Cover Page
for CTF Project/Program Approval Request[a]
Dedicated Private Sector Programs (DPSP-III)

1. **Country/Region**	Honduras	2. **CIF Project ID#**	XCTFHN709A
3. **Public or Private**	Public		✓
	Private		
4. **Project/Program Title**	Upgrade of the El Cajón Hydropower Plant to Facilitate the Integration of Renewable Energy		
5. **Is this a private sector program composed of sub-projects?**	Yes		
	No		✓

6. **Financial Products, Terms and Amounts**

Financial Product		**USD** (million)	**EUR** (million)[b]
Grant			
Fee on grant			
MPIS (for private sector only)			
Public sector loan	Harder terms		
	Softer terms	16.4	
Senior loan			
Senior loans in local currency hedged			
Subordinated debt / mezzanine instruments with income participation			
Second loss guarantees			
Equity			
Subordinated debt/mezzanine instruments with convertible features			
Convertible grants and contingent recovery grants			
Contingent recovery loans			
First loss guarantees			
Other (please specify)			
Total		16.4	

7. **Implementing MDB(s)**	Inter-American Development Bank (IDB)
8. **National Implementing Agency**	Empresa Nacional de Energía Eléctrica (ENEE)
9. **MDB Focal Point**	Claudio Alatorre (calatorre@iadb.org)

10. **Brief Description of Project/Program (including objectives and expected outcomes)**[c]

Among the actions aimed at reducing dependence on hydrocarbon imports, the Government of Honduras (GoH) has been promoting renewable electricity generation since 2007, mainly through the Law for the Promotion of Electricity Generation with Renewable Sources. These efforts led to a rapid growth in variable renewable electricity (VRE) capacity, placing Honduras as the non-island country with the largest share of photovoltaic solar energy in the generation mix worldwide. In year 2018, PV represented 19% of the national installed capacity and 10% of generation, and wind 8.4% of capacity and 9.4% of generation.[1] This high share of VRE represents a challenge for the electricity dispatch and for the provision of auxiliary services that are essential to maintain the quality and reliability of the service. It has thus become an important challenge for the operation of the national interconnected system and of the regional transmission network.

The Francisco Morazán Hydropower Plant (CHFM, also known as El Cajón) has played a key role in the growth in VRE generation. El Cajón is the largest hydropower plant of the country. In 2018 it provided 16.4% of the national electricity supply, and it is the main provider of essential auxiliary services such as the regulation of voltage, primary and secondary frequency and reserve margins.

For El Cajón, however, the provision of these services has implied a substantial increment of stops and starts of the generation units, a higher share of time operating at low loads, and the generation of more reactive power. Since El Cajón was not designed to perform this role, the high penetration of VRE has led in turn to (i) the accelerated wear and tear of key mechanical components, (ii) loss of efficiency (due to low load operation), (iii) reduction of winding insulation of stators (due to the increment of reactive power generation), and (iv) damage in discharge pipes (due to operation out of recommended limits).

Despite a complete overhaul[2] that was carried out between 2006 and 2012 and that was expected to extend its lifetime by at least 25 additional years, the hydropower plant has now reached a point where not only its system regulation role is severely impaired (leading to an increase in the curtailment of VRE generation), but further additions of VRE capacity in some regions have become impossible. It is necessary to upgrade the equipment for the automation and control of power generation and transmission and modernize the communication system to improve the efficiency of the power plant.

In this context of an exceptionally high penetration of VRE in Honduras, this operation seeks to restore and enhance the role of El Cajón as an effective grid flexibility asset, and also assess the possibility of making additional investments to increase its installed capacity, thereby enabling El Cajón to provide further system flexibility (the power plant currently houses four generation units with 75 MW Francis-type turbines, but was designed to house four additional units).

This will help Honduras to move from a system where hydropower provides baseload and fossil fuels provide the peak, to a system where VRE increasingly provides the baseload and

[1] According to the Global status report from REN21, now Honduras is one of the 10 countries with the largest share of electricity generation coming from variable renewable sources.

[2] The overhaul included: (i) improvements in the generators; (ii) general repairs, wiring and electrical equipment replacement in turbines and governors; (iii) improvements in the auxiliary systems; (iv) replacement of safety valves; (v) overhaul for the valve servomotors and (vi) capacity building.

hydro increasingly plays a flexible generation role. Whereas in other countries with high rates of VRE penetration the best technological solution to provide grid flexibility may be new storage systems such as batteries, in the case of Honduras the most effective path involves improving this existing flexibility asset.

In order to reach this objective, this project foresees the upgrade of El Cajón and the development of assessments and designs to evaluate the capacity increase of the plant. Three lines of action are proposed: (i) make upgrade investments in the generation equipment and in the substation to replace critical components that have suffered high wear, or do not have spare parts designed to work in the current VRE conditions, considering the configuration of the generation mix, and incorporating advanced innovative elements such as a Command, Control and Data Acquisition System (SCADA) demanded by the new electricity market to process real-time data, and state-of-the-art speed regulators; (ii) finalize the detailed engineering and environmental studies for the increase in generation capacity, in order to inform the decision-making process to install one or more generation units; and (iii) strengthen the capacities of the local staff at the existing and planned operational units of the power plant, such as watershed management, tourism and community work, implementing the corporate gender equity policy, and strengthening the operational financial, environmental and social management of El Cajón.

The expected results of the project are: (i) increase in the participation of renewable sources in the generation mix; (ii) improvement in the quality and reliability of the supply service; (iii) reduction of operation and maintenance costs; (iv) availability of information to determine the feasibility of expanding the capacity of El Cajón; (v) strengthened operational, financial, environmental and social management of El Cajón; (vi) implementation of the corporate gender policy for El Cajón; and (vii) strengthened tourism unit. The program will avoid GHG emissions due to the increase in the participation of VRE in the electricity mix, (in addition to a marginal increase in the generation of El Cajón).

This project will complement an IDB USD 162.5 million package (including USD 12.5 million of SREP resources), which constitutes the largest IDB infrastructure investment loan in Honduras and is aimed at addressing another hurdle for the development of renewable energy in Honduras, namely the bottlenecks in the transmission system that are currently leading to the curtailment of renewable energy generation. In addition, the IDB is co-financing with JICA a USD 167 million investment for the rehabilitation and refurbishment of the Cañaveral-Río Lindo hydropower complex, the second largest hydro facility in Honduras after El Cajón, built between the 60s and 70s.

11. **Consistency with CTF investment criteria**	
(1) Potential GHG emissions savings	The project will enable increasing RE generation through: • Increasing the generation of El Cajón by 3%. Considering an annual generation of 1,625 GWh, this involves an additional generation of 48.75 GWh. • Allowing the operation of a 10MW solar project, generating 17.52 GWh per year (0.2 plant factor). Total increase will be therefore 66.27 GWh per year. By considering an emission factor of 612.5tCO_2e/GWh, emission reductions would be 40,590tCO_2e/year, or 811,800 tCO_2e over a 20-year lifetime. This figure does not include the impact of the project in reducing the probability of malfunction in the turbines. Every time a turbine in El Cajón malfunctions, a similar capacity of solar and wind generation needs to be curtailed. In these cases, both hydro and VRE need to be substituted by fossil fuel-fired generation. This figure does not include either the impact of this operation on the contribution of renewable energy sources in the electricity mix of Honduras by keeping the average generation of the El Cajón and supporting the integration of renewable energy sources into the national interconnected system.
(2) Cost-effectiveness	This project has a cost-effectiveness of USD 22.17 per ton of CO_2e, considering only CTF resources.
(3) Demonstration potential at scale	Other countries in LAC are facing or will soon face similar conditions in terms of high VRE penetration, and the opportunity to make investments to turn existing hydropower plants into flexibility assets. The experience of El Cajón will help inform such efforts.
(4) Development impact	The project will have the following impacts: • Increase in the participation of renewable sources in the generation mix. • Improvement in the quality and reliability of the supply service. • Reduction of operation and maintenance costs. • Determination of the feasibility of expanding the capacity of El Cajón. • Strengthening of the operational, financial, environmental and social management of El Cajón. • Strengthening of the tourism unit with a focus on women's capabilities.

(5) Implementation potential	The IDB is currently executing different power investment projects with ENEE and has contributed to strengthen the capacity of the Project Management Unit (PMU) that is in charge of investment programs funded by IDB and JICA. The PMU is responsible for meeting IDB's fiduciary guidelines and coordinates with the technical, environmental and social, administrative and social teams from ENEE. The PMU has been executing since 2008 infrastructure programs mostly in transmission, but it is also executing the IBD – JICA co-financing program (USD 167 million) for the rehabilitation and uprating of Canaveral – Rio Lindo complex. The business unit of El Cajón includes a highly specialized administrative and engineering team (AET) that participated in the execution of major civil and electromechanical maintenance works that have been successfully implemented in the period 2006 – 2017. The integration of the PMU with the AET from El Cajón is expected to help reaching the expected results of the project. In addition, as part of the reform process of the power sector, which started in 2013, the IDB has supported the GoH with a series of three Programmatic Policy Based Loans and technical assistance. As a result of the reform process there are improvements in the institutional organization of the power sector including ENEE. There are still challenges for improving the financial sustainability of the power sector[3] and the government has prioritized a list of actions for business units such as El Cajón.

[3] The national power utility has an important contribution to the public deficit. The IMF – GoH agreement has defined a list of actions to improve the finances of the power sector including ENEE.

(6) Additional costs and risk premium	The concessionality provided by the CTF is critical to allow this transformational operation, considering (i) IDB's requirements for lending conditions to Honduras; (ii) the financial situation of ENEE; and (iii) the financial lending conditions in Honduras due to the standby agreement with the IMF. The IDB lending conditions for Honduras in the period 2019-2020 establish the need for a grant element of at least 55%. The financial situation of ENEE has been affected by the support that the public utility has provided to the development of renewable energy. First, it has taken the financial burden of the incentives offered by GoH to independent private producers. In addition, ENEE has been responsible for building all the new transmission infrastructure to integrate clean energy production into the national interconnected system. Due to its financial rating ENEE has not had the possibility of accessing financial resources with commercial terms and must resort to concessional financing with sovereign guarantee to develop new infrastructure. Finally, Honduras is under the IMF and GoH standby agreement and the approval of new loans is contingent on the availability of softer concessional conditions.
Additional CTF investment criteria for private sector projects/ programs	
(7) Financial sustainability	N/A
(8) Effective utilization of concessional finance	N/A
(9) Mitigation of market distortions	N/A
(10) Risks	N/A
12. **For DPSP projects/programs in non-CTF countries, explain consistency with FIP, PPCR, or SREP Investment Criteria and/or national energy policy and strategy**	
This operation is aligned with the SREP investment criteria of supporting the penetration of renewable energy in the grid. It is also complementary to SREP-funded operations.	

13. **Stakeholder Engagement**

Since 1986, when El Cajón entered into operation, ENEE has built a good relationship with the surrounding communities. It has helped with rural electrification and productivity projects but also with community development programs such as the successful fishing module which has become the second largest producer at national level of the community enterprise Aquafinca Saint Peter Fish.

The project under Component 3 has included activities to strengthen watershed management, tourism and community development. The watershed management unit is responsible for executing projects to guarantee water bodies that feed the reservoir, including forest conservation, reforestation, and implementation of environmentally sustainable practices from the community. The tourism unit has been responsible for showing the project to visitors including students from Honduran schools and universities. Tourists can also visit the hydropower project facilities a program with the surrounding communities that includes in the visitors' agenda excursions to surrounding communities has recently been started. Finally, ENEE wants to increase the implementation of productive activities with the communities that live around the reservoir so that they could diversify their income and improve their quality of life.

14. **Gender Considerations**

Component 3 of this operation involves the development of training courses, awareness-raising activities, and a mentoring program to promote women's participation in different work areas of the hydropower plant. It will also develop and implement the gender equity policy in this plant.

The project will also strengthen the capacities of the tourism department of El Cajón that is composed mainly by women and will incorporate this approach working with local communities through the promotion of economic activities related to tourism.

15. **For projects/programs with activities in countries assessed as being at moderate or high risk of debt distress, macro-economic analysis to evaluate the potential for the CTF project or program to impact the country's debt sustainability**

The Bank's policies into place (specifically its macroeconomic safeguard GN-2753-7) require conducting a comprehensive assessment of each borrower's macroeconomic situations and overall capacity to take on new debt.

16. **For public sector projects/programs, analysis of how the project/program facilitates private sector investment**

El Cajón provides to the national power system ancillary services such as voltage, primary and secondary frequency regulation and reserve margins. Without El Cajón the participation of IPPs that generate electricity based on non-conventional renewable energy would be reduced. In this context, the adequate operation of El Cajón enables private investment in RE.

17. **Indicators and Targets**

Project/Program Timeline	
Expected start date of implementation[d]	2021
Expected end date of implementation[d]	2026
Expected investment lifetime in years (for estimating lifetime targets)	20

Core Indicators		**Targets**[e]
GHG emissions reduced or avoided over lifetime (tons of CO_2-eq)		811,800
Annual GHG emissions reduced or avoided (tons of CO_2-eq/year) (specify: upon completion of the project/program / on the maximum year / on a representative year)	Upon completion	40,590
Installed capacity of renewable energy (MW)[4]		19
Number of additional passengers using low-carbon transport per day		N/A
Energy savings cumulative over lifetime of investment (MWh)		N/A
Annual energy savings (MWh/year) (specify: upon completion of the project/program / on the maximum year / on a representative year)		N/A
Identify relevant development impact indicator(s)		**Targets**
Reduced average cost of electricity.		To be confirmed once the new tariff system is implemented
Additional income in communities benefited for productivity projects		To be confirmed

18. **Co-financing**		
	Please specify as appropriate	Amount (in million USD)
IDB	This operation	1.6
IDB	HO-L1186[5]	2.5
Government	ENEE	18.83
Private Sector		
Bilateral		
Others (please specify)		
Total		22.93

19. **Expected Date of MDB Approval**
November 2020

NOTES:
[a] This cover page is to be completed and submitted together with the MDB project/program proposal when requesting CTF funding approval by the Trust Fund Committee.
[b] For products denominated in EUR, please also provide USD equivalent in the column to the left
[c] Please provide the information in the cover page or indicate page/section numbers in the accompanying project/program proposal where such information can be found.
[d] Insert "not applicable" (N/A) if dates cannot be determined at the time of submission (e.g. private sector programs)
[e] Insert value N/A if indicator is not applicable to the project/program.
Version March 2, 2018

[4] This includes the increase of 3% in the capacity of CHFM (namely 9MW), and the capacity of a solar plant (10MW) whose operation depends on this Project. This figure does not include the impact of the project in terms of reduced probability of RE curtailment.
[5] These resources (USD 2.5 million) are part of the IDB loan HO-L1186 National Transmission Program and target investments in transmission in El Cajón. These resources are considered as part of the contribution of ENEE in the project document.

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Acronyms and Abbreviations

AAS	*Análisis Ambiental y Social* (Environmental and Social Analysis)
AET	administrative and engineering team
CC	climate change
CHFM	*Central Hidroeléctrica Francisco Morazán* (Francisco Morazán Hydropower Plant) (also known as *El Cajón*)
CREE	*Comisión Reguladora de Energía Eléctrica* (Electricity Regulatory Commission)
CTF	Clean Technology Fund
ENEE	*Empresa Nacional de Energía Eléctrica* (National Electric Power Company)
GHG	Greenhouse gases
GoH	Government of Honduras
HNL	Honduran lempira (local currency)
LAC	Latin America and the Caribbean
MER	*Mercado Eléctrico Regional* (Regional Electricity Market)
MOP	Manual of Operations
NCRE	Non-Conventional Renewable Energy
OdS	*Operador del Sistema* (System Operator)
OPC	IDB's Operations Policy Committee
PA	*Plan de Adquisiciones* (Procurement Plan)
PAPTN	*Plan de la Alianza para la Prosperidad del Triángulo Norte* (Plan of the Alliance for the Prosperity of the Northern Triangle)
PEP	Project Execution Plan
PGAS	*Plan de Gestión Ambiental y Social* (Environmental and Social Management Plan)
PME	*Plan de Monitoreo y Evaluación* (Monitoring and Evaluation Plan)
PMU	Project Management Unit
POA	*Plan Operativo Anual* (Annual Operational Plan)
RE	renewable energy
SCADA	Supervisory Control and Data Acquisition
SEN	*Secretaría de Energía* (Ministry of Energy)
SREP	Scaling-up Renewable Energy in Low-income Countries Program
SIN	*Sistema Interconectado Nacional* (National Interconnected System)
VRE	variable renewable electricity

DOCUMENT OF THE INTER-AMERICAN DEVELOPMENT BANK

HONDURAS

UPGRADE OF THE EL CAJÓN HYDROPOWER PLANT TO FACILITATE THE INTEGRATION OF RENEWABLE ENERGY

Project Document

This document was prepared by: Carlos Jácome (ENE/CHO) Team Leader; Jorge Mercado (INE/ENE) Alternate Team Leader; Claudio Alatorre (CSD/CCS) Alternate Team Leader; Astrid Mejía (ENE/CHO); Robert Langstroth (VPS/ESG); María Cecilia del Puerto (FMP/CHO); Nadia Rauschert (FMP/CHO); Cecilia Correa and Jeanette Bonifaz (INE/ENE); Esteban de Dobrzynski (LEG/SGO).

PROJECT SUMMARY
HONDURAS
UPGRADE OF THE EL CAJÓN HYDROPOWER PLANT TO FACILITATE THE INTEGRATION OF RENEWABLE ENERGY
HO-L1203

Financial Terms and Conditions				
Borrower: Republic of Honduras	**Source**	**%**	**USD M**	**%**
	IDB (Regular OC)	35	0.56	1.4
Executing Agency: Empresa Nacional de Energía Eléctrica (ENEE) / ENEE *Holding*	**IDB (Concessional OC)**	65	1.04	2.6
	CTF		16.4	42.7
	ENEE		21.34	54.2
	Total		39.34	100.0

	Regular OC (FFF)	**Concessional OC**	**CTF**
Amortization Period	30 years	40 years	40 years
Disbursement Period:	5 years		
Grace Period:	5.5 years	40 years	10.5 years
Interest rate:	LIBOR based	0.25%	0.25%
MDB Administration Fee (single payment):			0.45%
Credit fee:	[b]	N/A	N/A
Inspection and supervision fee	[b]	N/A	N/A
Weighted average life:	15.25 years	N/A	N/A
Approval Currency	US Dollars		

Project at a Glance

Project Objective/Description: In the context of an exceptionally high penetration of VRE in Honduras, this operation seeks to restore and enhance the role of the Francisco Morazán Hydropower Plant (El Cajón) as an effective grid flexibility asset, and also assess the possibility of making additional investments to increase its installed capacity, thereby enabling El Cajón to provide further system flexibility (the power plant currently houses four generation units with 75 MW Francis-type turbines, but was designed to house four additional units).

Special Contractual Clauses prior to the first disbursement: (i) the Manual of Operations has been approved in the terms previously agreed with the Bank; (ii) the PCU keeps the minimum staff currently in charge of the execution of loans 3435/BL-HO, and reinforces it with the hiring of consultants as required in the MOP.

Exceptions to Bank Policies: None.

Strategic Alignment

Challenges[c]:	SI	☑	PI	☑	EI	☐
Cross-Cutting Themes[d]	GD	☑	CC	☑	IC	☐

[b] The credit and the Inspection and supervision fees will be periodically established by the Bank accordingly with the correspondent policies.

[c] SI (Social Inclusion and Equality); PI (Productivity and Innovation); and EI (Economic Integration).

[d] 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 and Justification

1.1 **The Honduran electricity sector** has been undergoing a reform process to improve its operational and financial sustainability. Among the main actions developed in the reform process, the development and implementation of legal and institutional arrangements for improvements in the sector should be highlighted. In compliance with the General Law of the Electricity Industry of July 2014, the governance of the sector relies on three institutions: (i) the Ministry of Energy (SEN) is responsible for strategic planning and formulation of energy policies (it is now operating normally); (ii) the Electricity Regulatory Commission (CREE) regulates, develops and implements regulations for the modernization of the sector and the development of the electricity market; and (iii) the System Operator (OdS) is responsible for guaranteeing the continuity and security of the electricity supply, the correct coordination of the generation and transmission system, and the review and approval of the transmission expansion plan. The unbundling of the National Electric Power Company (ENEE) in generation, transmission and distribution companies was also legalized and will allow allocating resources to each company, strengthening them financially and making investments to preserve their infrastructure and ensure their future operation. From the financial point of view, adjustments were made to the tariff scheme that have allowed to recover to a large extent the costs of the electricity industry chain. Cross-subsidies were eliminated, and direct targeted subsidies were introduced, focusing on the less favored socio-economic sectors. The main challenge that exists is in the reduction of electricity losses. Among the actions aimed at reducing dependence on imported hydrocarbons, the Government of Honduras (GoH) since 2007 promotes a process of diversification of the energy matrix that relies on the introduction of sources of variable renewable electricity (VRE) generation through the Law of Promotion of Electricity Generation with Renewable Resources. Thanks to this effort, the participation of Renewable Energy (RE) in the electricity mix in 2018 was 62%, as compared to 37% in 2007. There has also been an increase in the participation in the Regional Electricity Market (MER) in 2018, when 4% of the country's energy came from MER.

1.2 **Francisco Morazán Hydropower Plant (CHFM)**. The CHFM is located in the department of Cortés, 230 km from Tegucigalpa. It entered into operation in 1986 and has an installed capacity of 300 MW. Its generation amounted to 1,625 GWh in 2018. The original construction of the project consisted of the following works: (i) a 226 meter high double curved arch concrete dam; (ii) a reservoir with an area of 94 km² and with a multi-annual regulation capacity of 5,700 million cubic meters built for energy storage and flood control of the Humuya and Sumaco rivers; (iii) a dam-type machine house, where four Francis-type turbines of 75 MW each are currently installed. The plant was designed to install four additional generation units.

1.3 **National Electric Power Company (ENEE)**. ENEE is a public company that owns the transmission and distribution systems almost entirely, as well as 19% of the installed generation capacity. It is responsible for the operation of the National Interconnected System (SIN) and for the participation in the MER.

1.4 **Electricity generation in the country.** In 2018, the maximum power demand in the system was 1,602 Megawatts (MW) and the installed generation capacity amounted to 2,682 MW. ENEE has the largest hydropower plants in the country, with an installed capacity of 433 MW. It also owns some inefficient thermal power plants that supply energy to areas with supply problems, with a combined capacity of 65 MW. The private

sector has the largest participation in thermal generation with an installed capacity of 966 MW and in the generation of Non-Conventional Renewable Energy (NCRE) with an installed capacity of 1,225 MW. The private sector participates in the electricity market by selling energy in the long-term market with energy purchase contracts, as well as in the spot market. The energy supply in 2018 amounted to 9,177 GWh. ENEE contributed 21.6% of the energy of the SIN, mostly from hydropower plants. Private generation contributes 74.4% and MER 4%.

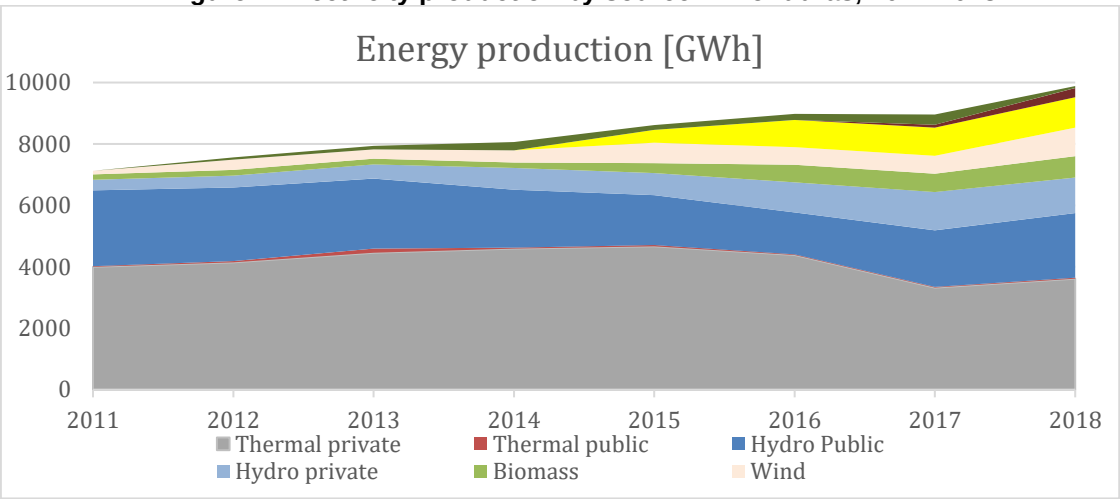
1.5 **The participation of Renewable Energy (ER)** in the generation mix increased significantly in recent years with the entry into operation of private VRE generation projects. In the last four years, 607 MW, corresponding to 125 MW of wind power and 482 MW of photovoltaic energy, were added to the renewable generation park. Honduras became the non-island country with the largest share of photovoltaic solar energy in the electricity mix worldwide.

1.6 **Importance of CHFM in the electrical system**. The CHFM contributes 16.4% of the energy generated in the SIN and is the hydropower plant with the greatest contribution to the system. In addition, it is the main regulator of voltage, primary and secondary frequency and reserve margins, essential auxiliary services to maintain the reliability of the network. The high participation of VRE represents a challenge in the operation of the SIN and in the regional transmission network, as well as in the dispatch of energy. The high participation of VRE alters the supply of auxiliary services that are essential to maintain the quality of the service. The increased variability in the SIN requires power plants with rapid response time. In Honduras, CHFM fulfills this service. Additionally, the CHFM has a fundamental role in the contribution of firm reserve margins, which would alternatively be covered by expensive and inefficient thermal power plants, with higher average generation costs.

1.7 **Carbon emissions minimized by operating CHFM for system regulation.** Although CHFM was originally designed to provide baseload power, the fact that it has a multi-annual reservoir makes it the ideal option to provide flexibility to the power system of Honduras. During the last years, there has been a significant increase in solar, wind and run-of-the-river hydro capacity, but no increase in thermal generation capacity. However, in the absence of CHFM the only alternative way to provide flexibility to the system would be to install more rapid response diesel (or gas) turbines, leading to an increase in GHG emissions. As Figure 1 shows, by having CHFM play this regulation role, the production of fossil-fuel-fired electricity has been reduced during the last years. The emission factor of Honduras has been reduced form 0.67 tons CO_2e/MWh before 2012 to 0.61 tons CO_2e/MWh in 2014.[6]

[6] The emission factor was registered in 2019 at UNFCCC. For more details please visit. https://cdm.unfccc.int/methodologies/standard_base/2015/sb136.html

Figure 1. Electricity production by source in Honduras, 2011-2018



Source: ENEE statistical reports.

1.8 **Status of the plant**. Despite a complete overhaul[7] that was carried out between 2006 and 2012 (before VRE started to provide an important contribution into the electricity energy mix) and that was expected to extend its lifetime by at least 25 additional years, the hydropower plant has now reached a point where not only its system regulation role is severely impaired (leading to an increase in the curtailment of VRE generation), but further additions of VRE capacity in some regions have become impossible. There are many elements of the plant, mainly those of automation and control, which have become obsolete, because they are not available in the market. This hinders the availability of parts and spare parts that are necessary to carry out repairs. Moreover, the current conditions of the control system do not allow communication with the national energy dispatch center, and therefore strategic information cannot be processed in real time, delaying decision making. Due to the age of the equipment and the wear and tear of mechanical and pneumatic elements of the generator groups due to the electrical system regulation services that this plant provides and that have been intensified by the entry of greater VRE into the network, some of these elements are susceptible to interruptions due to failures and require more extended maintenance and unplanned stops. The risk and impact of performing maintenance practices and leaving one or more generation units unavailable increases with the level of wear. Therefore, it is imperative to carry out a modernization project in order to have a more reliable operation. It is also necessary to assess the viability of increasing the capacity of CHFM.

1.9 **The role of the CHFM in response to VRE increase.** The role of CHFM has changed in four different ways.

1.10 **Substantial increment of stops and starts of the generation units of CHFM.** Figures 2 and 3 show the number of starts and stops of the CHFM turbines. Figure 2 shows a period in 2012 when there was no production of solar photovoltaic energy, while Figure 3 was determined for 2019, with a number of solar projects in operation. The increment in stop-start cycles leads to higher wear in the governing systems, to alternating mechanical stresses in the turbine speed regulator and spherical valves, and to the

[7] The overhaul included: (i) improvements in the generators; (ii) general repairs, wiring and electrical equipment replacement in turbines and governors; (iii) improvements in the auxiliary systems; (iv) replacement of safety valves; (v) overhaul for the valve servomotors and (vi) capacity building.

premature ageing of the generator and transformer insulation due to greater cooling and heating cycles. According to the information provided by the manufacturer of the generators, each start of the unit is equivalent to the ageing produced by 20 hours of operation. This additional wear leads to the need to replace these systems much before what was foreseen in the short and medium-term maintenance plan that was prepared when VRE was not in place. As Figure 3 shows, the number of events of starts and stops increased substantially due to the fact that CHFM has to guarantee the stability of the entire national power system in the country. Whenever there is a fluctuation of power produced by the solar or wind farms, the generation equipment of CHFM needs to change its operation mode in order to control the frequency and voltage of the system and compensate power balance fluctuations. The picture shows that there is an increment of events between 10:00 am and 4:00 pm, the period when there is a maximum production of electricity from PV systems.

Figure 2. Starts and stops of CHFM in a 3-month period in 2012

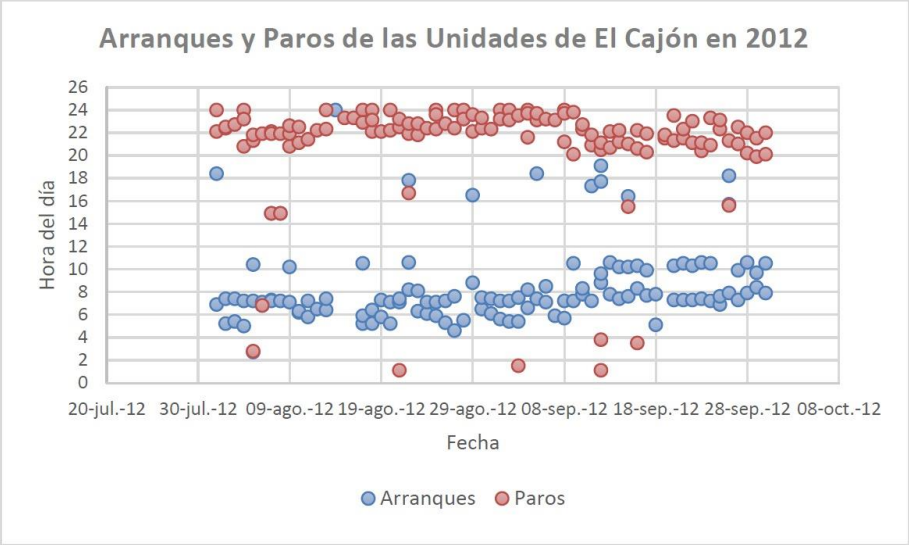
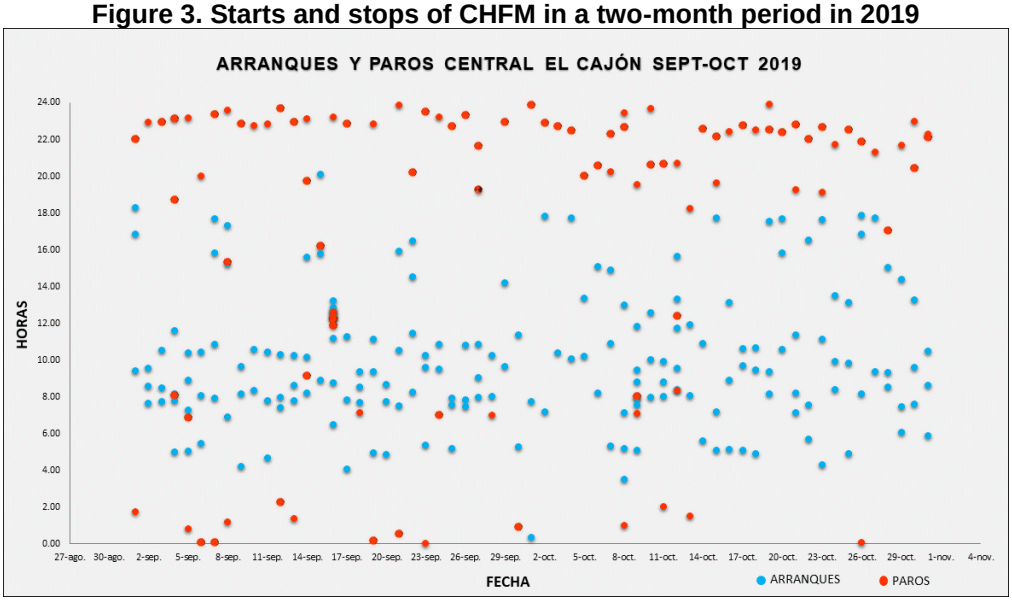


Figure 3. Starts and stops of CHFM in a two-month period in 2019



1.11 **Loss of efficiency due to low load operation rates**. Since CHFM needs to regulate the frequency of the system by means of automatic generation control (AGC), it must repeatedly leave the areas of maximum efficiency and move to areas of lower efficiency, with the consequent loss of water resources. This causes economic losses to ENEE that are proportional to the efficiency reduction.

1.12 **Reduction of winding insulation of stators due to the increment of reactive power generation.** The need to provide more reactive power to the system, in order to compensate for the lack of reactive power offered by VRE generators leads to an increase in generator warming, which in turns reduces the lifetime of the winding insulation.

1.13 **Damage in discharge pipes due to operation out of recommended limits.** Due to the fact the equipment sometimes operates in conditions that were not originally designed, cavitation appears and deteriorates the discharge pipes.

1.14 **Description of the CHFM upgrade project**. The CHFM is the most important generation plant in the country and it is necessary to ensure its continuous contribution in terms of energy, power and auxiliary services. This project foresees the upgrade of the CHFM and the development of studies to evaluate the viability of increasing the capacity of the plant. To develop the operation, three lines of action are proposed: (i) make upgrade investments in the generation equipment and in the substation to replace critical components that have suffered high wear, or do not have spare parts designed to work in the current conditions, considering the configuration of the generation mix, and incorporating innovative digitalization elements such as a Supervisory Control and Data Acquisition (SCADA) demanded by the new electricity market to process real-time data, and state-of-the-art speed regulators; (ii) finalize the detailed engineering and environmental studies for the increase in generation capacity, in order to inform the decision-making process to install one or more generation units; and (iii) strengthen the capacities of the local staff at the existing and planned operational units of the power plant, such as watershed management, tourism and community work, implementing the corporate gender equity policy, and strengthening the operational financial, environmental and social management of CHFM.

1.15 **Project execution strategy**: The experience of ENEE in the execution of IDB loans dates back to 40 years ago, when CHFM was built. During the last 15 years, the IDB has financed a number of transmission projects, as well as the very complex Rehabilitation and Repowering of the Canaveral-Río Lindo Complex (the second largest hydropower plant in Honduras). ENEE has since 2008 a Project Management Unit (PMU) that ensures that loans are executed in strict compliance with Bank policies and safeguards. The PMU performs fiduciary execution functions and ensures the coordination with the relevant ENEE teams on technical, environmental and social, and legal issues. In addition, ENEE has a multidisciplinary administrative and engineering team (AET) in CHFM, which has ensured the appropriate execution of civil and electromechanical works in the plant, such as the reduction of water leaks and the overhaul of the generation units in the period of 2006 to 2012 (specialized works with investments of over HNL 1,400 million). This AET would be involved in the execution of the proposed project.

1.16 From the point of view of the **environmental and social management** of the project, there is a good relationship between the CHFM staff and the neighboring communities, including the communities located in the margins of the reservoir. ENEE, with its own resources, as well as with other community relations and watershed management

programs, has promoted productive development activities, including a community enterprise for fisheries and other products that led to the creation of a company that is today the second largest tilapia export company in Honduras. The operation seeks to promote similar productive activities with the communities that are part of the direct influence area of the CHFM.

1.17 **Country strategy in the sector**. At the end of 2013, the GoH began a process of sector reform, adopting measures to ensure its financial sustainability, operational efficiency and sufficiency, and to reaffirm its commitment to boost Mesoamerican energy integration. The program is consistent with the Bank's Country Strategy 2019-2022 (GN-2944), as it supports the strategic objective of improving the efficiency, coverage, quality and sustainability of the electric service. The operation will increase the participation of renewable sources in the generation mix, improve the reliability of the system and contribute to the evacuation of energy from NCRE projects in operation. In addition, the Country Strategy defines climate change (CC) and disaster risk management as a cross-sectional area of application, focusing, for the case of the energy sector, on vulnerability reduction, adaptation and mitigation to CC in the design of viable systems, ER actions and improvement in the coverage of public services. The project will be aligned with the initiative of the Plan of the Alliance for the Prosperity of the Northern Triangle (PAPTN) to contribute to the revitalization of the productive sector through the diversification of the electricity mix.

1.18 **IDB experience in the sector.** The IDB has extensive knowledge of the Honduran electricity sector since 1980, when it co-financed the construction of the CHFM, which was considered the most important infrastructure financing in the country. The IDB has supported the GoH in the financing of strategic investments and technical support in transmission and distribution. The Bank is financing the Operation of Support for the Integration of Honduras to the MER (3103/BL-HO), the rehabilitation and repowering of the Cañaveral-Rio Lindo hydropower complex (3435/BL-HO), with ENEE as executing agency; and the support to the GoH in the sector reform process, through program operations 3386/BL-HO, 3619/BL-HO and 4448/BL-HO. The bank has been providing support to strengthen the capacity of the national transmission system in Honduras and to integrate it with the MER. In 2018, the GRT/SX-16864-HO, 4598/BL-HO, 4599/SX-HO contracts were signed. The IDB also supports the GoH in the ongoing reform process and in the improvement of planning and operation of the sector. Technical cooperation HO-T1296, currently under preparation, will support the preparation and execution of this project. The Bank has experience in the rehabilitation of other hydropower plants in the region, especially those of Furnas and Luis Carlos Barreto (2549/OC-BR) and Passo Real and Itauba (2813/OC-BR), both in Brazil, Simón Bolivar Guri (2429/OC-VE) in Venezuela, Peligre (1296/OP-HA) in Haiti, Carlos Fonseca and Central America (1933/BL-NI) in Nicaragua, Acaray (4690/OC-PR) in Paraguay, and the Salto Grande Binational Hydropower Plant (4694/OC-RG, 4695/OC-RG) between Uruguay and Argentina.

1.19 **Strategic alignment**. The program is consistent with the Second Update of the Institutional Strategy (AB-3190-2), in particular with the development challenges of: (i) productivity and innovation, through the introduction of new technologies and energy sources in the mix; and (ii) social inclusion and equality, through the provision of inclusive infrastructure, contributing to the improvement of the quality of electric service. The project is also aligned with the cross-cutting issues of Climate Change (CC) and environmental sustainability, by increasing the participation of RE and contributing to the reduction of GHG emissions. The project is aligned with the Strategy for Sustainable

Infrastructure for Competitiveness and Inclusive Growth (GN 2710-5), supporting the modernization of infrastructure to meet energy demand in a sustainable way; and the IDB Integrated Strategy for Mitigation and Adaptation to Climate Change and Sustainable and Renewable Energy (GN-2609-1). The operation is aligned with the Energy Sector Framework (GN-2830-8), by supporting the priority area of energy security and sustainability and energy efficiency; with the Sectoral Framework for Climate Change (GN-2835-8), by promoting RE; and with the Gender and Diversity Framework (GN-2800-8), by developing a training, awareness and mentoring program to promote women's participation in different work areas of the hydropower plant and by implementing the gender policy in this plant. It is also aligned with the PAPTN, and specifically with the area of revitalization of the productive sector for supporting the development of tourism activities and community groups.

1.20 The program is consistent with the objectives of the Public Utility Services Policy (GN-2716-6) and meets the conditions of financial sustainability and economic evaluation by demonstrating the sustainability and viability of the investments to be financed (¶1.8).

B. Objectives, components and cost

1.21 **Objective:** The general objective of the program is to enable national grid to integrate in an efficient way future VRE capacity through the financing of upgrade investments in the CHFM. The specific objectives are: (i) to improve the reliability and operational efficiency of the plant as a flexibility asset to increase renewable energy integration into the power system; (ii) integrate it into the National Dispatch system; and (iii) develop studies to evaluate the feasibility of increasing its generation capacity.

1.22 **Component 1: Modernization of the plant (USD 30.52 million: USD 9.49 million CTF, USD 1.6 million IDB, and USD 19.43 million ENEE)**. Works and goods related to the modernization of the power plant will be financed, consisting of: (i) development and installation of a new SCADA incorporating information digitalization; (ii) replacement of equipment that has experienced a high level of wear or for which spare parts are no longer available; (iii) modernization and expansion of the existing electrical substation in order to ensure the reliability of the supply of the plant to the SIN; and (iv) improvement of instrumentation to ensure the insertion of the plant in the new national electricity market.

1.23 **Component 2: Development of studies and designs to increase generation capacity (USD 4 million CTF).** Geological and geotechnical studies for the installation of the new generation unit(s); electromechanical blueprints for the generation equipment to work in conditions of high power fluctuation due to high VRE participation; studies of national and regional electrical interconnection; environmental impact studies; evaluation studies to increase the capacity of the plant and documentation to prepare the bidding documents for the next phases of the project.

1.24 **Component 3: Capacity development of local staff at the existing and planned operational units (USD 1.77 million: USD 1.6 million CTF and USD 0.17 million ENEE).** This component will train staff to operate and maintain the plant in a new national and regional electricity market. It will strengthen the capacities of operational units such as tourism, watershed management and community work in the development of productive activities. Capacity building activities will strengthen environmental, social and climate sustainable management, with a focus on the reduction of climate vulnerability and with a gender inclusion approach. A training, awareness and mentoring program will be developed to promote women's participation in different work areas of

the hydropower plant, and the ENEE gender policy will be implemented in this power plant.

1.25 **Other costs (USD 3.03 million: USD 1.31 million CTF and USD 1.72 million ENEE)**. This component will cover the costs of technical, environmental, administration, audit and contingency supervision of the operation.

B. Key Results Indicators

1.26 **Expected results.** The following results of the project are expected: (i) increase in the participation of renewable sources in the generation mix; (ii) improvement in the quality and reliability of the improved service supply; (iii) reduction of operation and maintenance costs; (iv) viability of the extension of the CHFM assessed; (v) strengthened operational, financial, environmental and social management of CHFM; and (vi) strengthened tourism unit with a focus on women's capabilities. The program will have an impact on the participation of the VRE in the energy mix by maintaining the average level of CHFM generation and by supporting the penetration of VRE, and therefore avoiding the emission of greenhouse gases (GHG).

Table 1. Expected Results and Indicators

Results	Indicator
Mitigation of climate change	Greenhouse gas emission reduction
Increase of the installed capacity of renewable electricity.	ER installed capacity.
Increase in renewable energy generated / total energy	Participation of renewable energy in the generation mix
Increase in the reliability of the electricity supply	CHFM reliability index
Increased competitiveness of the CHFM	Increase in energy production in the CHFM
	Marketing in the regional electricity market
	Increase in energy made available at peak times
Increase in the financial efficiency of the CHFM	% Reduction of operation and maintenance cost
Improvement of environmental, social, gender equity, and tourism management	Environmental and social policy implemented
	Corporate gender equity policy implemented
	Increase in tourist visits
	Communities with productive activities underway

1.27 **Beneficiaries of the program.** The project will allow the operation of the CHFM to be maintained with adequate availability and reliability indexes, benefiting 1.84 million users of the Honduran electricity system with greater introduction of RE, and a quality and cost-effective service.

1.28 The ENEE will benefit from strengthening the management of generation, specifically in CHFM, which is the most important power plant in the national electricity system, not only because of the physical infrastructure but also because of its human resources. The project will develop new capacities for infrastructure management and project management by results. There will also be improvements in operational, financial management and in the implementation of the corporate gender and environmental and social responsibility policy of the CHFM.

II. FINANCING STRUCTURE AND MAIN RISKS

A. Financial Instruments

2.1 **Financing structure.** The program is structured under the modality of investment financing with resources from the Clean Technology Fund (CTF) and the IDB. CTF and IDB resources will be disbursed in five years, from the year 2021. The 5-year duration of the loan is due to the sequence in the execution of works within the plant, which seeks to minimize the down time of each of the machines. However, the executing agency will begin the execution of the works in 2020.

B. Feasibility and Sustainability

2.2 Technical feasibility

The modernization of hydropower plants is increasingly frequent, considering that the majority of large hydropower plants in Latin America were developed in the 70s and 80s, and many of them already fulfilled their useful life, leading to the need to replace elements for reasons of use and wear, or because parts are outdated. Additionally, the instrumentation, automatic control and digitization have made substantial progress that enable power plants to work with higher levels of efficiency. As reported, ENEE has the human resources and organizational structure to carry out this type of project.

In order to ensure reliability, some parts will be directly procured with the original manufacturer of the generating units. The operation in its component 2 contemplates the financing of studies for the expansion of the generation capacity. Since this extension implies a knowledge of the geological and geotechnical features of the site. it is recommended to directly contract the company that has studied the area during the last years.

2.3 Financial Viability

Financial evaluation: The expected financial benefits of the proposed investment are mainly derived from the lower cost of operation and maintenance; operating efficiency gains; and greater reliability of supply. With these considerations, a 15-year projection of the increase in power and power generation and the associated operation and maintenance costs was made, using the following parameters and assumptions:

Table 2. Summary of Assumptions

Current situation		Price (US $)
MWh average generation	1,050,000	0.085
Firm Power El Cajón kW	123,000	8.78
With investment USD 36.83 million	**Variation**	
Additional MWh Energy	31,500	3%
Additional Capacity kW	3,690	3%
O&M costs	12% reduction	

Internal rate of return: The Internal Rate of Return (IRR) and the Net Present Value (NPV) of the expected investment flows using a 12% discount rate were calculated. The results show an IRR of 6.48%; an NPV of USD 26.1 million; and 9.4 years of investment recovery. The IRR of 6.48% obtained is lower than the minimum expected return of 12% to 15% expected by the private sector to recover the cost of financial resources in Honduras (considering commercial, financial regulatory and other risk premiums).

Simulations of changes were made to the results in the parameters considered more sensitive and of moderate probability of occurrence. In all cases, the IRR values are obtained below the normal threshold of the Honduran market (Table 3):

Table 3. Sensitivity Analysis - Internal Rate of Return (%)

Base Case	Variation							
	Efficiency gain		Availability gain		Energy price (USD)		Value of the investment	
	↓ 16.7%	↑ 10%	↓ 16.7%	↑ 10%	0.065	0.10	↑ 20%	↓ 10%
6.48	5.3	7.6	6.2	6.7	3.6	8.5	3.9	8.1

B. Environmental and Social Risks

Since the activities financed by the operation are limited to the procurement of goods and the replacement and maintenance of existing equipment, there are no civil works necessary for the financed activities, and such activities do not induce or generate cumulative impacts that generate long-term effects. The potential risks and impacts will be local, temporary, and can be mitigated with specific actions, corresponding to "Category B" operations.

The following will be developed: (i) an Environmental and Social Evaluation with an Environmental and Social Management Plan; and (ii) a public consultation with the participation of interested parties in the area of influence of the project.

2.4 Likewise, the quality of life of the poor people of the communities around the reservoir will be improved by the implementation of productive activities, as well as by their involvement in tourism activities and sustainable watershed management. At national level there will be an improvement in the reliability of the electricity supply and in the generation of clean energy. At the moment the Environmental and Social Impact Assessment has been produced, together with the Environmental and Social Management Plan (PGAS) of the project, which include mitigation measures for the impacts and risks identified, such as the management of potential waste products due to the replacement of parts and equipment and their correct disposal. The report on the Evaluation of Dam Safety, or the community consultations have not been carried out. The dam safety assessment report will be available before going to OPC. The consultations will take place once the financing of the CTF is approved.

2.5 The executing agency has delivered a record of ownership of the installation sites, to ensure their legal viability. The Environmental and Social Analysis (AAS), PGAS and consultation reports have been published on the Bank's virtual page as indicated in the OP-102 information access policy.

C. Fiduciary Risks

2.6 A risk of increased workload was identified in the fiduciary area of the current PMU, which was rated as medium. As a mitigation measure, ENEE is committed to strengthening this area, by hiring additional technical staff. Similarly, with funding from the institution, the PMU will be strengthened with fiduciary consultants: a financial coordinator, a procurement coordinator and assistants in the technical, monitoring and contract follow-up areas, according to terms of reference that will be agreed with the Bank. The consultants will support the ENEE Holding, which will execute the Program using its organizational structure and the current PMU, and fiduciary management systems.

D. Other Key Risks and Issues

2.7 The main execution risks are associated with the proper integration of the equipment to be replaced with the existing major equipment and in compliance with the planning schedule. The Executing Agency has contemplated the direct procurement of the equipment to be replaced and the coordination of work with the system operator and the regional operator in order to comply with the work schedule. The Institution is also linked to the reform process and its effects on the restructuring of the ENEE. The Bank, together with the World Bank and the Central American Bank for Economic Integration, are developing technical assistance actions to ensure proper implementation of the reform program and seek solutions to improve the financial situation of the ENEE. There is also the risk that the level of wear of the equipment requires anticipating major maintenance activities or replacing the generation, transmission and control equipment. For this, the ENEE has identified the investments that are required and has made the budgetary reserves for the replacement of the critical elements of the project, while the Bank loan is approved.

III. IMPLEMENTATION AND MANAGEMENT PLAN

D. Summary of Implementation Arrangements

3.1 The responsibility for the execution, administration, monitoring and evaluation of the Program will be of ENEE Holding through the existing PMU for IDB loans in execution. ENEE will hire an external supervisory firm for the supervision of works.

3.2 The ENEE as executor will be responsible for implementing and supervising the program, defining and approving the Annual Operational Plans (POAs), providing information that allows the Bank to monitor and evaluate the results of the program, coordinating and managing disbursements and keeping accounting and financial records, including the annual financial statements required by the program. The ENEE has a technical team trained in energy transmission issues and in the feasibility and socio-environmental studies of the works to be financed. The PMU will be responsible for the fiduciary management of the three sources of financing (CTF, IDB and ENEE). **Conditions precedent to the first disbursement will include that** the PCU keeps the minimum staff currently in charge of the execution of loans 3435/BL-HO, and reinforces it with the hiring of consultants as required by the Manual of Operations.

3.3 **Procurement management**. For the contracting of works and the procurement of goods and consulting services financed with Bank resources, the Policies for the Procurement of Works and Goods Financed by the Bank (GN-2349-9) and the Policies for Selection and Contracting of Consultants Financed by the Bank (GN-2350-9) will be applied. The supervision method will be a combination of ex post and ex ante according to what is established in the Procurement Plan (PA). Procurements must be included in the PA approved by the Bank and follow the methods and ranges established therein. A PA will be agreed for the first 24 months of execution and will be monitored and updated through the tools agreed upon with the Bank. The PCU staff may be hired directly, in order to ensure the continuity of the services provided in operations previously financed by the Bank and executed by ENEE, subject to positive performance evaluation, in accordance with the Bank's procurement policy GN-2350-9. Direct contracting is foreseen for power transformers, stator windings of each generation group, exhaust pipes, turbine seals, geological and geotechnical studies for the expansion of generation capacity; as well as for the purchase of several special licenses for the management of the CHFM. These licenses will be acquired from the developers of each *software*, who own their property

rights, thus adapting to the provisions of the Bank's Procurement Policies (GN-2349-9 3.6.c goods that can be obtained from a single source).

3.4 **Advance purchases.** The operation provides for the possibility of advancing the procedures, at the client's own risk, for the first tender of works and their corresponding supervision, using the selection methods provided for in Bank policies, which must be examined by the Bank for it to consider eligibility for financing subsequent contracts.

3.5 **Financial management**. The ENEE Holding, through the PCU, will be responsible for the financial management and will present audited financial statements for the CTF, IDB and ENEE financing, within 120 days of the close of each fiscal year. The last of these reports will be submitted within 120 days of the date of the last disbursement. ENEE will contract external audit services based on terms of reference previously approved by the Bank. Disbursements will be made according to the financial plan, in accordance with the provisions of the Financial Management Guide for Projects Financed by the IDB (OP273-6) and their updates.

3.6 **Manual of Operations (MOP).** The execution of the program will be governed by the provisions contained in its MOP, previously agreed with the Bank. The MOP will incorporate all the procedures to be used during program execution. During execution, the MOP may be modified with the Bank's written non-objection. The MOP will include: (i) detailed execution scheme and institutional and operational roles and responsibilities of the entities involved; (ii) detailed procedures for the selection and contracting of works, goods and services; (iii) investment sustainability strategy: recognition of expenses via application of the current rate system, maintenance responsibilities; (iv) rules and procedures for administrative and financial management; (v) procedures for monitoring and monitoring; and (vi) measures, actions and procedures established in the PGAS. **It will be a special contractual condition prior to the first disbursement of the financing, that the MOP has been approved in the terms previously agreed with the Bank**. The MOP is necessary to ensure the proper execution of the program

B. Summary of the arrangements for the monitoring of results

3.7 The program has a Monitoring and Evaluation Plan (PME). The monitoring scheme will include: (i) the PA; (ii) the Project Execution Plan (PEP) and the POA; (iii) annual verification of compliance with targets set out in the Annex II; and (iv) semiannual reports that will contain: (a) activities carried out during that period, progress in its execution, problems that have arisen and how to solve them; (b) evaluation of: Results Matrix, PA, and POA; and (c) analysis of the Bank's Project Monitoring Report, for which the compliance of goals of the product and results indicators of the Results Matrix will be evaluated. The execution of that period will be evaluated and the planning for the following semester will be included. The Semiannual Reports will be sent for approval to the IDB, no later than July 30 and January 30 of each year.

3.8 The PME includes the evaluation mechanisms of the project, whose objective is to verify compliance with the goals agreed in the Results Matrix. The ENEE will select and contract the consulting services to carry out: (i) an intermediate evaluation, once 50% of the project resources have been disbursed and justified, or after 30 months of execution, whichever comes first. This evaluation will focus on analyzing the progress achieved; coordination and execution aspects; the degree of compliance with contractual obligations; recommendations to achieve the proposed goals and the sustainability of investments; (ii) a final evaluation, no later than 90 days before the date of the last disbursement, whose final report must be submitted no later than 30 days after the final justification of financing disbursements, which will determine: the degree of compliance with the goals set in the

Results Matrix; the performance of the executor; factors that influenced implementation; and recommendations for future operations; and (iii) an ex post cost-benefit analysis following the methodology applied to the ex-ante economic evaluation.

Annex 1. Resource Distribution by Component

Table 1: Resource distribution by component (USD)

COMPONENTS	CTF resources	IDB resources	ENEE (Co-financing)	TOTAL FUNDING
Component 1a. Modernization of the Power Plant: Generation	9,487,816	1,600,000	16,934,068	28,021,884
Component 1b. Modernization of the Power Plant: Transmission[8]			2,500,000	2,500,000
Component 2: Development of studies and designs to increase generation capacity	4,000,000		0	4,000,000
Component 3: Capacity development of local plant personnel and existing and future operating units	1,600,000		170,000	1,770,000
Other cost. Supervision, monitoring, project management and contingency costs	1,312,184		1,722,932	3,035,116
TOTAL	**16,400,000**	**1,600,000**	**21,327,000**	**39,327,000**

Table 2. Disaggregation of Component 1a (USD)

Component	CTF resources	IDB resources	ENEE (Co-financing)	TOTAL
Generation and control equipment				
Engineering reviews*	107,000			107,000
Replacement of the governing system for the 4 power generation systems*	4,140,816	1,600,000		5,740,816
Modernization of the Supervisory Control and Data Acquisition - SCADA to control VRE of the hydro complex. Modernization of the electromechanical instrumentation of the plant*	5,240,000			5,240,000
Modernization of power transformers*			3,600,000	3,600,000
Replacement of stator windings main units*			10,833,333	10,833,333
Strengthening of discharge pipelines*			448,980	448,980
Additional Investments				
Procurement of turbine seals			220,000	220,000
Wastewater treatment plants for camps			612,245	612,245
Dynamic barriers for landslide protection			1,056,245	1,056,245
Turbine house cranes			163,265	163,265
Component 1a total	**9,487,816**	**1,600,000**	**16,934,068**	**28,021,884**

* Items that are connected to the role of CHFM as regulator for VRE

[8] The contribution of ENEE for component 1b will be financed by IDB loan HO-L1186 L1186 National Transmission Program.