boost the tourism appeal of the CHA.
- 1.9 **Importance of the CHA in regional energy integration.** Historically, ANDE has exported energy to Brazil¹⁵ and Argentina, through various interconnections with the

¹³ Rehabilitation work on the Group 3 generator has already been completed, and ANDE is now working on Group 4.

¹⁴ Most visitors come from Ciudad del Este and Hernandarias, which together have a population of around 355,000. [Paraguay – Population projection by sex and age per district for 2000-2025](#). The total number of visitors to the premises of the CHA is unknown. As a reference, the Salto Grande binational plant (Argentina-Uruguay) received approximately 78,000 visitors in 2017 (source: Salto Grande), and the Yacyretá binational plant (Argentina-Paraguay) received 24,758 in 2014; 28,576 in 2015; 31,038 in 2016, and 33,664 in 2017 (source: Yacyretá).

¹⁵ To export from Paraguay to Brazil, 50-to-60-hertz frequency conversion stations are needed.

respective interconnected systems.¹⁶ In recent years, exports have gone to Argentina in particular, through the Carlos Antonio López substation (located in eastern Argentina on the Paraná River) and El Dorado (in the province of Misiones, Argentina).¹⁷ The export volume over the last 20 years has ranged from a maximum of 788,067 megawatt hours (MWh) (2006) to a minimum of 73,025 MWh, with an annual average of 115,000 MWh over the 2013-2017 period. This represented 10.9% of the energy generated by the CHA in that period. ANDE hopes to continue these international transactions and eventually increase the volume of its energy exports from the plant to the countries of the region (see the [Regional Energy Integration](#)).

- 1.10 **Problem to be addressed.** The CHA, which is the only power plant owned 100% by ANDE, is showing significant deterioration, due not only to its age, but also a lack of investment and major maintenance resulting from budgetary and technical constraints and difficulties managing the maintenance plan. For the reasons summarized in the comprehensive diagnostic assessment of the CHA (paragraph 1.6), it is increasingly common to see turbine damage caused by cracks or heavy vibration, short circuits in generator windings, and transformer and auxiliary equipment failures. Often times, one or more of the four units are out of operation for days or weeks and, in some cases, for many months.¹⁸ The units in Power House I are estimated to have a high likelihood of failure (80%).¹⁹ When a unit stops operating, the energy not produced has to be replaced with power purchased from the Itaipú or Yacyretá binational entities, which has financial implications for ANDE. The comprehensive diagnostic assessment (paragraph 1.6) also reveals that technical and managerial staff require further training, especially in operating and maintaining the plant once it is upgraded with new equipment and technology (paragraph 1.17), and in monitoring and overseeing the rehabilitation work.
- 1.11 **Rationale.** A comprehensive rehabilitation and modernization program for the CHA, including security improvements, is vital to ensure the availability and reliability of the only power plant owned by ANDE and to extend its useful life by at least 30 years. Moreover, the investment will substantially reduce unscheduled stoppages of the plant's generation units (paragraph 1.10). The plant's availability and reliability will also be enhanced by incorporating new available technology

¹⁶ The CHA has sold or continues to sell energy to the following regional companies: (i) Electricidad de Misiones, S.A., (Argentina) with two connections: one 132-kilovolt (kV) connection between Carlos Antonio López and El Dorado, in operation, and a 33-kV connection between Encarnación and Posadas, currently deactivated; (ii) Companhia Paranaense de Electricidade (Brazil), through a 220/138-kV interconnection that was deactivated in 2009 due to malfunctions and an obsolete frequency converter; (iii) Empresa Energética de Mato Grosso do Sul (Brazil) in Amambay with a 23/34-kV connection, currently deactivated; and (iv) Electricidad de Formosa (Argentina) in Clorinda, through a 220-kV transmission line to Puerto Mariscal, in operation. Currently, the interconnections with Argentina in Misiones (El Dorado) and Formosa operate to provide mutual support in emergency situations. A new 220-kV interconnection is planned between Encarnación in Itapúa, Paraguay, and Posadas in Misiones, Argentina.

¹⁷ Export volumes, modalities, and conditions are negotiated between ANDE and Energía Binacional, S.A. (EBISA), an Argentine State-run enterprise that sells the energy from binational entities and nuclear power plants in that country. EBISA is in the process of merging with Energía Argentina, S.A., to form Integración Energética, S.A.

¹⁸ Group 1 was stopped for repairs for approximately 16 months from September 2016 to January 2018.

¹⁹ Phase II Report – Short, Medium, and Long-term Action Plan. Vol 1. Main Report. Manitoba Hydro International, December 2017.

such as digital tools and working to upgrade management systems, refurbish civil works, and improve the protection and security of the dam and power plant (paragraphs 1.19 and 1.21).

- 1.12 **Evidence.** As hydropower plants age, their units have an increased risk of failure due to wear and tear on the equipment, especially if maintenance is inadequate. This reduces their availability and reliability.²⁰ Such deterioration worsens over time until operation and maintenance costs surpass earnings from the energy generated, rendering operation of the equipment unviable. Rehabilitation programs restore power plants to their initial design conditions, ensuring their availability and reliability.²¹ The unit costs of rehabilitation investment are lower than those of a new power plant²² due to the sunk costs of civil works (dam, tunnel, and power house) and the mitigation of environmental and social impacts (areas flooded to make reservoirs). Hydroelectric power plant rehabilitation projects are, therefore, rather attractive and generally have positive economic returns (of around 20% or higher). While the main advantage of rehabilitation is that it extends the useful life of power plants, the use of technologies that were not available 30 or 40 years ago can increase the efficiency and availability of plants²³ or potentially boost their capacity. Lower operating costs, especially by employing digital technologies, is another advantage.
- 1.13 **Gender and diversity analysis.** Along with upgrading the CHA, the gender equity situation was examined. Women make up 20% of ANDE's permanent and contract staff. That said, the breakdown of their job duties is as follows: 5% are operational; 7%, technical; 29%, professional; and 46%, administrative. Additionally, 21% of leadership positions are occupied by women. Based on this, there are expected opportunities to improve gender equity that can enrich ANDE, given that diversity is essential for innovative, modern companies to develop and perform well. With the support of the IDB, a diagnostic assessment on gender²⁴ is being conducted to better understand the conditions and situation of women in the institution and identify possible areas for work. To develop successful practices and solutions, it is also important to understand the reality of the sector in Paraguay as far as gender issues are concerned and craft appropriate public-sector responses. The diagnostic assessment consists of designing tools, conducting surveys and interviews, compiling secondary data on labor market supply and demand in the electricity sector, and gathering internal ANDE and CHA documents, then processing and analyzing the information and making decisions based on that. This information will be used to prepare and implement an ANDE action plan and gender diversity policy ([Gender document](#)). The project will also support ANDE's

²⁰ Alarcón, Arturo D., [El sector hidroeléctrico en Latinoamérica: Desarrollo, potencial y perspectivas](#). Technical Note IDB-TN-1405. IDB. June 2018.

²¹ Goldberg, Joseph; Espeseth Lie, Oeyvind. 2011. Rehabilitation of Hydropower: An Introduction to Economic and Technical Issues. Water Papers; World Bank. Washington, D.C.

²² A range of US\$500 to US\$1,000/kW for rehabilitation projects versus more than US\$1,300/kW for new projects. See [El sector hidroeléctrico en Latinoamérica: Desarrollo, potencial y perspectivas](#), page 43.

²³ Rehabilitation and Upgrading Hydro Plants: A Hydropower Technology Round-Up Report. Volume 2, EPRI, Palo Alto, CA: 1999. TR-113584-V2.

²⁴ The IDB will support ANDE with a gender diagnostic assessment and the preparation of a gender plan through the program to promote gender inclusivity in the energy sector (operations ATN/OC-16266-RG and ATN/OC-16267-RG) and, thus, make headway on that work.

efforts on behalf of persons with disabilities, as part of its corporate social responsibility work.²⁵ Both the implementation of the gender action plan and interventions to support persons with disabilities will be funded by the proposed operation. Some of the possible actions to be implemented under this operation include: (i) launching campaigns in primary and secondary schools and universities to get girls and women interested in studying science, technology, and other related fields and in working in the sector; (ii) updating hiring processes and making candidate selection more transparent; and (iii) encouraging more women to remain in the workforce by designing flexible employment opportunities, as well as mentoring, sponsorship, professional development, and training programs.

- 1.14 **The Bank's experience in the sector and lessons learned.** The IDB has extensive knowledge of Paraguay's energy sector. It has financed more than US\$440 million in loans and technical cooperation funding in the country for, among other things, the construction of hydroelectric power plants (Acaray), the expansion of transmission grids, investments in power distribution, rural electrification projects, and energy efficiency programs. The Bank also has vast experience with modernization and rehabilitation projects for hydroelectric power plants, such as Furnas and Luiz Carlos Barreto (2549/OC-BR) in Brazil; Itaúba and Passo Real (2813/OC-BR), also in Brazil; Peligre (1296/OP-HA) in Haiti; Río Macho in Costa Rica; and Carlos Fonseca in Nicaragua (1933/BL-NI-1). The main lessons learned from these projects are the following: (i) there is an inherent level of uncertainty about the scope of rehabilitation projects, since the actual state of some of the equipment is not fully known. Therefore, no effort should be spared when performing diagnostic assessments prior to rehabilitation processes and anticipating the resources and time required for contingencies; (ii) it is important to coordinate the rehabilitation timeline with the system operator, especially when units at the plant will have to be stopped; stoppage times should be quantified in the project evaluation since they entail a cost; (iii) an ad hoc management unit or group should be created. Power plants usually have operation and maintenance teams, but they generally do not have the capacity or time to work exclusively on a rehabilitation project; (iv) as these projects have long-term outcomes, outcome indicators should be measured over a long enough period to adequately capture the project's benefits; and (v) rehabilitation projects offer excellent opportunities to incorporate the latest available technology, such as digital power plant control and operations tools, which should be harnessed.
- 1.15 **Strategic alignment.** The program is consistent with the Update to the Institutional Strategy 2010-2020 (document AB-3008) and aligned with the development challenges of: (i) productivity and innovation, as it: (a) provides infrastructure for a steady, sustainable energy supply, and (b) promotes the increased use of digital technology (paragraph 1.17); and (ii) economic integration, through ongoing international energy transactions with countries in the region (paragraph 1.9). It is also aligned with the following crosscutting areas: (i) gender equality and diversity, through the implementation of a gender action plan (paragraph 1.13); (ii) climate change and environmental sustainability, insofar as it provides continuity in clean energy generation, thus preventing carbon dioxide (CO₂) emissions; and

²⁵ In 2014, ANDE began identifying persons with disabilities within the institution. In 2018, it now has all of the information and is identifying concrete actions to respond to current regulations on disability, as an institutional initiative.

- (iii) institutional capacity and the rule of law, through training workshops for technical and managerial staff. The program will contribute to the Corporate Results Framework 2016-2019 (document GN-2727-6) through the output indicator “sustainability of generation capacity with renewable sources.” It is aligned with the strategic energy objective of the Bank’s country strategy with Paraguay (document GN-2769), in that it provides sustainable electric power for the population and the productive sector and is included in the Update of Annex III of the 2018 Operational Program Report (document GN-2915-2). Through its support for the modernization of infrastructure to sustainably meet energy demand, the program is aligned with the Sustainable Infrastructure Strategy for Competitiveness and Inclusive Growth (document GN-2710-5). The operation is consistent with the Energy Sector Framework Document (document GN-2830-5) based on the different pillars addressing sector challenges, namely: energy sustainability and security, energy efficiency, renewable energy, energy infrastructure, and regional energy integration for the provision of reliable services; and with the Climate Change Sector Framework Document (document GN-2835-5), as it promotes renewable energy, and with the Gender and Diversity Sector Framework Document (GN-2800-8).
- 1.16 In all, 100% of the operation’s proceeds are expected to be invested in climate change mitigation activities based on the [multilateral development banks’ joint methodology for tracking climate change finance](#) (Climate change document). These proceeds contribute to the IDB Group’s goal of increasing financing for climate change projects to 30% of all operation approvals by the end of 2020.
- 1.17 **Innovation and digitalization.** Digital technologies are reshaping and revolutionizing the energy sector. They offer an opportunity to improve the electricity industry by making electricity systems more connected, intelligent, efficient, reliable, and sustainable. The program will promote innovation and the increased use of digital technologies (paragraph 1.19) to improve the power plant’s controls, dam monitoring systems, instrument panels, and management tools.
- 1.18 **Consistency with the Public Utilities Policy (document GN-2716-6).** The program is consistent with the Public Utilities Policy in that its investments target renewable energy, make the power plant more efficient and reliable, and lower electricity costs. It also meets the objectives, principles, and conditions of economic viability and financial sustainability as established in the [Public Utilities Policy](#). ANDE’s revenue has been sufficient to cover the costs of the service and make its debt payments, except in 2016 when it ended the fiscal year with a deficit.²⁶ In 2017, the government ordered an increase in electricity rates for various categories of customers except residential ones to stabilize ANDE’s financial situation.²⁷ The economic viability of the program was confirmed through a cost-benefit analysis

²⁶ ANDE has US\$1.901 billion in net assets and liabilities of US\$1.087 billion. In 2017, it had operating revenue of US\$728 million and operating expenses of US\$687 million, with a 5.02% return on fixed investment. ANDE contributed value-added tax to the tune of US\$42 million and US\$13 million in customs tariffs. [ANDE 2017 Annual Report](#).

²⁷ With this adjustment, residential rates were not raised for consumption of under 300 kilowatt hours (kWh) per month. The last rate adjustment prior to 2017 was in 2002. Adjustments were not necessary for many years due primarily to the availability of low-cost hydroelectricity generation. The current average rate for residential customers with consumption of under 200 kWh/month is US\$0.64/kWh and for industrial customers with consumption of between 300 kWh/month and 50 MWh/month, it is US\$0.44/kWh. [ANDE 2017 Annual Report](#).

(paragraph 1.28). The financial viability analysis (paragraph 1.31) confirmed that the program will generate sufficient revenue to cover fiduciary commitments and the operation and maintenance costs of the financed works.

B. Objectives, components, and cost

- 1.19 The program's general objective is to help modernize Paraguay's electricity sector by financing investment to rehabilitate ANDE's electricity infrastructure. The specific objective is to assist ANDE in rehabilitating and modernizing the CHA in order to: (i) extend its useful life; (ii) enhance its availability and reliability; and (iii) boost its generation capacity. The program envisages two components:
- 1.20 **Component I. Investment to rehabilitate and modernize the power plant (US\$133.8 million).** This component will finance the design and the electric and electromechanical infrastructure of the CHA, to include: (i) basic design and supervision of works; (ii) engineering and designing the two turbines and generators in Groups 1 and 2 (Power House I); (iii) manufacturing and installing the new turbines and generators for Groups 1 and 2;²⁸ (iv) replacing two elevating transformers and procuring a reserve unit; (v) rehabilitating the Acaray and Yguazú dam spillways, including cranes and other auxiliary equipment; (vi) improving the power plant's civil infrastructure, including investment in Power Houses I and II, the control center, and offices; (vii) incorporating a comprehensive control system into the power plant; and (viii) upgrading the high-, medium-, and low-voltage equipment in the substation.
- 1.21 **Component II. Support for management, protection of the premises, gender equity, and institutional capacity (US\$9.3 million).** This includes: (i) investment to protect and secure ANDE's installations and premises in the areas of the Acaray dam and power plant, including construction of visitor facilities; (ii) the implementation of a gender and diversity strategy and action plan in ANDE with guidelines that promote gender equity, female workforce participation, diversity, and the elimination of gender and diversity gaps in the electricity sector; (iii) support to build the institutional capacity of ANDE's technical and managerial staff; and (iv) hiring a panel of experts to support program execution.
- 1.22 **Administration, monitoring, and evaluation (US\$2.0 million).** This component will finance administration and monitoring costs throughout the full execution of the program. Such costs include the fees of the consultants who will support ANDE (paragraphs 2.8 and 3.1), as well as external auditing and the midterm and final evaluations.

²⁸ No actions are planned under the program for the Group 3 and 4 (Power House II) generators, since they are currently being rehabilitated. The turbine interventions will be examined once work is completed on the generators and the rehabilitation outcomes are analyzed. The program does, however, consider measures for control and auxiliary equipment in Power House II.

Table 1. Program cost by component (US\$)

Component	IDB loan (Ordinary Capital)	Local counterpart	Total
Component I - Investment to rehabilitate and modernize the power plant	115,000,000	18,807,200	133,807,200
Component II - Support for management, protection of the property, gender equity, and institutional capacity	8,100,000	1,203,120	9,303,120
Administration, monitoring, and evaluation	1,900,000	190,000	2,090,000
Total	125,000,000	20,200,320	145,200,320

C. Key outcome indicators

- 1.23 **Expected outcomes.** The program is expected to: (i) extend the useful life of the CHA; (ii) enhance its availability and reliability; (iii) boost its installed generation capacity; and (iv) ensure the complete registration of all visitors to the premises. The operation will also make electricity service more sustainable, while ensuring continuity and increasing renewable energy generation. This will help avoid CO₂ emissions and support regional energy integration by continuing renewable energy exports from Paraguay. Additionally, through specific actions, the program is expected to improve gender equity in ANDE (see Results Matrix).
- 1.24 **Beneficiaries.** The program's beneficiary population will be ANDE's customers nationwide who are connected to the National Interconnected System.²⁹ ANDE will also benefit through the technical training that its staff will receive, especially on rehabilitating hydroelectric power plants and operating a power plant with modern technology, including all of the digital-interface controls, monitoring systems, instrument panels, and management tools.
- 1.25 **Technical viability of the program.** The Component I works were established through a [comprehensive technical assessment of the CHA](#), following international criteria on the subject. The planned interventions are standard for the industry and include equipment design and engineering (turbines, generators, and transformers), as well as assembling and implementing it, and replacing and repairing the remaining equipment covered by a rehabilitation and modernization program.
- 1.26 For Component II, the project team conducted a [technical preliminary design evaluation](#) for measures to enhance the security and protection of the Acaray dam and its premises and better utilize the available areas surrounding the power plant (paragraph 1.8). These measures are not technically complex; they are mostly simple construction works, such as improving vehicle access; installing lighting systems, security cameras and alarms; and building visitor facilities at the plant.
- 1.27 **Economic and financial evaluation.** For the economic evaluation, the procurement costs of supplies and labor were calculated using market costs minus taxes and converted to social prices through their respective correction factors.³⁰

²⁹ ANDE has 1,355,217 customers throughout the country. [ANDE 2017 Annual Report](#).

³⁰ The following were used: the "Social Price Calculation for Labor in Paraguay" and the "Social Price Calculation for Currency" prepared by the Ministry of Finance (2017), discounted at the Country Social Discount Rate of 9%.

- 1.28 The [economic evaluation](#) was performed through a cost-benefit analysis by comparing: (i) the investment required to maintain and boost the available power capacity of and amount of energy produced by the CHA;³¹ and (ii) the cost of acquiring the quantity of energy and the power the CHA would stop producing if the program were not executed. In addition to these savings for ANDE, another benefit considered was the lower operation and maintenance costs from incorporating more-efficient modern equipment. Without this rehabilitation and modernization investment, the power plant's production would fall steadily because its equipment would become increasingly unavailable. This would increase the costs incurred by ANDE to purchase energy needed to meet demand.³² According to the evaluation, Groups 1 and 2 (Power House I) would have a high likelihood of failure (85%) by 2023 and 2025, respectively; these groups would stop operating or have greatly reduced operational availability without the rehabilitation investment. For Groups 3 and 4 (Power House II), given that work is currently being done on the generators (not the turbines since ANDE worked on these in 1999) (paragraph 1.7), the initial availability considered was 85%, declining over time. As part of the program, these groups would be provided with modern operational equipment and auxiliary systems to enhance their availability; no action would be taken for the turbines. In order to have a conservative assessment, other potential benefits were not considered, such as the possible incorporation of nonconventional intermittent renewable energy in the future, with the CHA being the only exclusively Paraguayan power plant that could regulate the intermittence of these sources. The evaluation also did not consider the global social benefits resulting from the reduction in greenhouse gases.
- 1.29 Under these conservative assumptions for the economic evaluation, the economic internal rate of return (EIRR) was 15.8%, with a net present value of US\$27.3 million, considering a discount rate of 12%. Sensitivity scenarios were developed by considering an increase in investment costs (20%) and a potential delay in works (1 year), as well as a lower purchase cost for contracted power.³³ In all cases, the EIRR was over 12%.
- 1.30 For the [financial evaluation](#), market costs were used, with a discount rate equal to ANDE's cost of capital³⁴ of 7.37%. This evaluation resulted in a net present value of US\$98.4 million and an EIRR of 32.7%. The evaluations showed that the program will be beneficial for society as a whole and for ANDE from an operational and financial standpoint.

³¹ Groups 1 and 2 increase their capacity (from 47 MW x 2 to 56 MW x 2) and Groups 3 and 4 remain at 60 MW x 2.

³² To determine the cost of power and energy, the current price of contracted power from Itaipú was used as a reference. Over the medium and long term, the reference was a firm power price of US\$60/MWh with the associated energy, which is the projected medium- and long-term cost in Brazil. Taking into account growth in demand, the evaluation showed that in 2030, Paraguay could be consuming its entire share of energy from the Itaipú and Yacyretá binational plants. This means that as of that year, the country would have to opt for new sources of power generation at home or else import energy from neighboring countries. The price considered for the base case is conservative, as any other option would result in higher values.

³³ The Itaipú Treaty with Brazil is expected to be negotiated by 2023, which could modify the current purchase arrangement for the plant (US\$22/kW/month for power, which is equivalent to US\$43/kWh of energy). A sensitivity analysis was performed maintaining the current power price through 2030, when Paraguay will need other energy sources beyond Itaipú and Yacyretá. The analysis did not consider the Yacyretá purchase price given the modality and conditions of the plant's transactions, which are not firm power contracts.

³⁴ Report on ANDE's Weighted Average Cost of Capital at the close of 2017.

- 1.31 **Financial sustainability analysis.** A [financial sustainability analysis of ANDE](#) was performed, which included financial projections for the program execution period (2019-2026). At December 2017, ANDE had annual receipts equivalent to US\$852.1 million, which would rise to US\$1,265,900,000 in 2026. Based on these projections, ANDE has adequate financial capacity to execute the planned investments over the period, both with external financing and its own funds, and to fulfill the obligations it contracts for those purposes, while maintaining sufficient cash flow.

II. FINANCING STRUCTURE AND MAIN RISKS

A. Financing instruments

- 2.1 The program will be financed with a specific investment loan of US\$125 million from the Bank's Ordinary Capital under the Flexible Financing Facility (document FN-655-1) to support a CHA short-term investment plan and will have a sovereign guarantee from the Republic of Paraguay for the borrower's financial obligations. Additionally, the program includes a counterpart contribution of US\$20.2 million from ANDE. The disbursement period is six years.

Table 2. Disbursement projection*

Item	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Total
IDB Ordinary Capital (US\$ millions)	3.88	26.29	33.86	29.22	23.98	7.77	125.00
% IDB Ordinary Capital	3.1%	21.0%	27.1%	23.4%	19.2%	6.2%	100.0%
Counterpart (US\$ millions)	0.39	4.00	5.74	4.87	3.99	1.21	20.20
% counterpart	1.9%	19.8%	28.4%	24.1%	19.8%	6.0%	100.0%
Total	4.26	30.29	39.61	34.08	27.98	8.99	145.20
% Total	2.9%	20.9%	27.3%	23.5%	19.3%	6.2%	100.0%

* Annual amounts may not match the totals due to rounding.

B. Environmental and social risks

- 2.2 In accordance with the Environment and Safeguards Compliance Policy (Operational Policy OP-703), this has been classified as a Category "B" operation. The environmental and social impacts of program interventions are expected to be limited and easily mitigable, as they are associated with the replacement of equipment and repairs to existing infrastructure on ANDE property and do not include significant works or new access roads.³⁵ There are no indigenous communities in the project's area of influence, so no relocation is required, and the reservoir's water level will not be altered.³⁶
- 2.3 The potential impacts and risks of activities are related to: (i) noise during equipment installation; (ii) soil and water contamination due to potential spills of liquid waste like oils and gasoline; (iii) occupational health and safety accidents connected to the handling, transport, and installation of equipment; (iv) solid waste generation,

³⁵ The construction of visitor facilities will involve minor works that are part of the measures to enhance the security of the power plant and the premises.

³⁶ The CHA has only recently been granted an environmental license (December 2017) since the environmental authority and regulations were created after the power plant was built.

- including asbestos and polychlorinated biphenyls that could be found when disassembling the transformers' stator winding bars.
- 2.4 Although the operation's activities do not in themselves increase vulnerability to the risk of natural disasters, the risk is moderate, since the age of the existing infrastructure could increase the vulnerability of CHA workers and populations downstream. The interventions, in turn, will improve the safety of the hydropower complex.
- 2.5 To mitigate these impacts and risks, program preparation included an environmental and social analysis that created environmental and social mitigation programs for waste management and occupational health and safety. Dam safety studies were also performed following international best practices.³⁷ To that end, a safety analysis of the two dams (Yguazú and Acaray) was prepared, together with a supervision plan for CHA work, a plan to update operation and maintenance procedures, a CHA instrumentation improvement plan, and analysis of gaps in the existing resolution describing emergency measures at both dams³⁸ (see Table 3.)
- 2.6 Two consultations were held beforehand in accordance with Bank policies³⁹—one in Ciudad del Este (22 persons participated, of whom 18% were women) and the other in Asunción (30 people participated, of whom 50% were women). The two public meetings had the participation of individuals with activities in the project's direct and indirect area of influence, neighborhood and productive sector entities, as well as representatives of public institutions and local civic organizations. Participants in the two consultations were in favor of the project and the proposed mitigation measures. The results of the consultations were incorporated into the environmental and social analysis and published (see [published environmental documents for PR-L1156](#)). It should be noted that the program's planned investment will support comprehensive improvement to the safety of the hydroelectric complex and the population downstream from the dams.

Table 3. Identification of social and environmental risks

Risk	Risk classification	Mitigation measure
The program does not comply with environmental and social safeguards.	Medium	Creation of the Environmental and Social Management Framework and its incorporation as part of the program Operating Regulations.
The volume of the materials, equipment, and waste and the risks associated with them cannot be appropriately managed by the current environmental management system.	High	Waste management performed as described in the Environmental and Social Action Plan.
The program does not have an emergency action plan.	High	Preparation of the emergency action plan.

³⁷ The World Bank's Dam Safety Policy was used as a reference.

³⁸ Through [Resolution 3819](#) of 25 November 2016, the Emergency Operations Plan for ANDE's Facilities and Property entered into force. It will serve as a foundation for the preparation of an emergency action plan for the Yguazú dam and the Acaray dam and power plant.

³⁹ In accordance with the Access to Information Policy (OP-102) both the preliminary and final versions of the environmental and social analysis were published.

C. Fiduciary risks

- 2.7 The program will be executed by ANDE using its organizational structure and fiduciary management systems. During the preparation phase, ANDE's institutional and fiduciary capacity was analyzed using the Institutional Capacity Assessment System. This analysis reported satisfactory development and a low risk level for program execution. A risk workshop was also held, which identified the fiduciary risks listed in Table 4.
- 2.8 With regard to the organizational and fiduciary structure, a Program Management Unit (PMU) will be created under ANDE's Technical Office for coordination, execution, and monitoring of the program's technical aspects. Nevertheless, to ensure proper execution, training workshops on the Bank's procurement and financial management policies are planned.

Table 4. Identification of fiduciary risks

Risk	Risk classification	Mitigation measure
Accounting and financial system to record transactions is inadequate.	Medium	Purchase a financial computer system.
Noncompliance with programming and deadlines for the execution of the procurement plan.	Medium	Hiring consultants.
International competitive bids declared void and/or procurement delayed.	Medium	Support for the project team to prepare bid specifications and monitor the bidding process. Public hearings held prior to bids; consider using the by-invitation modality. Training workshops on the limited international bidding modality.

D. Other risks

- 2.9 A potential risk in the Component I works is the executing agency's limited institutional capacity to monitor power generation contracts, since it has not executed power generation investment projects in recent years. This risk will be mitigated by engaging a supervisory firm and consultants with extensive international experience.

Table 5. Identification of other risks

Risk type	Risk	Risk classification	Mitigation measure
Public management and governance	Delay in the approval of the loan by the Congress of Paraguay.	Medium	IDB and ANDE political and institutional actions.
	Change in government policy on the energy sector.	Medium	Change in government policy on the energy sector.
	Inadequate institutional capacity of the executing agency.	Medium	Visit facilities where similar work was done.

III. IMPLEMENTATION AND MANAGEMENT PLAN

A. Summary of implementation arrangements

- 3.1 **Execution mechanism and implementation arrangement.** ANDE is the borrower and executing agency. The Republic of Paraguay will be the guarantor of the borrower's financial obligations (including the payment of principal, interest, and all other fees) resulting from the loan contract and will not cover either the borrower's obligations to perform or the local counterpart contributions. ANDE will be responsible for proper compliance with the administrative, fiduciary, procurement, financial, accounting, social, and environmental aspects of the loan contract. ANDE's Planning and Research Office, acting as PCU, will be responsible for overall program coordination. The PCU will also be responsible for the administrative and operational management of the program, which includes: (i) coordinating the procurement of works, goods, and services; (ii) requesting loan disbursements; (iii) drafting the annual work plans and the procurement plan, among other documents; (iv) submitting semiannual program management reports; and (v) acting as an interlocutor with the Bank. The PCU will be supported by existing departments in ANDE, which will be responsible for performing all procurement processes throughout the original disbursement period and any extensions thereto. The Bank will train the members of ANDE on current procurement policies, procedures, and documents before the program begins.
- 3.2 The PMU will be created under ANDE's Technical Office for technical supervision and execution of program activities. The PMU can administer the contracts for program works and services. In coordination with ANDE's Environmental Management Division, it will verify fulfillment of all the social and environmental conditions specified in the Environmental and Social Management Plan and the Environmental and Social Management Framework. The PMU is to have a core team with at least a civil engineer, an electromechanical engineer, an electrical engineer, an environmental and social specialist, and a specialist from the occupational health and safety management system. **The creation of the PMU under ANDE's Technical Office and the appointment of its key staff will be a special contractual condition precedent to the first disbursement of the loan.** This condition serves to assure the Bank that ANDE will be prepared with a suitable team to begin executing the program.
- 3.3 **Partial exception to the policy on guarantees required from the borrower (document GP-104-2).** A partial exception to the policy on guarantees required from the borrower (document GP-104-2) is requested, so that the sovereign guarantee of the Republic of Paraguay be applicable only to the borrower's financial obligations (including payments of principal, interest, and fees) and not to its obligations to perform or the local counterpart contributions. This request is justified because the Government of Paraguay has stated that it can only guarantee the borrower's monetary obligations associated with the repayment of the loan. It should be noted

that ANDE is a solvent entity with the financial and management capacity to fulfill the obligations it will undertake to the Bank.⁴⁰

- 3.4 **Program Operating Regulations.** Program execution will be governed by the provisions established in the loan contract, as well as the [program Operating Regulations](#), which will include the following: (i) procedures for procuring works, goods, and consulting services; (ii) guidelines for the use of resources and the financial management of the program; (iii) disbursement procedures; (iv) a detailed description of program activities and monitoring and supervision; (v) the structure of the PMU, a description of the roles of key staff, and linkages and mechanisms for coordination with other ANDE units; and (vi) a section on the Environmental and Social Management Framework. **The approval and entry into the force of the program Operating Regulations, under the terms previously agreed upon with the Bank, will be a special contractual condition precedent to the first disbursement of the loan.** This condition is required to ensure proper execution of the program, bearing in mind that the Bank's experience in the region shows that having the program Operating Regulations approved prior to the first disbursement assists the executing agency with its internal organizational structure for program implementation.
- 3.5 **Operation and maintenance.** Upon completion of the program, ANDE will: (i) ensure that the program's works and equipment are adequately maintained based on generally accepted technical standards; and (ii) submit an annual maintenance report to the Bank on the state of the program's works and equipment during the first quarter of each calendar year through the fifth year after the end of the disbursement period. For adequate operation and maintenance, ANDE staff will receive ongoing training in these areas during program execution.
- 3.6 **Procurement policies.** Goods, works, and services will be procured in accordance with the Policies for the Procurement of Works and Goods Financed by the Inter-American Development Bank (document GN-2349-9), and consultants financed by the Bank will be selected in accordance with the Policies for the Selection and Contracting of Consultants Financed by the Inter-American Development Bank (document GN-2350-9). The electronic reverse auction and competitive bidding subsystems of Paraguay's Public Procurement System will be used for the operation in accordance with the terms specified in Annex III. The [procurement plan](#) provides detailed information on program procurement.
- 3.7 **Beginning of the selection process.** Once the loan contract is signed, the executing agency will begin the selection and procurement process, following the Bank's procurement policies, for engineering and supervision services to rehabilitate and modernize the Acaray and Yguazú complex. This will be conducted under the

⁴⁰ Source: Abogacía del Tesoro [Treasury Legal Department] within the Ministry of Finance based on Law 1,535 on the Financial Administration of the State. The counterparts in Paraguay have stated that the obligations to perform associated with the execution of the loan fall outside the legal mandate of the authorities of the Government of Paraguay. According to Law 966 (expanded by Law 976), Article 2, ANDE is an autarkic, decentralized institution within the public administration system, created for an unlimited period of time, that has legal status and its own budget; therefore, a total guarantee from the Republic of Paraguay (covering ANDE's obligations to perform and local contribution) would be contrary to such autonomy and decentralization. It should be noted that the Bank's Board of Executive Directors has authorized partial exceptions of the same scope to the abovementioned policy in other operations, such as loans 2236/OC-BR (2010), 3866/OC-BR (2017), 3271/OC-ES (2014), 4439/OC-CO (2017), and 4568/GN-PR (2018).

ad-referendum modality and with ex ante supervision by the IDB. The engineering and supervision services contract may not be awarded until the loan contract has reached eligibility.

- 3.8 **Audit.** Throughout the program's disbursement period, ANDE will submit its annual audited financial statements to the Bank within 120 days after the close of the respective fiscal year. The audit will be performed by an independent audit firm acceptable to the Bank, which will be selected in accordance with IDB policies and procedures. The scope and other related aspects of the audit will be determined as established in the Financial Management Guidelines for IDB-financed Projects (document OP-273-6) and the Guidelines for the Preparation of Financial Statements and External Audits. Audit costs will be financed with the loan proceeds.

B. Summary of arrangements for monitoring results

- 3.9 The monitoring arrangement consists of administration missions, six-monthly progress reports, and annual external audits. ANDE, acting through the PMU, will track the program through the Results Matrix targets and the [annual work plan](#), which will be updated yearly. The [multiyear execution plan](#) will describe the progress of activities and provide the execution schedule through the end of the disbursement period. ANDE, acting through the PMU, will also be responsible for preparing six-monthly reports and submitting them in March and September each year, and holding meetings with the Bank to assess the program's progress. The Bank, acting through its Energy Division, will supervise program execution. The monitoring arrangement is explained in detail in the [monitoring and evaluation plan](#).
- 3.10 **Evaluation.** ANDE will submit a midterm evaluation report to the Bank 60 days after the date on which 50% of the loan proceeds have been disbursed, if so required by the Bank, and a final evaluation report 90 days after the date on which 90% of the loan proceeds have been disbursed. Both reports will be financed with the loan proceeds. The terms of reference for these reports will require the prior no objection from the Bank. These reports will describe: (i) the progress made on reaching the Results Matrix targets; (ii) the degree of compliance with environmental requirements and specifications for the works, as established in the respective environmental and social management plans and in accordance with the guidelines of the program's [Environmental and Social Management Report](#); (iii) the extent to which the obligations established in the loan contract have been fulfilled; (iv) the effectiveness of the monitoring and evaluation system; and (v) the lessons learned. At the end of the program, a project completion report will be prepared to assess whether the program's objectives were achieved and capture the lessons learned that would be applicable to future projects.
- 3.11 **Ex post evaluation.** ANDE will perform an ex post cost-benefit analysis considering up-to-date information on: (i) the costs of infrastructure financed by the program; (ii) the power generation dispatched from the CHA; and (iii) the increase in the plant's availability. This evaluation will be submitted to the Bank 90 days after the end of the disbursement period or any extensions thereto and will be financed with the loan proceeds.

Development Effectiveness Matrix		
Summary		PR-L1156
I. Corporate and Country Priorities		
1. IDB Development Objectives	Yes	
Development Challenges & Cross-cutting Themes	-Productivity and Innovation -Economic Integration -Gender Equality and Diversity -Climate Change and Environmental Sustainability -Institutional Capacity and the Rule of Law	
Country Development Results Indicators	-Reduction of emissions with support of IDBG financing (annual million tons CO2 e)* -Installed power generation from renewable energy sources (%)* -Government agencies benefited by projects that strengthen technological and managerial tools to improve public service delivery (#)*	
2. Country Development Objectives	Yes	
Country Strategy Results Matrix	GN-2769	Promote the sustainability of the electricity supply service for the population and for the productive sector
Country Program Results Matrix	GN-2915-2	The intervention is included in the 2018 Operational Program.
Relevance of this project to country development challenges (If not aligned to country strategy or country program)		
II. Development Outcomes - Evaluability		
3. Evidence-based Assessment & Solution		8.5
3.1 Program Diagnosis		3.0
3.2 Proposed Interventions or Solutions		4.0
3.3 Results Matrix Quality		1.5
4. Ex ante Economic Analysis		10.0
4.1 Program has an ERR/NPV, or key outcomes identified for CEA		3.0
4.2 Identified and Quantified Benefits and Costs		3.0
4.3 Reasonable Assumptions		1.0
4.4 Sensitivity Analysis		2.0
4.5 Consistency with results matrix		1.0
5. Monitoring and Evaluation		8.5
5.1 Monitoring Mechanisms		2.5
5.2 Evaluation Plan		6.0
III. Risks & Mitigation Monitoring Matrix		
Overall risks rate = magnitude of risks*likelihood		Low
Identified risks have been rated for magnitude and likelihood		Yes
Mitigation measures have been identified for major risks		Yes
Mitigation measures have indicators for tracking their implementation		Yes
Environmental & social risk classification		B
IV. IDB's Role - Additionality		
The project relies on the use of country systems		
Fiduciary (VPC/FMP Criteria)	Yes	Financial Management: Budget, Treasury, Accounting and Reporting, External Control, Internal Audit.
Non-Fiduciary	Yes	Monitoring and Evaluation National System.
The IDB's involvement promotes additional improvements of the intended beneficiaries and/or public sector entity in the following dimensions:		
Additional (to project preparation) technical assistance was provided to the public sector entity prior to approval to increase the likelihood of success of the project		

Note: (*) Indicates contribution to the corresponding CRF's Country Development Results Indicator.

The objective of the program is the rehabilitation and modernization of the Acaray Hydroelectric Plant (CHA) to achieve: (i) the extension of its useful life; (ii) improve its availability and reliability; and (iii) increase its generation capacity. The diagnosis of the current situation of the CHA is supported by evidence and highlights the decline in the availability and reliability of the plant, as well as the opportunity to incorporate new technologies and management systems.

The results matrix does not include appropriate outcome indicators associated with component II, which affects its vertical logic. Some product and results indicators for component II do not meet SMART criteria.

The economic evaluation was carried out through cost benefit analysis comparing: (i) the investments necessary to maintain and increase the capacity of the available power and the energy produced by the CHA; and (ii) the cost of acquiring the amounts of energy and power that the CHA would not produce if the program were not executed. In addition, the reduction of O&M costs as a result of the incorporation of more efficient modern equipment was considered a benefit. The sensitivity analysis carried out indicates that the economic viability of the program is maintained with an ERR of more than 12% considering an increase in investment costs (10%) and the potential delay of the works (1 year), as well as a lower cost in the purchase of contracted power.

The Monitoring Plan complies with the requirements of the DEM. The proposed evaluation consists of an ex-post Cost Benefit analysis.

RESULTS MATRIX

Project objective:	The program's general objective is to help modernize Paraguay's electricity sector by financing investment to rehabilitate the National Electricity Administration's (ANDE) electricity infrastructure. The specific objective is to assist ANDE in rehabilitating and modernizing the Acaray Hydroelectric Power Plant (CHA) in order to: (i) extend its useful life; (ii) enhance its availability and reliability; and (iii) boost its generation capacity.
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EXPECTED IMPACT

Indicators	Unit of measure	Baseline	Baseline year	Final target	Final target year	Means of verification	Comments ²
IMPACT 1: Enhanced sustainability of the country's electricity service							
IM.1 Average annual renewable energy from Acaray	GWh/year	947	2017	980	2025	ANDE Statistical Summary	The baseline was determined using historical operational data from the CHA spanning a 10-year period. The final target was determined by considering the increase in the CHA's efficiency and availability as a result of the program.
IM.2 Total CO ₂ emissions avoided	Ton CO ₂ /year	0	2017	48,700	2025	ANDE Statistical Summary (+ emissions factor)	The amount of CO ₂ emissions avoided was determined by estimating the reduction in thermal generation in the combined cycle power plants of the interconnected system of Paraguay, Brazil, and Argentina made possible by the larger volume of renewable energy generated by the CHA as a result of the program.
IMPACT 2: Renewable energy exports maintained							
IM.3 ANDE energy exports	GWh/year	73	2017	115	2025	ANDE Statistical Summary	Exports do not depend solely on available generation capacity, but also on other factors, such as need, price, and agreements. This means that an increase in generation capacity does not necessarily translate into an increase in energy exports. For that reason, the target value was estimated at 115 GWh/year, the average export amount over the last five years.

EXPECTED OUTCOMES

Indicators	Unit of measure	Baseline	Baseline year	Final target	Final target year	Means of verification	Comments ²
Outcome 1: Extension of the power plant's useful life							
O.1 Theoretical useful life of Units 1 and 2, Power House I	Years	0	2017	30	2025	Final project evaluation	Includes the replacement of powertrain equipment: turbine, generator, and transformer.
Outcome 2: Enhanced availability and reliability of the CHA							
O.2.1 Availability of Units 1 and 2, Power House I	%	55%	2017	78%	2025	Acaray performance indicators report	The project's interventions impact availability, which is expected to reach 96% after at least one year has elapsed from the time that the last unit has been commissioned.
O.2.2 Forced unavailability rate of Units 1 and 2, Power House I	Failures/year	22	2017	7	2025	Acaray performance indicators report	N/A
Outcome 3: Increase in the nominal capacity of Power House I							
O.3 Nominal capacity of Power House I	MW	94	2017	114	2025	Acaray performance indicators report	N/A
Outcome 4: Number of visitors to the premises of the CHA							
O.4 Complete registration log of visitors to the premises	#	0	2017	1	2025	Entrance log	Currently, only the entrance of visitors to one part of the power plant is logged.

OUTPUTS

Outputs	Unit of measure	Baseline	Baseline year	2020	2021	2022	2023	2024	2025	Final target ¹	Means of verification	Comments ²
Component 1: Investment to rehabilitate and modernize the power plant												
Output 1 Engineering designs and supervision plans developed	#	0	2017	0	0	0	0	0	1	1	Final report on designs and basic engineering	N/A
Output 2 Hydro-electro-mechanical systems for the Acaray and Yguazú dams replaced and modernized	#	0	2017	0	0	0	0	0	1	1	Six-monthly progress report for the program	Includes spillway, intake, bulkhead, and bottom outlet gates for the Acaray and Yguazú dams
Output 3 Cranes and gantries obtained for the Acaray 1 and Acaray 2 power stations, and Acaray and Yguazú dams renovated	#	0	2017	0	0		2	5	0	7	Six-monthly progress report for the program	Includes 2 cranes in the Acaray power plant (Acaray 1 + 2), 2 at the Acaray dam, and 2 at the Yguazú dam
Output 4 Acaray power plant generation system replaced	#	0	2017	0	0	0	0	0	1	1	Six-monthly progress report for the program	Includes the rehabilitation of Acaray 1's two turbines, as well as 7 of its transformers and 2 of its generators.
Output 5 Low- and medium-voltage electrical systems replaced	#	0	2017	0	0	0	0	0	1	1	Six-monthly progress report for the program	Includes the systems for the Acaray and Yguazú dams and Power Houses I and II
Output 6 Digital comprehensive data collection and management system for the plant	#	0	2017	0	0	0	0	0	1	1	Six-monthly progress report for the program	Includes the expansion and installation of the SCADA system in Acaray 1 and 2 and the Acaray and Yguazú dams
Output 7 Existing CHA substation rehabilitated	#	0	2017	0	0	0	0	0	1	1	Six-monthly progress report for the program	Includes control gear and measurement equipment

Outputs	Unit of measure	Baseline	Baseline year	2020	2021	2022	2023	2024	2025	Final target ¹	Means of verification	Comments ²
Output 8 Dam security system implemented	#	0	2017	0	0	0	0	0	1	1	Six-monthly progress report for the program	Includes construction works for the security of the Acaray and Yguazú dams
Output 9 Infrastructure built for the interventions	#	0	2017	0	0	0	0	0	1	1	Six-monthly progress report for the program	Includes the construction of civil infrastructure to store equipment and house workshops throughout the rehabilitation and modernization of the power plant.
Output 10 CHA buildings rehabilitated	#	0	2017	0	0	0	0	0	1	1	Six-monthly progress report for the program	Includes the rehabilitation of the buildings of Power Houses I and II and the power plant's command post and administrative offices
Output 11 Acaray River Basin hydrometeorological network rehabilitated and expanded	#	0	2017	0	0	0	0	1	0	1	Six-monthly progress report for the program	N/A
Output 12 Environmental management and occupational health and safety plans for the Acaray-Yguazú complex implemented	#	0	2017	0	0	0	0	0	1	1	Six-monthly progress and program closure reports	Includes the drafting and implementation of the Emergency Action Plan
Component 2: Support for management, protection of the premises, gender equity, and institutional capacity												
Output 13 Civil works built to protect the premises, including the visitor center	#	0	2017	0	0	0	0	1	0	1	Six-monthly progress report for the program	Includes a package to install perimeter fencing, lighting, and other measures to protect the premises of the Acaray dam

Outputs	Unit of measure	Baseline	Baseline year	2020	2021	2022	2023	2024	2025	Final target ¹	Means of verification	Comments ²
Output 14 Management system for the plant's maintenance and operation implemented	#	0	2017	0	0	0	0	0	1	1	Six-monthly progress report for the program	Refers to the operation, maintenance, and protection system for ANDE's properties in the project area.
Output 15 Gender strategy designed and implemented in ANDE	Strategy	0	2017	0	0	0	0	0	1	1	Six-monthly progress report for the program	Includes the implementation in ANDE of a gender action plan and strategy
Output 16 Training workshops held for ANDE staff	#	0	2017	0	0	1	1	0	1	3	Workshop attendance lists	Permanent training system for staff involved in the Acaray rehabilitation program, including activities on ANDE's properties in the program's area of influence

FIDUCIARY AGREEMENTS AND REQUIREMENTS

Country: Paraguay

Project name: Rehabilitation and Modernization Program for the Acaray Hydroelectric Power Plant

Project number: PR-L1156

Executing agency: National Electricity Administration (ANDE)

Prepared by: Fernando Glasman, Bruno Candia, and Jorge Luis González (Fiduciary Specialists)

I. EXECUTIVE SUMMARY

- 1.1 The institutional assessment for the program's fiduciary management was performed by holding meetings with the Bank's fiduciary team and staff from ANDE's administrative, financial, and procurement divisions. It was supplemented with the findings of the institutional capacity assessment of ANDE. The Fiduciary Agreements were prepared on the basis of those assessments.

II. THE COUNTRY'S FIDUCIARY CONTEXT

- 2.1 In general, the country's financial management systems have a medium level of development. They need to be supplemented for execution of Bank-financed projects in the area of specific financial reports, which are produced using auxiliary accounting systems. The financial control tools, such as the Integrated Financial Management System (SIAF), the Accounting System (SICO), and other subsystems, allow executing agencies to manage payment transfers to suppliers through the Central Bank of Paraguay under acceptable terms. Their integration will make it possible in the future to produce the audited financial statements of a program or project through the SIAF. In the meantime, parallel systems are being used. External control is currently performed through private audit firms.
- 2.2 With regard to the National Public Procurement System, efficiency and transparency have improved significantly in recent years, as a result of the creation of a governing body, the National Public Procurement Office (DNCP). This entity has implemented a transactional platform for purchases via electronic procedures like electronic reverse auctions, as well as a system for suppliers and the Statistical Information System. Bank-financed operations have been employing the Public Procurement Information System and the country electronic reverse auction and competitive bidding subsystems for the amounts and categories established in the agreement for their use, signed by the Bank and Paraguay on 17 June 2014.

III. THE EXECUTING AGENCY'S FIDUCIARY CONTEXT

- 3.1 The executing agency will be ANDE which, through its Planning and Research Office serving as the Program Coordination Unit (PCU), will be responsible for overall coordination of the program. The Program Management Unit (PMU) will be created under its Technical Office for technical supervision and execution of program activities in coordination with the Finance Office, the Public Procurement Office, and the Planning and Research Office.
- 3.2 During program preparation, an institutional capacity assessment was performed on ANDE, which covered: programming and organizational capacity; execution capacity for programmed and organized activities, including personnel, goods and services, and financial management systems; and control capacity. According to the assessment, ANDE's technical competencies in fiduciary areas are solid overall. The consolidated findings of ANDE's capacities evaluated through the Institutional Capacity Assessment System (ICAS) present a satisfactory level of development.

IV. FIDUCIARY RISK EVALUATION AND MITIGATION ACTIONS

- 4.1 Based on the abovementioned evaluations, the focus should be on the following opportunities for improvement:
 - a. A financial and accounting information system should be implemented to record transactions and report information required by the Ministry of Finance, ANDE, and the IDB;
 - b. Profiles should be designed and developed for PMU positions;
 - c. Accounting and internal control should be strengthened through courses and training sessions to ensure compliance with the Bank's financial management policies.
 - d. Procurement should be strengthened to ensure compliance with the Bank's procurement policies and the adoption of international dissemination strategies for bidding process.
- 4.2 **Procurement management.** According to the ICAS evaluation report (September 2018), the overall findings on the executing agency indicate a low risk. The result of the specific execution capacity assessment, which involves the Goods and Services Administration System, is that there is a satisfactory level of development and a low level of risk. Nonetheless, as ANDE has yet to establish the PMU for operation PR-L1156, it will have to strengthen the new unit by incorporating staff with expertise in the policies of multilateral organizations and offering courses and workshops focused specifically on IDB procurement policies. Additionally, the following medium-level fiduciary risks have been identified in the Results Matrix: noncompliance with programming and deadlines for execution of the procurement plan, which will be mitigated by engaging consultants; and international competitive bids being declared void and/or delays in awarding contracts, to be mitigated through support from the project team in drafting bid specifications, monitoring the bidding process, holding public hearings prior to bids, and developing training workshops on the use of the limited international bidding

modality. This will require close monitoring of the planning process and specific advisory support on the procurement strategy.

- 4.3 **Financial management.** The following medium-level risk has been identified: The Planning and Research Office lacks an accounting and financial system to record transactions. This will be mitigated by purchasing an accounting and financial system.

V. CONSIDERATIONS FOR THE SPECIAL PROVISIONS OF CONTRACTS

- 5.1 The agreements and requirements to be included in the Special Provisions are as follows:
- a. For the purpose of Article 4.10 of the General Conditions, the parties agree that the applicable exchange rate will be the one specified in Article 4.10(b)(i). The agreed-on exchange rate will be the one in effect on the date on which the approval currency or disbursement currency is converted to the borrower's local currency. To determine the equivalence of expenses incurred in local currency and chargeable to the local contribution, the agreed-on exchange rate will be the one in effect at the time that ANDE or any other legal entity or individual that has been delegated the authority to incur expenses makes the respective payments to the contractor, provider, or beneficiary. To determine the equivalence of expense reimbursements chargeable to the loan proceeds, the agreed-on exchange rate will be the one in effect on the date of the reimbursement request.
 - b. The program's annual financial statements will be submitted 120 days after the close of the fiscal year, and the final financial statements will be submitted 120 days after the date of the last disbursement.

VI. FIDUCIARY AGREEMENTS AND REQUIREMENTS FOR PROCUREMENT EXECUTION

- 6.1 The procurement policies to be applied for this loan are set forth in documents GN-2349-9 and GN-2350-9. In addition, the Bank's Board of Executive Directors has approved the use of the electronic reverse auction and competitive bidding subsystems (document GN-2538-11) of Paraguay's Public Sector Procurement System (Law 2051/03). Use of other country systems approved subsequent to approval of this program will be applicable automatically, and this will be indicated in the procurement plan.
- A. Procurement execution**
- 6.2 **Procurement of works, goods, and nonconsulting services.** Contracts for works, goods, and nonconsulting services¹ subject to international competitive bidding (ICB) will be procured using the Bank's standard bidding documents. Bidding processes subject to national competitive bidding (NCB) will be conducted using the national bidding documents agreed upon with the Bank. The program's sector specialist will be responsible for reviewing the technical specifications for

¹ Policies for the Procurement of Goods and Works Financed by the IDB (document GN-2349-9), paragraph 1.1: Nonconsulting services are treated similarly to goods.

procurement during preparation of the selection processes. Initially, no selection processes involving single-source selection are planned.

- 6.3 **Selection and contracting of consultants.** Consulting services will be contracted using the standard request for proposals issued by or agreed upon with the Bank. The program's sector specialist will be responsible for reviewing the terms of reference for the procurement of consulting services.
- a. **Selection of individual consultants.** Pursuant to the Bank's procurement policies set forth in document GN-2350-9.
 - b. **Training.** Procurement workshops will be held.
 - c. **Use of country system.** Pursuant to document GN-2358-11 of October 2013, the use of the electronic reverse auction and competitive bidding subsystems of Paraguay's Public Sector Procurement System (SCSP) in IDB-financed operations will apply to:
 - (i) All contracts for goods and nonconsulting services eligible for use of the electronic reverse auction under the SCSP, for amounts below the threshold set by the Bank for use of the shopping method for off-the-shelf goods (for reference, US\$250,000).
 - (ii) All works contracts for amounts below the threshold set by the Bank for use of the shopping method for complex works (for reference, US\$250,000), and contracts for goods and nonconsulting services up to the threshold set by the Bank for use of the shopping method for complex goods and services (for reference, US\$50,000).
 - (iii) Contracts for amounts equal to or above the aforementioned thresholds will be governed by Bank policies (document GN-2349-9).
- 6.4 Section 1 of the Bank's policies (document GN-2349-9) will remain applicable to all contracts, regardless of the amount or procurement method. Any system or subsystem subsequently approved will be applicable to the operation. The procurement plan for the operation and its updates will indicate which contracts are to be executed using the approved country systems.²
- 6.5 **Beginning of the selection process.** Once the loan contract is signed, the executing agency will begin the selection and procurement process, pursuant to the Bank's procurement policies, for engineering and supervision services to rehabilitate and modernize the Acaray and Yguazú complex. This process will be conducted under the ad-referendum modality, with ex ante supervision by the IDB. The contract may not be awarded until the loan contract has reached eligibility.
- 6.6 **Domestic preference.** Not planned under this operation.

² If the Bank validates another system or subsystem, it will be applicable to the operation in accordance with the terms of the loan contract.

Table 1. Procurement processes to be applied according to the threshold

Type of procurement	Threshold (US\$000)	Method
Works	≥ 3,000	International competitive bidding (ICB)
	From 250 to 3,000	National competitive bidding (NCB) or shopping*
	< 250	Shopping or use of country systems (UCS)**
Goods and nonconsulting services	≥ 250	ICB
	From 50 to 250	NCB or shopping* or UCS***
	< 50	Shopping or UCS****
Consultancy – Consulting firm	≥ 200	Shortlist of six firms with extensive geographic representation (international and national advertising)
	< 200	Shortlist of six firms that may be national (national advertising)
Individual consulting service		3 CVs

* Shopping for works, goods, or off-the-shelf services.

** UCS for works considered complex when competitive bidding is used.

*** UCS for goods and nonconsulting services considered complex when electronic reverse auctions are used.

**** UCS for complex goods and nonconsulting services.

Table 2. Main procurement processes

Activity	Method	Process no.	Estimated amount (US\$)
Works			
Contracting of construction company for civil works in the Acaray Hydroelectric Power Plant (5 lots)	ICB	1	15,950,000
Goods			
Procurement of electromechanical equipment for the Acaray Hydroelectric Power Plant (8 lots)	ICB	3	85,030,000
Consulting firms			
Engineering and supervision consultancy for the rehabilitation and modernization of the Acaray and Yguazú complex	QCBS	4	12,650,000

Table 3. Procurement by category

Category	IDB financing (US\$)	Total amount (US\$)
Works	16,200,000	17,820,000
Goods	77,300,000	91,214,000
Consulting firms	16,560,000	18,216,000
Individual consultants	2,173,200	2,390,520
Procurement plan total	112,233,200	129,640,520

6.7 Procurement supervision. All procurement processes governed by the Bank's procurement policies (documents GN-2349-9 and GN-2350-9) will be subject to ex ante review by the Bank, bearing in mind the position of the Ministry of Finance on the matter. Supervision of all procurement processes governed by the SCSP

electronic reverse auction and competitive bidding subsystems (document GN-2538-11) will be performed using the country system.³

- 6.8 **Special provisions.** No special provisions are anticipated apart from those indicated in paragraph 5.1 of this annex.
- 6.9 **Records and files.** Program reports will be prepared and filed using the systems, formats, and procedures specified by, or agreed upon with, the Bank.

VII. FIDUCIARY AGREEMENTS AND REQUIREMENTS FOR FINANCIAL EXECUTION

A. Financial management

7.1 Programming and budget

- a. Program coordination and execution will be centralized in the ANDE's Planning and Research Office, which operates under the Finance Office. It will receive support from all other ANDE departments and offices, as necessary.
- b. Budget programming, administration, and execution, under the zero-based budgeting system, will be the responsibility of ANDE.

7.2 Accounting and information systems.

The country primarily employs modified cash basis accounting; however, accountability reporting for IDB-financed projects operates on a cash basis.

- a. **Information systems.** The Planning and Research Office will have access to the SIAF through the Finance Office. Country systems do not issue the reports required by the Bank, as they are prepared using different systems, so this office will be responsible for that additional task.
- b. **Disbursement and cash flow.** Program disbursement will normally be made through advances of funds, corroborated by the monthly submission of a detailed financial plan covering a six-month period, and another long-term plan, making it possible to determine the program's actual needs, as reflected in the multiyear execution plan, the annual work plan, and the procurement plan. The second and subsequent disbursements will require justification of at least 80% of the advance granted. The "direct payment to supplier" and "reimbursement of payments made" modalities will also be used, if so requested.
- c. **Exchange rate.** The exchange rate agreed upon with the executing agency for accountability reporting will be the monetization rate.
- d. **Internal control and internal audit.** ICAS finds that there is an advanced level of internal control.
- e. **External control and reports.** The executing agency will file annual reports on program audits, which are to be performed by a Bank-accepted independent audit entity, pursuant to the terms of reference previously approved by the Bank. Financial statements will include cash flow statements, a statement of cumulative investments, the notes to said financial statements,

³ Depending on the scope of use of the system, supervision may be supplemented with program audits, in which case mention must be made in the annex.

and a management (executing agency) representation letter. Audit reports will also include an evaluation of the internal control system.

- f. It will be necessary to select an eligible independent audit firm.
- g. External audit costs, estimated at US\$300,000 over six years of program execution, will be covered with the loan proceeds.
- h. **Financial supervision plan.** Financial supervision may be adjusted depending on the status of program execution and the findings of audit reports.

Table 4. Financial supervision plan

Nature/scope	Frequency
Ex post disbursement review	1 time per year
Financial audit and submission of financial statements	Annually
Review of disbursement requests and attached reports	2 to 3 times per year
Inspection visit / analysis of internal controls and control environment in the executing agency	Annually

- 7.3 **Execution mechanism.** As indicated in Section III.A of the loan proposal. ANDE is the borrower and executing agency. The Republic of Paraguay will be the guarantor of the borrower's financial obligations (including the payment of principal, interest, and all other fees) resulting from the loan contract and will not cover either the borrower's obligations to perform or the local counterpart contributions. ANDE will be responsible for proper compliance with the administrative, fiduciary, procurement, financial, accounting, social, and environmental aspects of the loan contract. ANDE's Planning and Research Office, acting as PCU, will be responsible for overall program coordination. The PCU will also be responsible for the administrative and operational management of the program.

DOCUMENT OF THE INTER-AMERICAN DEVELOPMENT BANK

PROPOSED RESOLUTION DE-___/18

Paraguay. Loan ____/OC-PR to the Administración Nacional de Electricidad (ANDE)
Rehabilitation and Modernization Program for the Acaray Hydroelectric Power Plant

The Board of Executive Directors

RESOLVES:

That the President of the Bank, or such representative as he shall designate, is authorized, in the name and on behalf of the Bank, to enter into such contract or contracts as may be necessary with the Administración Nacional de Electricidad (ANDE), as Borrower, and with the Republic of Paraguay, as Guarantor, for the purpose of granting the former a financing aimed at cooperating in the execution of the Rehabilitation and Modernization Program for the Acaray Hydroelectric Power Plant. Such financing will be for an amount of up to US\$125,000,000 from the Ordinary Capital resources of the Bank, and will be subject to the Financial Terms and Conditions and the Special Contractual Conditions of the Project Summary of the Loan Proposal.

(Adopted on ____ 2018)