Cover Page for Project/Program Approval Request			
1. **Country/Region**:	Nicaragua	2. **CIF Project ID#**:	XSRENI054A
3. **Source of Funding:**	☐ FIP	☐ PPCR	☑ SREP
4. **Project/Program Title:**	Nicaragua Geothermal Exploration and Transmission Improvement Program under the PINIC		
5. **Type of CIF Investment:**	☑ Public	☐ Private	☐ Mixed
6. **Funding Request in million USD equivalent:**	*Grant:* 0.75	*Non-Grant (contingent recovery grant):* 6.75	
7. **Implementing MDB(s):**	Inter-American Development Bank (IDB)		
8. **National Implementing Agency:**	Ministry of Energy and Mining (MEM), with the support from the Nicaraguan Electricity Company (Empresa Nicaragüense de Electricidad, ENEL), and the National Electricity Transmission Company (Empresa Nacional de Transmisión Eléctrica, ENATREL)		
9. **MDB Focal Point and Project/Program Task Team Leader (TTL)**:	*Headquarters- Focal Point:* Claudio Alatorre (calatorre@iadb.org)	*TTL:* Hector Baldivieso (hbaldivieso@iadb.org)	

10. **Project/Program Description** (including objectives and expected outcomes)**:**

Fit with Nicaragua's Investment Plan

The SREP Investment Plan for Nicaragua (PINIC) included the following two programs:

SREP Nicaragua: Financial Plan

Program	SREP-IDB		SREP-World Bank	
	Grant	Non-grant	Grant	Non-grant
1. Development of Nicaragua's Geothermal Energy	0.75	6.75	8.25	6.75
2. Integral Development of Rural Areas	7.50			

The proposal that we are now submitting covers only the IDB's Program 1 (with a total of USD 7.5 million, including grant and non-grant resources). Program 2 is scheduled to be submitted separately during the first semester of calendar year 2017.

Program Description

In 2015 electricity demand reached 665.4 MW, and it is projected to reach 896 to 1,038 MW by 2026. Around 80% of all electricity is produced by the private sector in Nicaragua and geothermal power for electricity production is solely developed by the private sector through exploration and exploitation concessions granted by the government. Despite having a good legal framework for geothermal energy, there is uncertainty regarding the availability, long-term durability, and cost of extracting it for power generation, that limit private investment, especially in the initial stage of exploration. Financing mechanisms need be developed to mitigate this risk and to stimulate competition in the development of the resource, in order to bring in private investors.

The IDB has developed this Program with two components. The first one seeks to diversify Nicaragua's energy matrix by developing additional geothermal capacity through supporting early exploration activities; and the second component seeks to increase access to electricity and

improve service reliability by increasing the national and regional transmission capacity through network reinforcements.

SREP resources are requested to support only the first component. In addition to SREP resources, the Government of Nicaragua and the IDB are simultaneously requesting an additional amount of USD 10 million from the Clean Technology Fund, under the Dedicated Private Sector Programs, for the same component (a separate submission is being sent to the CTF Trust-Fund Committee).

The Geothermal Development component consists of feasibility exploration activities at the Cosigüina geothermal field, including drilling of 5 commercial diameter explorations wells, road infrastructure and a feasibility evaluation report, all to be carried out by the Ministry of Energy and Mining (MEM). In case the field, with an expected capacity of 40MW, is considered feasible for further development, this component will also support the MEM in designing and implementing an international bidding process to award an exploitation concession to a private investor for the commercial development at the Cosigüina geothermal field. In addition, the design of an early exploration risk mitigation mechanism will be financed to attract private investment for the implementation of future geothermal projects. The revenues from the bidding process will provide the funding for this mitigation mechanism.

The Nicaraguan Government will repeatedly reinvest the resources from the mitigation mechanism in subsequent projects during a period of 30 years.

11. **Consistency with SREP Investment Criteria:**	
(a) Increased installed capacity from renewable energy sources	The feasible capacity for geothermal energy will be 40MW[a]. However through the implementation of a new risk mitigation scheme the installed capacity is expected to be higher.
(b) Increased access to energy through renewable energy sources	N/A
(c) Low Emission Development	As of 2015 Nicaragua's electricity matrix was composed of 50.6% renewable based generation (total generation is: 49.4% oil and products, 19.1% wind, 15% geothermal, 10% biofuels and waste, and 6.5% hydro). This project will help Nicaragua stay on a low emission development pathway by providing baseload renewable energy which also facilitates future integration of variable renewable energies like solar and wind.
(d) Affordability and competitiveness of renewable sources:	In case exploration activities confirm availability of the geothermal resource and the concession is awarded, the minimum price of electricity for the project would be 102 USD/MWh, which is around 13% lower than San Jacinto (an existing geothermal project), thus providing affordable and competitive renewable electrify to the grid.
(e) Productive use of energy	The electricity generated by the potential geothermal power plant would be fed into the grid and therefore serve residential, commercial and industrial consumers.

(f) Economic, social and environmental development impact	The project will have a positive effect on the local economy by creating 45 jobs during the exploration phase. In case the exploration activities confirm availability of the geothermal resource and a concession is awarded an additional 160 jobs will be created during construction and 68 for operation and maintenance[a]. Geothermal power also reduces imports of fossil fuels used for generating electricity and has positive environmental impacts as it is an almost emission free renewable energy technology.
(g) Economic and financial viability	A cash-flow analysis was done comparing scenarios with and without the project using a discount rate of 12%. An additional sensitivity analysis included the following factors (social cost per ton CO_2 emitted, fuel price of Bunker oil IFO 380, investment costs, etc.). The project results in a positive NPV and an IRR of 13-29%.
(h) Leveraging of additional resources	See below (section 15)
(i) Gender	See below (section 13)
(j) Co-benefits of renewable energy scale-up	See paragraphs above

12. **Stakeholder engagement:**

1. On March 17, 2016, the workshop "Development of Geothermal Energy in Nicaragua" was organized by MEM and IDB, with the participation of public and private sector organizations active in Nicaragua's geothermal sector, as well as international organizations. The objective of the workshop was to receive feedback on the proposed SREP/CTF program regarding funding amounts, timing, management and sustainability models, mitigation of impacts and the possibility of scale up.
2. On April 27 and 28, 2016, information about the scope of the Project was provided to cooperatives, representatives of the municipality in the area of influence of the project, and to the Ministry of Environment and Natural Resources (MARENA).
3. On June 2, 2016, a public consultation about the Project was carried out with the participation of residents of the municipality in the area of influence of the project, representatives of the municipalities' environmental management unit, the Cosigüina natural reserve management committee and MARENA.

13. **Gender considerations:**

The project will include a gender perspective by integrating activities that promote job creation and training among women. Also, incentives for access of women to technical careers or technical studies with career opportunities in the field of geothermal energy and / or creation of partnerships with technical schools and universities to promote internship programs for female students will be created. The institutions responsible for coordinating the geothermal project will be strengthened in order to include a gender perspective in the project.

14. **Indicators and Targets (consistent with results framework):**

Core Indicator	**Target**
(a) GHG emissions reduced or avoided over lifetime (tons of CO_2-eq)	2,614,170[a]
(b) Annual GHG emissions reduced or avoided (tons of CO_2-eq/year)	87,139[a]

(c) Feasible capacity of renewable energy (MW)		18[a]
Development Indicator(s): Jobs created		120[a]
Reduction in oil imports (USD million per year)		10.4[a]
15. **Co-Financing:**		
	Amount (in USD million):	*Type of contribution:*
• Government	2.814[a]	
• MDB (IDB)	9.99[a]	Loan
• Private Sector (please specify)		
• Bilateral (please specify)		
• Others (please specify)	(CTF co-financing excluded to avoid double-counting)	
Co-Financing Total:	12.804[a]	
16. **Expected Board approval date:**		
September 2016		

NOTES:

[a] Note on the attribution of results between CTF and SREP:

Since the Program is requesting both CTF and SREP resources, in order to avoid double-counting in CIF-level reporting, the expected and actual results of the program will be divided between both funds commensurately to the amount of funding (USD 9.524 million from CTF excluding MDB fees, and USD 7.5 million from SREP). The expected results are therefore as follows:

Indicator	Total	Attributable to CTF	Attributable to SREP
Capacity (MW)	40	22	18
Emission reductions over lifetime of 30 years (tons CO_2e)	5,933,820	3,319,650	2,614,170
Annual emission reductions (tons CO_2e / year)	197,794	110,655	87,139
Jobs created	273	153	120
Reduction in oil imports	23.6	13.2	10.4
IDB co-financing (USD million)	22.67	12.68	9.99
Government co-financing (USD million)	6.387	3.573	2.814

DOCUMENT OF THE INTER-AMERICAN DEVELOPMENT BANK

NICARAGUA

NICARAGUA GEOTHERMAL EXPLORATION AND TRANSMISSION IMPROVEMENT PROGRAM UNDER THE PINIC

(NI-L1094)

PROPOSAL FOR OPERATION DEVELOPMENT

This document was prepared by the project team consisting of: Hector Baldivieso (ENE/CNI) Project Team Leader; Alberto Levy-Ferre, Deputy Chief; Christiaan Gischler; Carlos Trujillo; Shohei Tada; Rodrigo Aragon; Wilkferg Vanegas; Stephanie Suber (INE / ENE); Claudio Alatorre (CSD / CCS); Paloma Marcos (SCL / GDI); Maria Cristina Landázuri (LEG / SGO); Zachary Hurwitz and Rachel Atkinson (VPS / ESG); Juan Carlos Lazo; Santiago Castillo (FMP / CNI); Alma Reyna Selva (CID / CNI); Samar Rimawi (ENE/CNI).

TABLE OF CONTENTS

ABBREVIATIONS	
CBA	Cost Benefit Analysis
CIF	Climate Investment Funds
CTF	Clean Technology Fund
EA	Executing Agency
EE	Energy Efficiency
EIA	Environmental Impact Assessment
EIRR	Economic Internal Rate of Return
ENATREL	Electricity Transmission National Company
ENEL	Nicaraguan Electricity Company
ENPV	Economic Net Present Value
ESAP	Environmental and Social Action Plan
ESMR	Environmental and Social Management Report
FIRR	Financial Internal Rate of Return
FNPV	Financial Net Present Value
FSO	Fund for Special Operations
GWh	Gigawatt-hour
IDB	Inter-American Development Bank
INE	Nicaraguan Energy Institute
km	Kilometers
kWh	Kilowatt-hour
MEM	Ministry of Energy and Mines
MHCP	Ministry of Finance and Public Credit
MW	Megawatt
MWh	Megawatt-hour
OC	Ordinary Capital
PEU	Program Execution Unit
PINIC	Nicaragua SREP Investment Plan
PNESER	National Sustainable Electrification and Renewable Energy
POM	Program Operating Manual
RE	Renewable Energy
REM	Regional Electricity Market
SIEPAC	Electric Interconnection System for Central American Countries
SIN	National Interconnected System
SREP	Scaling up Renewable Energy Program
SS	Substation
T/L	Transmission line

PROJECT SUMMARY
NICARAGUA
NICARAGUA GEOTHERMAL EXPLORATION AND TRANSMISSION IMPROVEMENT PROGRAM UNDER THE PINIC (c)
(NI-L1094)

Financial Terms and Conditions

Borrower / Recipient: Republic of Nicaragua

Executing Agency: Ministry of Energy and Mines (MEM), with support from the Nicaraguan Electricity Company (ENEL); and National Electricity Transmission Company (ENATREL)

Source	Amount (US$)	Loan %	Grant %
IDB (BL OC):	17,220,000	60.0	16.7
IDB (BL FSO):	11,480,000	40.0	11.1
IDB (Grant Leverage Mechanism OC) (d) -	22,670,000	51.0	21.9
KFI – (Korean Facility for Infrastructure) (f)	25,000,000		24.2
SREP (Contingent recovery grant):	6,750,000		6.5
SREP (non-reimbursable grant):	750,000	49.0	0.7
CTF (Contingent recovery grant):	9,524,000		9.2
Local contribution	10,009,000		9.7
TOTAL	103,403,000		100.0

	IDB (BL OC) and (IDB-GLM)	FSO	KIF
Amortization period:	30 years	40 years	30 years
Disbursement period:	5 years	5 years	5 years
Grace period:	6 years	40 years	10 years
Inspection and supervision Committee:	(a)	N/A	N/A
Charges on loan facility	N/A	N/A	0.1%
Interest rate:	Fixed Single Currency Facility (b)	0.25%	1.0%
Credit fee:	(a)	N/A	N/A
Currency approved:	US Dollar	US Dollar	US Dollar

Project Outline

Project objective / description: The overall objective of the project is to contribute to the sustainability of the electricity sector in Nicaragua through: (i) develop geothermal exploration potential to diversify the energy matrix; and (ii) increase the capacity of national and regional transmission through the network reinforcements. The specific objectives of the program include: (i) develop a geothermal field explored on a feasibility level mitigating risk and enhancing strong investment opportunities for its implementation; (Ii) design and implement a risk mitigation mechanism for geothermal projects; (Iii) ensure the continuous supply of electricity in the target areas for the expansion of electricity infrastructure under the program; (Iv) increase the transmission capacity to meet the load demand for electricity generation and supply of energy in the area of influence of the program; and (v) optimize the capacity of regional Transmission Line (T / L) in the sections located in Nicaragua (paragraph 1.17)

Special Contractual Conditions (a) precedent to the first disbursement: (i) that has been approved and is in effect (e) the Program Operating Manual in the terms previously agreed with the Bank (paragraph 3.3); (ii) it has been signed an implementation agreement between the Ministry of Finance and Public Credit (MHCP) and the MEM, and an agreement for transfer of resources between MHCP and ENATREL in the terms of paragraph; (Paragraph 3.1); and (iii) have been recruited to the program its coordinator and staff PEU identified in paragraph (paragraph 3.2); (iv) an Environmental and Social Action Plan is presented and all management plans identified in the ESMR.

(b) execution: (i) the MEM and ENATREL shall comply with environmental and social obligations as detailed in the Environmental and Social Management Report (ESMR) ii) MEM shall keep the financial indicators specified in the Financial Assessment of ENATREL: State and Projected Financial Indicators; and (iii) that prior to the awarding of each construction contract, the EA show that it has legal possession, easements or other rights necessary to start the work (paragraph 2.11).

Exceptions to Bank policies: None

Strategic Planning

Challenges [(g)]:	**SI**	☐	**PI**	☑	**EI**	☑
Cross-cutting issues [(h)]:	**GD**	☐	**CC**	☑	**IC**	☐

(a) The credit committee and the inspection and supervision committee will be established periodically by the Board as part of its review of the Bank's financial positions, in accordance with relevant policies.

(b) The Borrower shall pay interest on the outstanding portion of the loan under the OC at a rate based on LIBOR balance. When the outstanding balance reaches 25% of the approved amount or US $ 3 million, whichever is greater, the base rate will be set based on that balance. In any case the portion of the OC will have more than four base interest rates.

(c) Investment Plan for Nicaragua (PINIC) under the Program for the Promotion of Renewable Energy in Low Income Countries (Scaling up Renewable Energy Program - SPREP) from the Strategic Climate Fund (Climate Investment Fund - CIF). Nicaragua, April 15, 2015.

(d) Nicaragua has requested the use for PINIC of the IDB's Grant Leverage Mechanism (GLM) (AB-2946). The SREP resources and the Clean Technology Fund (CTF) are administered by the Bank in accordance with the financial procedures agreements signed between the Bank and the World Bank as manager of both funds. These resources correspond to the counterpart of the resources from the Ordinary Capital of the Bank within its regular program funding, representing 49% of this combination and will be disbursed simultaneously (pari passu) in accordance with the provisions of the AB -2946.
(e) Funds managed by the Bank under the Korean Infrastructure Facility. The charge of 0.1% of KIF is an initial fee on the approved loan amount payable only once.
(f) SI (Social Inclusion and Equality); PI (Productivity and Innovation); and EI (Economic Integration).
(g) GD (Gender Equality and Diversity); CC (Climate Change and Environmental Sustainability); and IC (Institutional Capacity and Rule of Law).

I. PROJECT DESCRIPTION AND RESULTS MONITORING

A. Background, Problem Addressed, and Justification

1.1 **Energy sector.** Nicaragua consumes daily 56,000 barrels of oil equivalent of primary energy. A high percentage comes from renewable energy (RE): geothermal (22%), hydro and solar (3%), biofuels (52%); and 23% oil. In power generation, in 2015 the RE in the National Interconnected System (SIN) came to 50.6%; while 49.4% was thermal. Electricity coverage increased from 73.7% in 2012 to 80.4% in 2014 and it is expected to reach 90% by 2020**.**

1.2 The transmission system in 2015 consisted of 2,287 km of national lines and 305.6 km of Electric Interconnection System for Central American Countries (SIEPAC). The last section of the SIEPAC of 1,790 km began operations in October 2014, designed to make up to 300MW exchanges between countries and increase the efficiency and reliability of the electrical system.

1.3 In 2015, electricity demand reached 665.4 MW, representing a growth of 4.6%; in 2014 the growth was 2.6% and 1.7% in 2013. Demand is projected to reach between 896 MW and 1,038 MW by 2026.[1]

1.4 The electricity sector has institutions and companies with fully identified functions: Ministry of Energy and Mines (MEM) designs policies, the Nicaraguan Energy Institute (INE) has the regulatory responsibility; the Nicaraguan Electricity Company (ENEL) the generation subsector and the National Electricity Transmission Company (ENATREL) the transmission subsector. The subsectors for generation and distribution have significant participation of private companies.

1.5 **Energy Sustainability**[2]. According to the World Energy Council, sustainable energy seeks balance within three dimensions: energy security, social equity and environmental impact mitigation. In other words, the development of stable, affordable and environmentally friendly energy. In that sense, Nicaragua faces a major challenge, mainly due to the steady increase in energy demand in the country - resulting from economic growth[3] and expansion of electricity coverage (paragraph 1.1) - which causes severe pressure on the generation as a source of supply and energy security, and on the transmission as the central axe of the electric system that guarantees its universal access.

1.6 According to the above, the country is still highly dependent on firewood and fossil fuels. The import of petroleum and petroleum products rose to US $ 1,186 MM in 2013 and represented more than 10% of GDP. The growth rate of final energy consumption was about 3.5% and the primary energy supply rose to

---

1 NPUD – IDB. *Sustainable Energy for All. Rapid Assessment Gap Analysis Nicaragua*. 2013.

2 The information contained in items paragraph 1.5, paragraph 1.6 and paragraph 1.7 of the report was extracted from SREP (Scaling-Up Renewable Energy Program) Investment Plan for Nicaragua. Investment developed by the Climate Fund, 2015.

3 Economic activity grew 4.9% in 2015. The largest contribution to growth came from services and trade with 2.7%, followed by construction activity with 1.3%, and agriculture, livestock and forestry activities with 0.6%. Source: Central Bank of Nicaragua. "Annual Report", 2015.

2,028 ktep in 2012. Oil imports accounted for an estimated 25.9% of total primary energy supply, while still almost half (49.5%) is covered by wood and other biomass. The residential sector is the largest energy consumer in the country, accounting for 46.3% of total energy consumption in 2012. Within this sector, fuelwood accounts for 87.1% of energy consumption, followed by electricity 8.5%, liquefied petroleum gas with 3.8% and 0.4% charcoal. The industrial sector, with 12.8%, most use fossil fuels (46%) and wood (19%).

1.7 Despite being a country with a low rate of per capita emissions of greenhouse gases (GHGs) in the world (0.8 tons of CO_2 per year), the Global Climate Risk Index ranked Nicaragua in fourth place among the countries most at risk to adverse extreme weather events and it is estimated that electricity generation and heat production contributes about 35% of emissions CO_{2EQ}[4]. Also, one in five people in Nicaragua have no power to light their homes or to provide energy at work and almost 60% of the rural population and 20% of the urban population still use firewood, charcoal or animal origin to cook. Also insufficient electricity coverage in the country, technical and non-technical losses and dependence on fossil fuels, which have been the primary means to meet the demand for energy stability and energy generation base over the past decade - have kept consumer prices among the highest in the region[5].

1.8 **Causal factors or main determinants of the problem**. There has been identified as determinants factors which cause the general problem of energy sustainability in Nicaragua have: i) constraints to meet the requirement of generating electricity using geothermal resource, identified as having the highest potential in the country; and ii) physical limitations in the transmission system.

1.9 **Constraints for geothermal development.** In Nicaragua there are 12 geothermal fields with an estimated potential of 1,500 MW. Despite having a legal framework for geothermal[6], and the benefits of geothermal energy in terms of reducing power generation costs, energy unserved and reduction of emissions (EEO # 1), this potential has been underdeveloped given the uncertainty related to the availability of the geothermal resource, durability in the long run, and the cost of removing it for power generation, thereby limiting private investment, especially in the initial stage of exploration. This uncertainty is reflected in the fact that only 10% has been developed (San Jacinto-Tizate and Momotombo with a capacity of 154.5 MW) out of the estimated potential.

1.10 **Constraints of the transmission system**. Efforts to increase electricity service coverage, the increased demand, diversification of the energy matrix and the need to continue to deepen the country's commitment to regional integration have resulted in pressure on sections of the transmission system and substations that have affected its reliability[7], limited its capacity and has prevented the connection of new users to the network. Among the determinants of the specific problems highlight the existence of points in the network where transformers are

[4] http://data.worldbank.org/country/nicaragua.
[5] For example, residential end users who consume more than 300kWh in Nicaragua pay 154% more than their neighbors in Costa Rica and 310% more than in Honduras.
[6] "Law on Exploration and Exploitation of Geothermal Resources", Act 443 of 2011.
[7] In 2014 the energy not served in Nicaragua reached 8,000 MWh representing 67% of the entire Central American region.

overloaded and in some cases to levels where the degradation of their physical parameters is accelerated, and of transmission lines operating outside the standards, producing high interruptions, both in quantity and magnitude.

1.11 **Transmission Line El Sauce - Villanueva.** Is a transmission line of 69 kV in the National Transmission System, built in wooden structures that already reached their time of service and drivers who exceeded their useful life. Both factors, the materials and the ancient towers, cause odd line outputs, with consequent disruption of service to users. Also the capacity of the line (69kV) is insufficient for current and future demand.

1.12 **Lack of support for transmission circuits.** The SS Sébaco has great importance since it is the point of convergence of a total of six 138 kV lines: Line Sébaco - Carlos Fonseca, line Sébaco - Tipitapa, line Sébaco - Esteli, line Sébaco-San Ramon and two lines to the Centralamerica plant. This substation, which came into operation more than 50 years ago and feeds the municipalities of Ciudad Dario, San Isidro, La Trinidad, Sébaco, Santa Rosa del Peñón and surrounding areas, has a simple bar scheme. This feature, the dependence of a bar makes more likely the occurrence of episodes of discontinuity of service, for example because of a failure or a breaker bar. These episodes leave unpowered 10 SSs connected to this node, with a load of approximately 45 MW. Another consequence of the output of this SS is the impossibility of hydroelectric plants Centroamérica, Larreynaga y Pantasma to inject 80MW of capacity to the system.

1.13 **Expanding capacity of 6 substations**. According to the analysis performed by ENATREL regarding transformer substations SIN, with measurements in the active part of the team, thermographic, of the insulation resistance in the dielectric oil, concentration of dissolved gases, among others, it was concluded that there are 23 transformers in hazardous operating condition, one of the key factors is the amount of time operating this equipment. The age of these teams hampers the availability and purchase of spare parts for repair, since in many cases models have been discontinued by the manufacturer. Given this situation, the project has identified equipment in substations: Acahualinca, Diriamba, San Benito, Catarina, Ticuantepe I and II, which have transformers at risk of overload and instability due to its obsolescence[8].

1.14 **Restrictions on the SIEPAC transmission capacity**. In October 2014 the SIEPAC line, designed under the compromise between countries to transport 300MW came into full operation. However, the line has not yet reached operating conditions for maximum capacity due to deficiencies in national networks - 403km in the case of Nicaragua - occupy part of the transfer capacity of the regional line. This requires the construction of additional infrastructure in certain sections of national lines of Nicaragua. According to the Regional Operator Unit, during the second half of 2014, the transport capacity of the SIEPAC between Honduras and Nicaragua to import or export energy was 200 MW and 210 MW, respectively, while the capacity of transactions between Nicaragua and Costa

[8] Some transformers (such as Catarina and Diriamba) also have overload (are loaded more than 90% of its nominal capacity), causing considerable losses in transformation and decreasing the efficiency of these teams.

Rica was reduced to 210 MW to export and 150 MW to import. This limitation has considerable economic consequences because it reduces the amount of energy in the Regional Electricity Market (REM). Specifically, the existing conductor between the points of interconnection Leon-Border Honduras and Amayo-Liberia does not meet the required transmission capacity.

1.15 **Proposed solutions.** To address the constraints that the development of geothermal potential and the transmission system are both facing, the program explores the geothermal potential in the country and developing mechanisms to promote private investment in its development. Specifically: (i) develop a geothermal field exploration conducted at a feasibility level, mitigating risk and enhancing strong investment opportunities for implementation and (ii) design and implement a risk mitigation mechanism for geothermal projects. The program also raises a number of investments that seek to overcome the limitations of the transmission system in order to create an electrical service of good quality. Investments are divided into two groups: (i) improving transmission infrastructure to support increased comprehensive coverage; and (ii) improvements in the national transmission system to support the capacity of the regional system **–** SIEPAC[9]. These Investments will improve the welfare of the populations of sixteen municipalities, of which fifteen are located in the North Central region and one in the northern Caribbean Coast region[10]. Several municipalities prioritized in the program suffered, according to the latest available measurements of poverty[11], of extreme poverty levels that exceed 50% of the population, being located within 25% of the poorest municipalities in the country[12].

1.16 **Sector knowledge.** The IDB has extensive knowledge of the Nicaraguan electricity sector since 1973 when it supported a first RE program. The Bank has complemented support investments in electricity infrastructure, with ample support to reform processes that have promoted the institutional strengthening of the sector. In 1998, through the loan 1017 / SF-NI, the Bank participated in the amendments to the Electricity Act that transformed the sector and led to private investment. Through the Support Program Electrical Sector I, II and III (1933 / BL NI, 1933 / BL-NI-1 and 1933 / BL-NI-2), generating RE, the transmission area and completed a pilot project aimed to normalize service standards in settlements program. With the loan National Transmission Reinforcements for Integration with SIEPAC (1877 / BL-NI) project works were financed to strengthen the power transmission network in Nicaragua and allow its adaptation to the regional network integration with the Central American electricity market.

1.16 The expansion of electricity coverage, reduced losses on settlements, implementation of projects of Energy Efficiency (EE), care throughout isolated areas, transmission reinforcements have been covered with active participation

---

9 Reliability of Transmission System plays a key role in the investment decision, above standard economic criteria. Joskow, Paul L. "Patterns of Transmission Investments". MIT. 2005.

10 Central Region: Jinotega Department (Municipalities: Jinotega, La Concordia, Santa Maria de Bloodsucker, San Rafael del Norte and San Sebastian de Yali); Madriz Department (Municipalities: San Juan del Río Coco); Matagalpa Department (Municipalities: El Cua, Rancho Grande); Nueva Segovia Department (municipalities: Old City, Jalapa, El Jicaro Murra, Quilalí, San Fernando, Wiwili of Nueva Segovia). Caribbean Coast Region: Department of the North Atlantic Autonomous Region (Municipalities: Siuna).

11 VIII National Census of Population and Housing IV 2005 and based on the Unsatisfied Basic Needs methodology. Municipal map of Extreme Poverty.

12 Before the end of 2016 new updated estimates for 2015 were published.

of the Bank through the National Sustainable Electrification and Renewable Energy (PNESER) (2342 / BL-NI and Amendments). The Bank is supporting policy actions on financial sustainability, transparency of results in management, sustainable energy matrix, promoting RE private investment, EE and promotion of the regional integration of the electricity sector through a Programmatic series of Support to Political Reforms[13].

1.17 Among the lessons learned[14] as a result of IDB interventions in the sector, the following stand out: (i) the benefit of having environmental and social assessments that provide in advance technical information and concrete action plans to enable compliance analysis of each project in conjunction with the IDB safeguard policies, especially on issues related to the availability and source water, disaster management, management of critical natural habitat areas, and treatment of solid, liquid, and gas; (ii) the need to define in advance the project profiles; (iii) the need to classify the project areas depending on the characteristics of land properties, to define appropriate sanitation strategies right of way; and (iv) the establishment of a Project Implementation Unit (PIU) to maintain a clear link with the management-decisional area of the Executing Agency (EA). This program has incorporated lessons learned through: early coordination with MEM, ENATREL and ENEL to ensure that it has completed the chain of technical and environmental studies defining the area to be operated, and establishing a Project Operational Manual (POM) defining a PIU supported in managerial and operational structure ENATREL and MEM with support from ENEL

1.18 The PNESER, which started in 2011 and was promoted by the IDB and seven multilateral agencies, it is in its final phase of execution and opens the possibility to PINIC to achieve complementary results in the development of geothermal potential improvement and strengthening of the transmission system. In the latter area, this program and the NI-L1091[15] operation, approved in 2015, are complementary because includes actions in transmission reinforcements to meet the whole demand and the new generation and transmission reinforcements for adaptation to the regional system.

1.19 **Government strategy**. As part of the actions taken by the government to address the needs of generation from renewable sources, by 2015 it was established the Investment Plan for Nicaragua (PINIC) under the Program for Promotion of Renewable Energy in Low Income Countries (Scaling up Renewable Energy Program - SPREP) from the Strategic Climate Fund (Climate Investment Fund - CIF). The PINIC includes the development of geothermal energy and the integral development of rural areas from RE and improvements in transmission[16], as its main components[17].

---

13 3068 / BL-NI in 2013 and 3493 / BL-NI in 2015; the third operation has not yet been scheduled.

14 Previous experiences in the country's geothermal energy projects can be found in PNESER (NI-L1040, L1050 NI, NI-L1063) Lessons learned from other countries in the region can be found in CR-L1070 operations and ME- L1148.

15 The NI-L1091 anticipated that the transmission works were complementary to financing provided -under the Investment Plan for Nicaragua (PINIC).

16 Map of improvements in transmission: NI-L1094_Componente geographical 2_Representacion improvements in transmission.

1.20 **Strategic alignment**. The program is consistent with the IDB strategy for Nicaragua 2012-2017 (GN-2683), which states that the Bank will consider investments that seek to: (i) improve financial and operational management of the system and reduce energy losses; (ii) expand electricity service coverage, especially in rural areas; (iii) improve service reliability; and (iv) transform the energy matrix to increase the participation of RE, indispensable conditions to reduce energy costs and overcome an active constraint to growth. The operation is included in the Country Program Document 2016 (GN-2849).

1.21 The program is consistent with the Institutional Strategy Update (UIS) 2010-2020 (AB-3008) and aligned with the challenges of development: (i) productivity and innovation under the criteria of provision of infrastructure and reliable public services and accessible; and (ii) economic integration under the criteria of development of the national part of a system of multinational electric transmission. All this through developing the potential of RE in an environmentally and financially sustainable and the strengthening of national networks to achieve full availability of SIEPAC. The program also aligns with the cross sectional area relate to climate change and environmental sustainability, through the financing of activities designed to reduce or prevent GHG emissions through the development of geothermal energy, improving the connection of renewable energy projects, the reducing the use of conventional energy sources based on fossil fuels and increasing efficiency by reducing energy losses in the transmission system. In addition, the program is aligned with the Strategy for Sustainable Infrastructure for Competitiveness and Inclusive Growth (GN-2710-5), in its two strategic principles, to promote access to infrastructure services, infrastructure support for regional integration and supporting the construction and maintenance of a socially and environmentally sustainable infrastructure that contributes to increasing the quality of life. The program is consistent with the Energy Sector Framework (GN-2830) to: (i) support energy sustainability through the development of renewable energy; and (ii) promote energy security through financing energy infrastructure and regional energy integration.

1.22 Consistency with the Bank's Policies[18]. The program is aligned with the Public Utilities Policy OP-708 (GN-2716-6) (EEO # 7) in reference to the electricity subsector as it complies with: (i) the condition of financial sustaintability[19] in seeking to improve ENATREL financial indicators, as they recover through rates operating costs and maintenance (paragraph 2.14); (ii) provided economic evaluation[20], to include projects that are economically and financially profitable; (iii) the technical and operational sustainability of the sector to support policy actions of the Government of Nicaragua to help develop geothermal generation

---

17 Under the PINIC, JICA is managing parallel financing non-refundable US $ 7 billion under management, for exploitation of Campo Mombacho and the World Bank is working on an initiative to support the development of the geothermal field Casita-San Cristóbal.

18 For detailed analysis of compliance with public policy consulting public utilities (EEO # 7)Financial sustainability: Striving have sufficient revenue for providing the service to the user, with input from the community and direct contributions from the government that cover the efficient costs of providing the service.

19 Financial sustainability: Striving have sufficient revenue for providing the service to the user, with input from the community and direct contributions from the government that cover the efficient costs of providing the service.

20 Economic Assessment: Projects of public services must be economically viable, according to assessment methodologies cost-benefit and cost-effectiveness used and accepted by the Bank.

and promote improvements in the transmission system; (iv) enhanced access and social sustainability through the strengthening of networks that allow the incorporation of new users; (v) the promotion of competition and private sector participation and environmental sustainability, developing geothermal exploration to reduce the risk of investment in renewable; and (vi) to improve efficiency by reducing technical losses in the transmission lines (T/L) and Substations (SS) and contribute to the adequate supply of electricity, satisfy the growing demand and increased service quality

B. Objectives, Components and Costs

1.23 **General and specific objectives.** The overall objective of the project is to contribute to the sustainability of the electricity sector in Nicaragua. The specific objectives are: (i) develop geothermal exploration potential to diversify the energy matrix; and (ii) increase the availability and reliability of electricity service by increasing the capacity of national and regional transmission network reinforcements.

1.24 **Component 1. Geothermal Development (Total US $46.1 M; IDB US$ 39.7M[21]).** This component will finance the following activities:

a. **Exploration feasibility level field with geothermal potential Cosigüina** already has surface research[22]. The use of this component is aimed to determine the technical feasibility of the exploitation of geothermal potential Cosigüina field. Accordingly, there will be exploration activities in two phases. Phase 1 includes the drilling of three exploration wells, commercial diameter, with an average depth of 2000m, in order to verify the potential of the field, obtaining information to confirm or modify the preliminary conceptual model of the geothermal system made from previous research prefeasibility including exploration wells reduced diameter "slim-holes," depth up to 1000m. The activities for Phase 1 include: (i) civil works preparation including enlargement of the 3 platforms (A,B,C) of 625m2 each used in the pre-feasibility, the improvement of 4km linear existing road of 3.5m wide and 2km of new linear gauge 3.5m wide, rehabilitated during the pre-feasibility, with safety bays, extraction and transportation of selected material from the banks of materials, installation 6.25 km water pipeline, the construction of a water pumping station size 400m2; and (ii) the drilling of three wells commercial diameter with an average depth of 2000m. If the resource were confirmed in Phase 1, Phase 2 would involve the drilling of two new wells commercial diameter (D, E). According to the results achieved, the five wells could become production or reinjection wells.
Exploratory Phases 1 and 2 will be conducted with program resources. As a consequence of this intervention it is desirable private investment for subsequent exploitation phase of the field[23]. Phase 2 will also include the construction of new roads and extension of the water supply pipe, considering the location of new wells which depends on the results of drilling

[21] It includes SREP and CTF funds.
[22] Surface investigations are those that do not include underground drilling and include geological, geochemical and geophysical studies of the site.
[23] The information so far obtained indicates that there is enough potential for geothermal utilization. It is in the process of defining the amount of MW that can be generated.

of Phase 1. Finally, from the results of the phases 1 and 2, a Final Feasibility Report will be elaborated which will allow to continue, the transmission phase to the private sector (Paragraph 1.18b). The private investor is responsible for investments in additional commercial diameter wells to define the whole setting of either production and reinjection wells for power generation; construction of a geothermal plant, transmission lines that connect the project to the nearest substation of the transmission system, a cooling tower, and storage lagoons.

b. **Development of a mechanism to attract private investment for the implementation of geothermal projects.** This component will support the MEM to call a bid in order to grant the project to private investors having demonstrated the feasibility of the geothermal resource. Documents and agreements will be developed to grant the concession, which will incorporate the obligations under the law to recover the invested resources (Art. 5), the concessionaire's obligation to establish a society in which ENEL will have 10% as required by the law and a member in the Board. In addition, this component will support the MEM to design and implement a mechanism to support geothermal research from the recovered resources, allowing further research in other fields, mitigating risks to attract private investment. This mechanism will include the development of a plan for training and dissemination of the results of Phases 1 and 2 contained in the feasibility report, which will be aimed at potential investors, the MHCP and PRONicaragua[24]. This component will add value to integrate a gender perspective with activities that promote job creation and training among women. Also, incentives will rise for access of women to technical careers or technical studies with career opportunities in the field of geothermal energy and / or creation of partnerships with technical schools and universities to promote programs of placements for female students; and will strengthen the institutions responsible for coordinating the component for inclusion of the gender perspective (Gender ANNEX).

1.25 **Component 2. Improvements in electricity transmission infrastructure (Total US $57,3M; IDB US$53,7M[25]).** This component seeks to increase the capacity of SS transformation to meet both current demand, and its long-term growth, reliably. The project will finance the construction and expansion of transmission lines and substations 138kV and 230kV which:

a. **Address the growing demand and connecting new generation**, including: (i) LT El Sauce - Villanueva: This project involves the construction of a transmission line 38km long of 138 kV between SS Villa Nueva and SS El Sauce, the construction of the new SE Villanueva and expanding SE El Sauce. This infrastructure will provide reliable and secure energy to current and future users in 10 municipalities in the department of Chinandega that are fed from the SS Villanueva, reducing energy unserved. This project will improve the service for more than 25,000 existing users and the connection of 1,440 new users; (ii) SS Sébaco: this project includes the addition of a

[24] Public entity responsible for providing free services for people and qualified companies wishing to explore business opportunities in Nicaragua.
[25] Facility includes Korean funds.

new bay / bar on the SS Sébaco in order to reduce the probability of occurrence of episodes of discontinuity of service, for the six TL of 238 kV that connect to that SS. These episodes of discontinuity leave unpowered 10 SSs connected to this node, with a load demand of 45MW and a load of hydroelectric generating about 80 MW, compromising the supply to 213,000 customers in municipalities within 7 departments; (iii) Expansion Capacity 5 SS: This project involves the replacement of 5 transformers in SE Acahualinca, Diriamba, San Benito, Ticuantepe II and Catarina) since the existing ones have completed their life cycle and also some are overloaded. This subset of projects expected to benefit more than 83,000 customers; (iv) Modernization of Ticuantepe I. This project involves the construction of a new 138kV SS, to replace the current SS Ticuantepe I of 69kV. The project includes a 2km TL of 138 kV. The project will benefit more than 12,000 customers; and (v) Acquisition of a Mobile Transformer. This project involves the acquisition of a mobile transformer of 40 MVA with voltage ratio 138 / 24.9 / 13.8 kV.

b. **Allow adaptation of the national transmission system for the SIEPAC reaches its design level transfer 300MW**. This project consists of increasing capacity of existing 230kV lines in the Lion-Border Honduras and Amayo-Frontera Costa Rica (and interconnections) sections, replacing 97km conductor with a new higher capacity and improving the transmission capacity in a length of 213km through complementary works, which along with other works will ensure the transfer of 300MW of power from north to south and vice versa.

1.26 **Cost and financing.** The total program cost is US$103,403,000 of which US$28,700,000 corresponds to Blend (US$17,220,000 charged to 60% OC resources, US $ 11,480,000 charged to FSO, 40%); US$39,694,000 as part of the Non Refundable Mechanism Leveraging IDB grants (US$22,670,000 under the GLM OC, and US$9,524,000 CTF (contingent recovery grant), US $ 6,750,000 SREP (contingent recovery grant), US$750,000 SREP (non-refundable grant), the latter three representing 42.9% return for the OC. in addition US$25,000,000 of a concessional loan under Korea Infrastructure Facility (KIF) from funds intended to infrastructure projects under the Bank's administration and US$10,009,000 will be financed with local input from MEM, ENEL and ENATREL to be primarily used to cover administrative, financial expenses and contingencies. The consolidated component budget is shown in Table 1 - Program Cost and in the detailed budget (EEO # 10). Procurement of goods, works, services and consulting will be financed by this program. The financial costs of the program and regular costs incurred will be covered by with funds from the General National Treasury. The loan will finance all costs inherent to the program.

Table 1. Cost of the program (in US $ thousands)

	BID (GLM)	BID (BL)	BID (KIF)	SREP (Ctg)	SREP (No reemb)	CTF (Ctg)	Local Contribution	TOTAL
1. Engineering Supervision and Administration	1,670	-	-	529	59	747	500	3,505
2. Direct Costs	19,031	-	-	6,035	671	8,514	-	34,251
2.1 Exploration feasibility	18,753	-	-	5,946	661	8,390	-	33,750
2.2 Implementation Strategy geothermal projects	278	-	-	88	10	124	-	500
3. Contingencies	585	-	-	186	20	263	5,796	6,850
4. Financial Expenses	1,384	-	-	-	-	-	91	1,475
Subtotal C1-GEOTHERMAL	22,670	-	-	6,750	750	9,524	6,387	46,081
1. Engineering Supervision and Administration	-	800	731	-	-	-	600	2,131
2. Direct Costs	-	25,824	23,582	-	-	-	-	49,406
2.1 Transmission to support national reinforcement	-	19,774	18,057	-	-	-	-	37,831
2.2 Transmission to support the capacity of the regional system	-	6,050	5,525	-	-	-	-	11,575
3. Contingencies	-	771	-	-	-	-	2,889	3,660
4. Financial Expenses	-	1,305	687	-	-	-	133	2,125
Subtotal C2-TRANSMISSION	-	28,700	25,000	-	-	-	3,622	57,322
TOTAL NI-L1094	22,670	28,700	25,000	6,750	750	9,524	10,009	103,403

C. Key Results Indicators

1.27 As a result of the program the following will be achieved: (i) development of the geothermal potential of Nicaragua in an environmentally and financially sustainability; (ii) ensuring supply of continuous, reliable, affordable electricity and cost effective in areas benefiting from the expansion of the electricity infrastructure of the program; and (iii) optimization of the energy capacity of SIEPAC in sections located in Nicaragua. The indicators established to measure these results are: (i) geothermal potential for additional power generation to existing, explored at a feasibility level; (ii) geothermal exploitation concessions granted; (iii) CTF financial leverage; (iv) GHG emissions avoided; (v) oil imports; (vi) unserved energy in GWh in the areas of influence of the program; and (vii) maximum capacity of regional transfer in Nicaragua-Honduras N-S section and increased in Nicaragua-Costa Rica S-N section.

II. FINANCING STRUCTURE AND MAIN RISKS

A. Financing Instruments

2.1 The proposed program will be co-financed with resources from the Bank loan and the loan proceeds of Korea Facility for infrastructure projects as well as contributions from CTF and SREP as part of PINIC for a specific investment program. The Bank resources will be charged to the following sources of funding: (i) the biennial allocation for Nicaragua (document GN-2442-42) from parallel loans of OC and FOE under the Framework MSD / SMABD (GN-2442); and (ii) the allocation of resources from OC regular financing program of the Bank (OC loan), as provided under the Grant Leverage Mechanism - GLM (document AB-2946.) In accordance with this mechanism, the Bank may finance investment financing with resources from the regular program funding of OC and grant resources provided by bilateral and multilateral donors. Each operation will consist of a combination of grant and loan from OC, to be approved and disbursed simultaneously (pari passu) in order to meet the requirements of concession. The resources provided by the CTF and SREP will be available when funding is approved as it is administered by the Bank in accordance with the agreement signed between the Bank and the World Bank as administrator of these resources. The CTF and SREP subcommittees approved the use of these resources.

2.2 As indicated in paragraph 2.1, each sum to be disbursed and charged under the loan OC, according to the GLM framework, will have a counterpart of equal amount (pari passu) of CTF and SREP resources. The resources from SREP and CTF are transferred to the country in non-reimbursable status to help mitigate and / or transfer financial risks associated with exploration and development of the Program. The MEM is obliged to call for bids to award to a private investor the future concession having demonstrated the feasibility of the geothermal resource, and in the concession granted to a private obligation it will be added the obligation to repay an amount not less than the resources invested by the State in the exploration. With the resources received from the private investor the MEM will implement a mechanism to support geothermal research (Mitigation Fund), which allows to continue to use them for research in other fields, mitigating risks to attract private investment. The resources of these contributions will continue to be used by the Fund Mitigation, and recovered from private investors repetitively. After thirty (30) years from the signing of the agreements, the Mitigation Fund established as a mandatory condition for the private winner of the last bid that the resources are returned directly to the Bank, in the account that the Bank states, to be transferred to the CTF, so that for the state the resources will be non-refundable. The Bank will not disburse the resources of OC until the resources from CTF / SREP are available for the purposes of the Program.

2.3 The resources, regardless of its source will be disbursed over a period of five years from the effective date of the loan agreement, as shown in Table 2:

Table 2. Program disbursements (US $ thousands)

SOURCE	2017	2018	2019	2020	2021	Total
BID (GLM)	196	425	4,695	12,411	4,943	22,670
SREP (Non-reimbursable Grant)	7	14	161	421	147	750
SREP (Contingent recovery grant)	61	130	1,451	3,791	1,317	6,750
CTF (Contingent recovery grant)	86	183	2,048	5,348	1,859	9,524
Local contribution (MEM-ENEL)	76	151	148	3,035	2,977	6,387
Subtotal C1-GEOTHERMAL	426	903	8,503	25,006	11,243	46,081
IDB (blend)	846	3,604	6,189	11,722	6,339	28,700
IDB (Korean Facility)	769	3,266	5,580	10,194	5,191	25,000
Local contribution (ENATREL)	179	151	145	1,579	1,568	3,622
Subtotal C2-TRANSMISSION	1,794	7,021	11,914	23,495	13,098	57,322
TOTAL NI-L1094	2,220	7,924	20,417	48,501	24,341	103,403

B. Environmental and Social Safeguard Risks

2.4 **Environmental Risks.** The Bank prepared an Environmental and Social Management Report (ESMR) presenting in detail the environmental and social risks associated with the program.

2.5 The adverse environmental and social impacts, if not mitigated would be significant, and thus the program was classified as "Category A" according to the Operational Policy OP-703 at IDB, the adverse impacts and significant risks associated with the program are: (i) habitat fragmentation and cumulative effects on forest cover caused by the conversion of habitat inside the Cosigüina Volcano Natural Reserve; (ii) a risk of cumulative effects on water availability caused by the extraction and consumption of water for Component 1, which could affect the viability of Component 1 as well as the health of surrounding communities; (iii) a high risk of natural disasters that could affect the viability of projects of Component 1 and 2 and the health and safety of surrounding communities, such as seismic activity, drought, extreme precipitation and storms, landslides, and volcanic activity; (iv) impact associated with the construction phase of projects regarding Component 1 and 2, such as pollution of surface waters and ground waters and soil by the resulting sludge caused by drilling, air pollution, the generation of noise and vibration impacts, visual impacts, potential contamination from improper waste management, and impacts associated with access and obtaining servitude, among others; and (v) negative impacts on the economic potential of neighboring owners as much as affected communities.

2.6 The mitigation measures that the Borrower shall take include conducting an Additional Assessment to determine the availability of water for Component 1 and identify appropriate management measures prior to distribution to OPC; the implementation of an Action Plan for Biodiversity to restore Cosigüina Volcano Natural Reserve during the period of disbursement; the realization of a Management Framework for Risk Management of Natural Disasters before the program is approved by the Board; the performance of a Supplemental Plan

Management for Transmission Line El Sauce-Villanueva of Component 2; the realization of a Valuation of Prior Compensation for Component 1.

2.7 A description of all the measures that the borrower must implement to mitigate the impacts and relevant risks so that the program meets the Operational Policy OP-703 during the whole validity of the contract, it is described in the Environmental Management and Social (ESMR).

2.8 The contract documents shall include requirements for this purpose, including those reflected in the ESMR, and appropriate monitoring and supervision. After approval of the project, the IDB will actively monitor the performance of the implementation of mitigation measures and environmental and social compensation.

C. Fiduciary Risk

2.9 **Risks.** While the elaboration the analysis of institutional capacity of each executant was updated, allowing the identification of the financial risk that an acceptable internal control for the Bank might not reestablished for fiduciary management. Overall, regarding the fiduciary management it is anticipated that the mitigation of risks measures is related to specific training, a close accompaniment initially and recruitment of ad-hoc personnel with appropriate operations skills necessary for the implementation of Bank's operations. Also an average risk of delays in acquisitions was identified due to the selected personnel not being updated in IDB policies. To mitigate these risks it is proposed to hold a workshop training and clinics scheduled by the IDB for technical and fiduciary staff involved in the Program. The procurement of goods, works, services different from consulting and consulting services will be carried out in accordance with the GN-2349-9 and GN-2350-9 policies.

D. Other Key Issues and Risks

2.10 Public management, governance and development. The following intermediate risk of Public Management and Governance were identified: (i) delays in the ratification of the National Assembly, delay the start of the program; and (ii) delays in fulfilling conditions precedent to the first disbursement delay the onset of the program, particularly the recruitment of the program coordinator and the key personnel of the PEU. As mitigation the following measures are proposed respectively: (i) negotiate with the Energy Commission of the National Assembly, consideration of expediting the approval of the loan agreement by the National Assembly, through a Legislative Decree duly published in the Gazette of the country; and (ii) negotiate with the government entities emissions in the short term, (a) the legal opinion of the Attorney General's Office to establish the date of effectiveness of the program; and (b) Transfer Agreements between ENATREL and MHCP and Implementation Agreement between the MEM and MHCP; and (c) must present evidence of the recruitment of program coordinator and key personnel of the PEU.

2.11 The following intermediate development risks were considered: (i) slow implementation of the Program caused by the participation of government entities; (ii) the delays in obtaining environmental permits, delay the start of

construction of the program; (iii) the limited update on Geothermal Energy, delay the preparation of technical specifications well drilling; (iv) increased costs limits the scope of Component 1; (v) delays in obtaining the results of topographic and geological studies; (vi) delay in negotiations regarding servitude; and (vii) lack of demand from the private sector to invest in the development of geothermal fields.

2.12 The proposed mitigation measures for development risks are: (i) establish a Monitoring Committee of the Program[26] for program monitoring and making important decisions and implement measures to strengthen according to the action plan resultant from the institutional capacity evaluation; (ii) Negotiate with the appropriate authorities to ensure approvals in the time provided; (iii) hire a specialist experienced in geothermal drilling to support the PEU in preparing technical specifications and timely hire the technical and environmental consultant firm considered in the program; (iv) conduct a market research of similar bids before starting the bidding process, ensure a contingency amount from the beginning of the program design, find additional resources from the MHCP and international cooperation, if any; (v) hire such studies with own resources which the Bank may finance retroactively; and (vi) EA constant coordination with local leaders, mayors and political secretaries of the affected regions. A special contractual execution condition will be that prior to the award of each contract work, the EA will show that has legal possession, easements or other rights necessary to start the work; and (vii) as part of the mechanism to attract private investment for the implementation of geothermal projects to be prepared, a plan for disseminating the results of Phases 1 and 2 contained in the feasibility report, aimed at potential investors, will be developed.

2.13 **Financial viability.** The assessment of the financial viability of the program for the Component 1 was conducted through a model of financial analysis of cash flow. The methodology uses this analysis is the evaluation of the Financial Internal Rate of Return (FIRR) using cash flow with costs and revenues, and Financial Net Present Value (FNPV). Sensitivities analysis were done with a discount rate of 12% of the factors considered, as rate energy sales agreement, interest rate debt, period, investment cost, tax rate and exemptions. Compared to the expected rate of return on capital, estimated in Nicaragua as a minimum of 18%, the cases which have a FIRR >18% and a positive FNPV are considered favorable. If confirmed by the exploration the existence of geothermal resource, the project would be financially viable from an energy price of minimum US$102 / MWh, which compares favorably with similar projects[27].

2.14 The Component 2 financial viability was analyzed from the historical evolution and projected financial statements based on financial indicators of ENATREL (EEO # 5) whose monitoring was agreed in previous operations (¶2,18). The results in 2015 were lower than expected: Cash operating margin was 28.8% compared with 30% agreed; the contribution of Net Internal generation of Funds from debt service to investments was -232% versus 35%, and the coverage of debt service reached 0.27 times versus 1.5%. The last two indicators were strongly affected by rising values of the payment of principal and interest due to

[26] In paragraph 2.2.1. Coordination Committee and Monitoring Program (CCSP) MOP contains detailed information about its composition and functioning.

[27] The geothermal project San Jacinto-Tizate, Nicaragua, currently receives a price of US $ 117 / MWh.

arrears ENATREL has registered both of repayment of principal and interest. ENATREL financial projections for the period 2016-2025 were developed considering an investment scenario of US$509 million, a normalization of accumulated debt and an average annual increase of 11% in the transmission toll.

2.15 Based on these financial projections it is estimated that ENATREL will reach the indicators defined as follows: (i) the contribution of the internal generation of net funds should be increased proportionally from that recorded in 2015 to 35% in 2020, continuing at that level in subsequent years; (ii) the cash operating margin calculated as the amount left after covering the costs of operation and maintenance, shall be at least 30%; and (iii) the coverage factor of debt service should be increased proportionally from that recorded in 2015 to 1.5 in 2019 and remain at that level in subsequent years. Monitoring of these financial indicators agreed with ENATREL and the borrower will allow to take the adequate actions to ensure that the income from the operation of ENATREL will be sufficient to cover normal operating costs and maintenance, debt service, and contribute substantially to the investment plan. In this context: The goals defined for these indicators shall be extended in its application to other existing loan operations involving ENATREL. **The monitoring of these indicators will be a special contractual execution condition and will be verified annually**. Should deviations in the indicators occur and if a deterioration of the financial situation of the company is determined, the borrower and the Executing Agency shall send the Bank an action plan that clearly identifies the causes of deviations and the financial management measures to be taken, the responsibilities of the executor and the borrower and the implementation schedule, so as to recover the financial sustainability.

2.16 **Economic viability.** A cost benefit analysis (CBA) was performed for each of the program components, obtaining an Economic Net Present Value (ENPV) cumulatively for the program of US $ 1,929,133,898 and a weighted Economic Internal Rate of Return (EIRR) of 23%. For component 1, was performed a cash flow analysis by making a comparison among the cases analyzed: with and without the existence of the project. Sensibilities were performed of the most important factors considered ("average" social cost per ton of CO2; IFO380 Bunker fuel prices, investment costs, etc.) and compared to the Discount Rate Opportunity (12%). The cases with the EIRR > 12% and positive ENPV are considered favorable. The project involves a positive ENPV and EIRR on the Base Case of 17% and variations in sensitivities ranging from 13% to 29%, (EEO # 1).

2.17 For Component 2 a CBA analysis was performed. It was performed on each of the projects in the program in which its direct and indirect effects were examined, including externalities that possibly arise using a discount rate of 12%. For this analysis projects were classified into two groups, projects reinforcing the national system and projects reinforcing of the regional system. Projects reinforcing national system generate a positive ENPV and EIRR weighted average of 42%. In terms of users, these projects involve an average of around US$5.700 per client economic benefits and include an economic aggregate local investment (adjusted for factors account) of US$41,904,080 generating an economic benefit of approximately US$1,825,000,000. This investment benefits more than 410,000

customers (over 2,000,000 people), resulting in an annual ENPV of about 585 US$/customer. In the case of projects strengthening the regional system, the economic investment of US$12,820,629 generates a ENPV of US $ 1,886,274,275 and EIRR of 23%. Component 2 has a weighted EIRR of 42% and a ENPV cumulative total of US$1,856,323,898. Details are presented in (EEO # 2).

2.18 **Technical feasibility.** Technical feasibility of the projects was analyzed for each component. For Component 1 the technical viability is ensured by a detailed priority plan of investment and work plan that includes different stages of development from the surface research to deep drilling (EEO # 3) processes. For Component 2 technical viability is ensured in the development of design and construction approval processes. The preparation of project designs follows the technical, regulatory and socio-environmental specifications in force in the sector. This process helps mitigate risks associated with social disagreements in areas of influence of the projects to be financed. The development of these projects is an integral part of the expansion plan of ENATREL for the National Transmission System (EEO # 4).

2.19 **Institutional viability.** MEM, which is responsible for formulating and promoting national policies and strategies applicable to the promotion, development, exploration and exploitation of geothermal resources in the country, also may conduct preliminary investigations of geothermal resources under the principles established in the Exploration and Exploitation of Geothermal Resources Act and its regulations (Art, 4 of Act 443). Currently performs drilling in the Cosiguina project to the prefeasibility stage financed by the PNESER. It will also have technical support from ENEL which has extensive experience in geothermal energy. Meanwhile, ENATREL has extensive experience implementing projects of expansion and reinforcement of the transmission system in the country, is it the case of the National Reinforcements of Transmission for SIEPAC (1877 / BL-NI) Project and Support Program for the Electricity Sector (1933 / BL-NI, 193A / BL-NI and NI-L1036). Likewise, is the EA responsible for the coordination and implementation of the largest running program for the electricity sector, such as PNESER (2342 / BL-NI, 2342 / BL-NI-4 and 2342 / BL-NI-5) with a comprehensive application to the sector's needs[28]. ENATREL has proven to be an executor of high management capacity, having completed execution of the first two programs with satisfactory results in 2012 and 2015 respectively, and is currently running the PNESER and NI-L1091 Program.

[28] The PNESER has seven components that have an influence on: rural electrification, standardization of networks, expansion of isolated systems, pre-investment studies, energy efficiency reinforcement of the transmission system and sustainability of isolated systems.

III. IMPLEMENTATION AND MANAGEMENT PLAN

E. Summary of Implementation Arrangements[29]

3.1 The borrower will be the Republic of Nicaragua and the executing agencies will be two (2): The MEM, with technical support from ENEL, for Component 1 and ENATREL for Component 2. A Coordination and Program Monitoring Committee is expected, integrated by the MHCP, MEM and ENATREL. ENEL's participation in the technical aspects of exploration to feasibility level (preliminary investigations) of Cosiguina project will be based on the provisions of Art, 2 of Law 882 2014 amending Act 443, which states that the public entity that will conduct preliminary investigations, must extend participation to ENEL, for which an interagency agreement participation between MEM, ENEL and MHCP will be held. The signing of such agreement establishes the terms and obligations of execution and shall stipulate the roles and responsibilities of the parties, ENATREL is a public company created by Law No. 583, and has its own legal status as Decentralized Entity dependent on the Executive Power, ENATREL will execute the program through PEU-ENATREL. The borrower, through the MHCP, will enter a resources transfer agreement with ENATREL where the terms of such transfer and the obligations regarding ENATREL's execution will be established. **Submit a signed and current inter institutional agreement between the MHCP and the MEM, and another agreement between the MHCP and ENATREL, under which the MHCP undertakes to transfer the loan proceeds and the obligations of implementing each executing agency for proper project implementation, will be a condition precedent to the first disbursement of Bank financing.**

3.2 **PEU**. The PEU will be the responsible units for the administration of each component of the program and serve as interlocutor with the Bank. To perform its tasks the PEU will have a Component Coordinator and the following key personnel: (i) an administrative-financial specialist; (ii) a procurement specialist; and (iii) a monitoring and evaluation specialist, who will work in coordination with specialized career staff in technical and administrative areas of the Ministry. **The evidence of Component Coordinators and key personnel recruiting of the PEU will be a condition prior to the first disbursement. That ENATREL, MEM and ENEL comply with environmental and social obligations included in the Environmental and Social Management and that ENATREL keep the financial indicators specified in the Financial Assessment ENATREL: State and Projection of Financial Indicators; will be considered special contractual conditions for its execution.**

3.3 **POM.** The implementation of the program shall be governed by the provisions of the POM. The POM incorporate all procedures to be used during execution of the program, including a comprehensive monitoring system, monitoring and evaluation of its actions and results, and an Environmental and Social Management Framework for the Geothermal Production Eventual Stage, as described in the PAAS. During execution, the POM may be amended with the written non-objection authorization by the Bank. **Introducing the POM, with**

[29] The section 2.*2 Coordination mechanisms for the implementation* of POM describes in detail the roles, functions and arrangements to / from program actors.

separate chapters for each executor agent, effective and approved by each agency in accordance with the terms and conditions previously agreed with the Bank, will be considered a special condition precedent to the first disbursement.

3.4 **Program Execution Plan (PEP).** The development of program activities will continue a program implemented through the PEP and its annual review that will be reflected in the respective POA. The PEP contains the equivalent POA for each year implementation detail. However, it must be modified each year taking into account the actual progress of the program. The annual reviews of PEP (for example, POA) must be submitted to the Bank.

3.5 **Procurement Plan (PP**). It has been agreed a PP for the first twelve months of implementation. The EA shall update the PP, coinciding with the annual evaluations and before the end of each calendar year or when substantial changes occur. The different types of procurement of goods, works, and consulting services will be made according to GN-2349-9 and GN-2350-9, policies respectively.

3.6 **Retroactive financing**. The Bank may finance retroactively, charging to the loans proceeds, engineering[30] costs incurred by the borrower prior to loan approval up to US $ 500.000 corresponding to 0.5% of the total amount of the transaction; provided they have complied substantially similar to those set forth in the loan agreement requirements. These expenses must have been made from 01 Jun 2016 on, date of approval of the project profile, but never made more than 18 months before the loan approval date.

3.7 **Financial Audit**. External audit services for the program will be provided by an external auditors firm acceptable to the Bank, which will be hired on the basis of the terms of reference to be agreed with the EAs. External audits will be hired under the loan proceeds and must be submitted to the Bank within 120 days after the end of each calendar year during the original disbursement period or extensions by each EA and 120 days from the date of the last disbursement.

F. Summary of Arrangements for Monitoring Results

3.8 **Monitoring**. The Bank team will make semiannual technical visits to the EA to review the program's progress and make adjustments arising from its implementation. Fiduciary oversight visits will be implemented according to the initial fiduciary risk. The amount of these visits will be adjusted according to the risk variation throughout the operation. There are accounting and operational external audits planned to validate the use of the loan proceeds and to validate the internal operational processes and controls to be implemented in the EA. The information collected will be analyzed each semester and monitoring and progress report will be made once a year (see Monitoring and Evaluation Plan).

[30] Component 1. Assessment Study of environmental and social impact. Component 2. Topographic and geological studies for TL and SS and LIDAR survey on existing transmission lines (partial).

3.9 The environmental and social monitoring will focus on compliance with environmental and social requirements contained in the Agreement, including the ESAP, according to the timing Schedule described in the ESAP.

3.10 **Evaluation.** The Evaluation Program includes an interim evaluation and a final evaluation, funded by the EAs with the loan proceeds. The interim evaluation will be hired by the EAs, within a maximum period of two months after the 50% commitment of the loan has occurred. The final assessment will include a cost - benefit analysis ex post and will be hired by the EA within a maximum period of two months after it has been paid 95% of the loan. The final evaluation will determine the degree of compliance with the goals established in the results matrix, that is to say examine the before and after program implementation. The semi-annual and annual reports will be presented by the EA under the Program Monitoring and Evaluation Plan, In addition, a workshop for elaboration for final report will be performed and an ex post cost benefit analysis will be performed as well, to verify the assumptions of the operation.

ANNEX I. RESULTS MATRIX

Objective	The objective of the project is to contribute to the sustainability of the electricity sector in Nicaragua. The specific objectives are: (i) developing exploration of the geothermal potential to diversify the energy matrix; and (ii) increase the accessibility and reliability of the electrical energy service by increasing the capacity of national and regional transmission implementing reinforcements to the grid.

Result / Indicator	Base Line 2016	Goal 2021	Observations/Means of Verification
Development of the geothermal potential of Nicaragua in an environmentally and financially sustainable manner			
Geothermal potential for the generation of additional electricity to the existing, explored at the level of feasibility, in MW	0	40	Feasibility study of the Cosigüina field approved by the MEM and ENEL
Geothermal exploitation concessions granted	0	1	Concession agreement between the MEM and a private or public-private investor, signed by both parties.
CIF financial leverage (USD million in 2021)	0	29.057	Loan Contract signed between the Government of Nicaragua and the IDB
GHG emissions avoided (tons of CO_2e/year starting in 2025)	0	197,794	Final Project Completion Report
Oil imports reduction (USD million per year starting in 2025)	0	23.6	Final Project Completion Report
Assurance of the supply of electric power in a continuous, reliable, accessible and cost effective manner in the areas benefited from the expansion of the electricity infrastructure of the program.			
Non-served energy[1] in GWh in the areas of influence[2] of the program.	1,178	0,080	The measurements of non-served energy shall be verified through technical and statistical reports of the Centro Nacional de Despacho de Carga (CNDC).
Optimization of the power load capacity of the Electrical Interconnection System of the Central America Countries (SIEPAC) in the tranches located in Nicaragua.			
Maximum Capacity of Regional Transfer in MW in the area Nicaragua-Honduras N-S increased [3].	120	300	The goal assumes that in addition to the reinforcements included under this program, all the reinforcements planned for the SIN are built. Report of the Regional Operating Entity

[1] Non-supplied energy refers to the amount of energy that is kept from delivery to users by reason of an event in the Transmission System which in turn, causes restrictions to the availability of the system's assets, preventing the transportation of energy.

[2] Central Region: Jinotega Department (Municipalities: Jinotega, La Concordia, Santa María de Pantasma, San Rafael del Norte y San Sebastián de Yalí); Madriz Department (Municipalities: San Juan de Rio Coco); Matagalpa Department (Municipalities: El Cuá, Rancho Grande); Nueva Segovia Departament (Municipalities: Ciudad Antigua, Jalapa, El Jícaro, Murra, Quilali, San Fernando, Wiwili de Nueva Segovia). Costa Caribe Region: North Atlantic Autonomous Region Departament (Municipalities: Waslala).

Maximum Capacity of Regional Transfer in MW in the area Nicaragua-Costa Rica S-N increased[4].	100	300	(EOR). The transfer capability shall be verified through technical and statistical reports of the EOR.

Products / Milestones	Base Line	Year 1	Year 2	Year 3	Year 4	Year 5	Goal	Observations/Means of Verification
Component 1.a. Exploration at a feasibility level of the Cosigüina filed with geothermal potential.								
1. Exploratory wells of commercial diameters, drilled[5].	0	0	0	3	2	0	5	Technical report approved by the MEM and the ENEL.
2. Feasibility study for the exploitation of the Cosigüina[6] field	0	0	0	0	1	0	1	Final report of the study approved by the MEM and ENEL
Component 1.b. Development of a mechanism to attract private investment for the implementation of geothermal projects.								
3. Designed mechanism for the mitigation of risk of geothermal exploration[7].	0	0	0	0	0	1	1	Study approved by the MEM
4. Designed bidding process for the concession of geothermal exploitation[8].	0	0	0	0	0	1	1	Report approved by the MEM which includes all the documentation prepared for the bidding process.
Cost								
Component 2.a. Improvement of the physical infrastructure of transmission to guarantee and increase the supply of								

[3] The increased areas of control refer to the Transmission Grid controlled by the CNDC, which also include the substations of neighboring countries to which the regional interconnection lines arrive.
[4] The increased areas of control refer to the Transmission Network controlled by the CNDC, which also include the substations of neighboring countries to which the regional interconnection lines arrive.
[5] The drilling process consists of civil works of preparation including the enlargement of platforms, the improvement of access to the wells, the construction of a water pumping station and the drilling of wells with a commercial diameter.
[6] The study shall include a detailed analysis with technical, social, environmental and financial information about the geothermal potential of the Cosigüina field.
[7] This study shall include: (i) proposal of the actions directed to support geothermal investigations from recovered resources, which allow their continued use for investigations in other fields, mitigating risks to attract private investment; (ii) a training plan and broadcasting of the results obtained in Phases 1 and 2 directed to potential investors, the MHCP and PRONicaragua.
[8] Includes the preparation of the documents necessary to call biddings and the agreements that may be required.

continuous electric power to meet the demand for electricity and the generation of power in the areas of intervention of the program.								
5. Substations (S/S) Villa Nueva and El Sauce built and in operation (S/S).	0	0	0	0	0	2	2	Minutes of receipt of works, supply, installation and start-up of equipment approved by ENATREL including as annexes, the technical-environmental supervision reports.
6. Transmission line in 138 kV El Sauce – Villanueva Sauce built and in operation.[9] (km).	0	0	0	0	0	38	38	
7. S/S Sebaco expanded and in operation (S/S).	0	0	0	0	1	0	1	
8. S/S San Benito, Catarina, Diriamba, Acahualinca and Ticuantepe II built and in operation (S/S).	0	0	0	0	5	0	5	
9. S/S Ticuantepe I built and in operation (S/S).	0	0	0	0	0	1	1	
10. Transmission line related to the S/S Ticuantepe I built[10] (km).	0	0	0	0	0	2	2	
11. Mobile transformer of 40 MVA acquired (transformer).	0	0	0	1	0	0	1	
Component 2.b. Improvement of the physical infrastructure of transmission to optimize the load capacity of the regional T/L in the tranches located in Nicaragua.								
12. 230kV transmission lines with an increased transmission capacity through the replacement of conductors in the area Leon – Honduras Border and Amayo – Costa Rica Border, in operation. (km)	0	0	0	0	97	0	97	Technical report approved by the CNDC.
13. 230 kV transmission lines with an increased transmission capacity through a LIDAR survey and the re-tightening of conductor, in operation. (km)	0	0	0	0	0	213	213	

[9] Includes the construction, assembly and start-up of the 138kV output bay of the S/S La Dalia.
[10] Includes the construction, assembly and start-up of the 138kV output line bay of the S/S La Dalia.

Document of the Inter-American Development Bank

NICARAGUA

RENEWABLE ENERGY WIDENING PROGRAM IN LOW INCOME COUNTRIES (SREP)

(NI-L 1094)

ANNEX II: Economic Analysis for Component 1

This document was prepared by PELICAN, S.A., Consulting Firm

PROGRAM FOR THE WIDENING OF RENEWABLE ENERGY IN LOW INCOME COUNTRIES (SREP)

(NI-L 1094)

1. INTRODUCTION

The SREP program promotes initiatives to widen access to energy and stimulate economic growth by means of the use of renewable energies, as well as initiatives aiming at the energy market's transformation and dynamism by means of public policies. The program is financed by the Strategic Climate Fund (SCF), one of the Investment Fund's Strategic Funds for Climate (CIF). The CIF provides financing for developing countries under concessional terms, concessional loans or else risk mitigation instruments, in order to foster renewable energies' generation projects promoting a development based on low emissions. The SCF, as a strategy, focuses on financing pilot projects with potential replication at a larger scale or at national scaling level, the focus of the SREP Program, as part of the SCF, aims at two lines of work:

- Line 1: Initiatives to widen access to energy and stimulate economic growth by means of larger use of renewable energy, and,
- Line 2: Transformation of the renewable energy market through public policies, eliminating hurdles and allowing greater availability of capital and income: support to governments for the creation of markets, private sector participation and productive use of energy.

SREP PROGRAM IN NICARAGUA

Nicaragua was declared illegible to have access to funds of the SREP program in the year 2014. In the year 2015, the country submitted its proposal for an Investment Plan (PINIC) up to the amount of US$30.0 millions. Projects eligible for SREP funds, derive from the PINIC, corresponding to two specific components:

- Component 1: Development of Nicaragua's geothermal sector's development
- Component 2: Integral development of rural zones, isolated zone's energizing by means of rural electrifying, and promotion of renewable energies for productive uses. Three kinds of projects derive from this component:
    - 2A: Photovoltaic Solar Systems (PVS) for rural electrifying and promotion of rural energies service enterprises (ESCOs),
    - 2B: Adoption and transfer of Clean Kitchens for residential uses, and,
    - 2C: Development of renewable energies' technologies for productive uses supporting the micro, small and medium enterprises (MSMEs), hydroelectric, firewood, biomass, SFV and solar energy.

Under these two components, the SREP program comprises projects aimed at four renewable energy sectors: Geothermal, Photovoltaic Systems, Clean Kitchens and renewable energy for productive uses.

This Attached document of the Nicaragua SREP Program, consists in the cost-benefit analysis (CBA) for the type of projects of the Geothermal sector (Component 1) in 3 potential exploitation fields: Mombacho, Apoyo and Cosigüina.

2. COMPONENT 1 COST – BENEFIT ANALYSIS

The ABC for geothermal energy projects was done to prioritize projects selected by the Government of Nicaragua, those requiring investment in depth studies, as well as additional excavation investments, as a condition to move forward large scale investments, allowing to unblock the geothermal sector at the country. For such end three primary fields have been analyzed, in order to facilitate the decision on which of them is the most attractive for investments in this sector.

- Mombacho Volcano
- Caldera de Apoyo and
- Cosigüina Volcano

The budget requested for SREP in May 2015 for component 1 was the following:

Components / Sub-components	SREP	SREP-IDB		SREP-World Bank	
		Grant	Reimbur-sable	Grant	Reimbur-sable
Surface studies and slim-holes (Resource's identification)	4.00	0.75	3.25		
Production wells (resource's Confirmation)	17.25		3.50	7.00	6.75
Feasibility studies	0.50			0.50	
Investment	0.00				
Technical assistance	0.75	0.00		0.75	
Subtotal Component #1	**22.50**	**0.75**	**6.75**	**8.25**	**6.75**

Table 1: SREP Investment's summary – Component 1

ECONOMIC ANALYSIS METHODOLOGY

The economic evaluation has the purpose to determine the economic impact of the considered project, which considered both the social and national points of view.

For this purpose, the cash flow was analyzed comparing to cases, the existence and the non-existence of the project. The methodology used in this analysis is the financial internal rate of return (IRR_f), and the net current present value (NPVe) similar to the financial net present value (NPV_f).

The considered factors' sensibilities are compared at the Opportunity Discount Rate (12%).

Are deemed favorable, cases that:

- Have a TIR_E > 12%
- Have a positive VAN_E

Economic cost

The total economic cost consists of the net cost, taxes and subsidies. However, taxes and subsidies, at the national economy, are simply transferred between the Project and the Government, for which reason, they are eliminated from total cost. Then, the net cost is the economic cost's basis. Accordingly, in order to obtain economic costs one must adjust the domestic cost with the frontier cost, an adjustment for which a conversion factor is used, one assumed discounting at 10% of DAI.

The considered project's assumed investment costs are summarized at the following table:

Initial investment cost

The initial investment's cost is estimated based on two elements:

a) the generation plant's cost by installed gross power and;
b) the quantity of wells required in order to achieve the project's estimated size, excluding taxes and converting the total cost into frontier cost.

Operation and maintenance cost (O&M)

In the same manner as for the financial analysis, one assumes that the O&M cost will reach 3% of the initial investment.

Reposition wells during the project's life

In geo-thermoelectric generation projects additional wells are needed in order to replace those in which the geothermal fluid's production capacity diminishes. In this project one has considered the Reposition Wells' drilling chronogram (also mentioned in the TIR_E analysis) and an estimate of its economic cost.

Definition of Economic Benefit

The economic benefits consist of:

a) additional benefits granted to consumers by means of the project's incorporation "incremental benefits"

In this case one must measure the value added by the energy excess generated by the project vs. the case without the project. At the contemplated scenario, if the project were not made, there would not be a generation deficit in view of the fact that Nicaragua's Expansion Plan contemplates other available technologies in order to satisfy the demand. The benefit from incremental energy is then null.

b) those benefits implying savings in costs, or "non incremental benefits"

In this case, substitution of imported fossil fuel (Heavy Fuel Oil), created by the substitution of a fossil thermal plant of equal size which would be fully displaced on the day when the geothermal project begins to operate reaches more than 50% of the energy sold in 2015 (INE's 2016 electrical statistics), and still represented 54% of the country's installed capacity at the end of 2015.

The additional benefits to consumers may be estimated starting from the installed gross energy generated by the geo-thermoelectric plant. The benefits implying savings under the effect of the Project's implementation include oil imports' reduction, since the geothermal one is an alternative energy source, part of the current thermal generation by means of fossil fuels would be replaced.

The type of thermal generation, of which the consumption is going to be reduced is the Bunker Co oil, equivalent to IFO380m whose price is estimated at US$268/ton in 2023, with basis on the 2015 Study of The United States' EAI[1]

The historical data in the European market (Rotterdam harbor, see source) and are projected at future with "low" and "high" was generated using the same evolution annual rates starting from an initial price +/- 20% in 2016.

c) the effect of CO_2 gas reduction, also a product of the project's incorporation and of the substitution of a thermal fossil plant of the same size that would be displaced.

[1] Source: http://www.eia.gov/forecasts/aeo/data/browser/#/?id-12-=AEO2016

The effect of CO_2 gas reduction means that if there were not this geothermal project, electricity would have been provided by oil thermal plants, with a substitution factor depending on the Expansion Plan foreseen for the country. It is assumed that it is 100%.

That is to say that with the project we may reduce the CO_2 gas and we include monetary terms in this effect. An oil thermal plant generates 726 tons of CO_2 by GWh annually. In the case of 40 MW we have 217,504 tons per year. On another hand, a 40 MW capacity geo-thermal plant typically generates non-condensable gases in a proportion of 1% of the vapor it consumes, within which 75% is CO_2. In accordance with it, the emission will reach 19.710 equivalent tons yearly. They are converted into a monetary value using Carbon's social price. Indicated by the projection study of the EPA[2] agency of the United States, proposing a "medium" social cost per CO_2 ton in 2015 and projected until 2050. The same study proposes alternate scenarios with several discount rates at future cost.

Revised Social Cost of CO_2, 2010 – 2050 (in 2007 dollars per metric ton of CO_2)

Discount Rate Year	5.0% Avg	3.0% Avg	2.5% Avg	3.0% 95th
2010	10	31	50	86
2015	11	36	56	105
2020	12	42	62	123
2025	14	46	68	138
2030	16	50	73	152
2035	18	55	78	168
2040	21	60	84	183
2045	23	64	89	197
2050	26	69	95	212

Table 2: Social CO_2 cost (at US$2007 per t)

Source: Interagency Working Group on Social Cost of Carbon, United States Government, 2015

The medium scenario was considered with an average of 3%, and so were the "low" and "high" price scenarios at 5% and 3% 95th, respectively.

THE FINANCIAL ANALYSIS' METHODOLOGY

The financial analysis' objective is to analyze the project's financial feasibility, In other words, it is analyzing if the project will generate profits or will have losses. The methodology used by this analysis is the evaluation of the Financial Internal Rate of Return (IRR_F) using the cash flow with costs and benefits, and a financial NPV (NPV_F).

The considered factors' sensibilities are compared to the Capital's anticipated Rate of Return, estimated in Nicaragua as a minimum of 18%. Are considered favorable, the cases that:

- Have a $IRR_F > 18\%$
- Have a positive NPV_F

Financial cost

The cost consists of initial investments, operation and maintenance and additional drilling costs. Detailed costs are used in SREP report.

[2] https://www3.epa.gov/climatechange/EPAactivities/economic/scc.html

Initial investment's cost

The necessary cost is different if the cost is leveraged or not. The research, wells development, plant's construction, etc. costs are distributed throughout the years according to the chronogram shown at the financial flag.

If the project is leveraged, one must add the interests incurred during the construction period (at a rate that may be different from the Senior rate) and the transaction expenses.

Operation and maintenance cost

Estimated as 3% of the initial investment

Additional wells' cost

In the case of geothermal projects, in order to adjust against the wells' productivity's drop, it becomes necessary to drill additional wells. The costs are detailed at the financial flag.

Financial Benefit's definition

The project's financial benefits consist of the income obtained from the sales of electricity and they may escalate under the terms of the offered IPP. This amount is the sum of the energy sale (which is the tradable generated volume (GWh) multiplied by its estimated unitary price) and the premium for the facility's capacity, is applied.

In the case of a 40MW plant, the tradable volume is 299.59 GWh annually, considering 10 percent of the plant's interior use and a plant factor of i90%.

The estimated "all-in" price is defined by the MEM (2015) prices' band. This estimated unitary price basis is US$0.092/kWh which corresponds to the price maximum established at the range of 0.074 to 0.092 US$/kW that the government established as unitary price in 2015. The effect of inflation has been taken into account to a certain point by means of the implementation of its 3% adjustment (half the real figure) effective for up to eight (8) years after the operation's initiation. With this adjustment, the estimated unitary price reaches US$ 116.54/MWh in2003.

Adding these factors one gets the annual financial benefit, taking into account the following relevant factors:

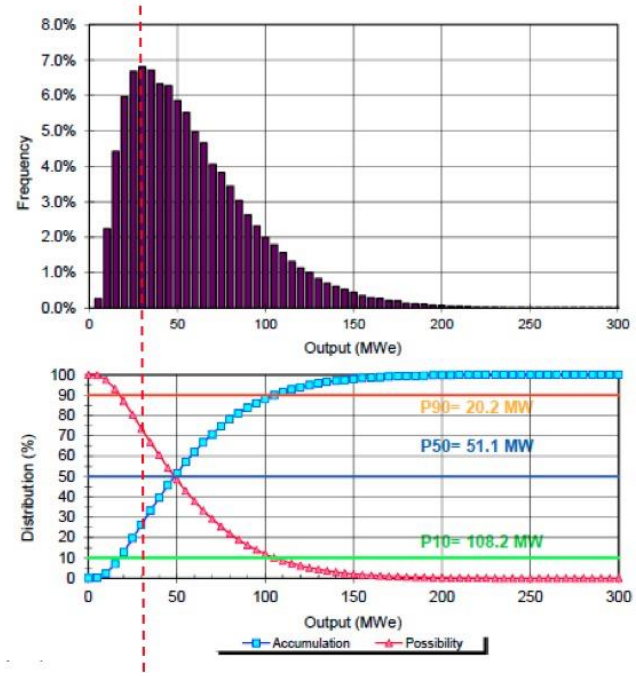
- The benefits and incentives of Law 532 (bearing in mind that they be extended beyond he law's current life until 2018): 7 years income tax exemption, and a progressive exemption of municipal taxes. The total exemption on Value Added Tax (VAT, 15%) and import taxes.
- The payment of charge for transmission to ENATREL, estimated at 50% of the total price escalated at 1% annually.
- A straight line fiscal depreciation over 10 years
- The possibility of cashing the interests during the construction phase at a rate lower than the senior debt rate.
- A variable recovery rate by the GNI by the private developer of the total exploration costs. Including the reduced diameter wells' drilling phase within the PNESER frame. A progressive calendar, also, for these costs' repayment, which may be added to the financing plan (senior debt).
- The possibility of exempting, from the project's investment cost, the construction of the 77 km transmission line up to the geothermal site.

MOMBACHO VOLCANO

Cost-benefit analysis methodology and results: Mombacho Volcano

For the Mombacho Volcano, a detailed study of the secondary information obtained was made, considering two exploration scenarios (Mombacho 1 and Mombacho 2). In both scenarios the exploration was analyzed in order to know the distribution of the geothermal potential.

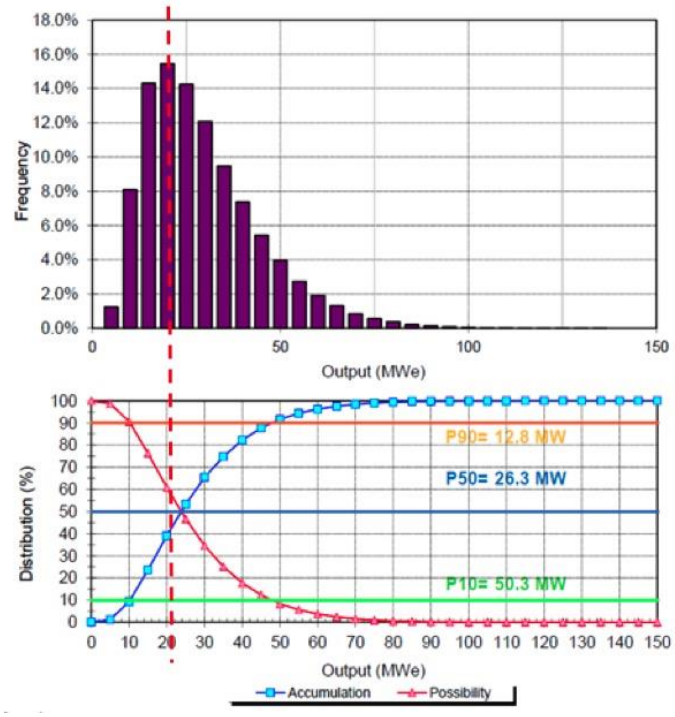
For both fields, an estimate was made under the stored heat volumetric method combined with the Monte Carlo method, proposing the following described resource probabilities:



Input

Parameter	min.	most likely	max.
Reservoir Area (km^2)	1.76	-	11.10
Reservoir Thickness (m)	1000	-	2000
Rock Density (kg/m^3)	2400	2500	2600
Porosity (-)	0.05	0.10	0.15
Recovery factor (-)	0.125	0.250	0.375
Rock Specific Heat (kJ/kg°C)	-	1.00	-
Reservoir Average Temperature (°C)	200	250	300
Reservoir Average Pressure (MPa)	-	15.0	-
Heat-Electricity Conversion Factor (-)	0.045	0.087	0.116
Plant Life (year)	-	30	-
Load Factor (-)	-	0.85	-
Abandonment Temperature (°C)	-	160	-

Figure 1: Distribution of resource probabilities of Mombacho-1 field (Monte Carlo)
Source: Pre-feasibility study West JEC, 2015



Input

Parameter	min.	most likely	max.
Reservoir Area (km^2)	1.73	-	6.06
Reservoir Thickness (m)	1000	-	2000
Rock Density (kg/m^3)	2400	2500	2600
Porosity (-)	0.05	0.10	0.15
Recovery factor (-)	0.125	0.250	0.375
Rock Specific Heat (kJ/kg°C)	-	1.00	-
Reservoir Average Temperature (°C)	200	240	280
Reservoir Average Pressure (MPa)	-	15.0	-
Heat-Electricity Conversion Factor (-)	0.045	0.080	0.105
Plant Life (year)	-	30	-
Load Factor (-)	-	0.85	-
Abandonment Temperature (°C)	-	160	-

Figure 2: Distribution of resource probabilities of Mombacho-2 field (Monte Carlo)
Source: Pre-feasibility study West JEC, 2015

For analysis purpose, only one case: 40 MW scenario was used, as one having a higher than 80% probability.

Project Mombacho's Economic Costs

The total economic cost consists of the net cost, taxes and subsidies. However, taxes and subsidies, at national economy, are simply transferred between the Project and the Government, for which reason, they are eliminated from total cost. Then, the net cost is the economic cost's basis. Besides, there is the tendency of over estimating the domestic costs by reason of the over valued rate of exchange type, one that was assumed discounting 10% of DAI.

A summary of the economic costs of the project can be found in the following table:

Investment detail			Cost	Local cost	With VAT	% ext.
Development	**Slim wells.**	**Commercial wells**				
Environmental and social consultancies			0.5	0.45	0.58	0%
Civil works for development stage			1.256	1.13	1.44	0%
Drilling for resource's evaluation (JICA)	0	4	26	26	29.90	100%
SREP support in drilling	0	0	2.55	2.55	2.93	100%
Feasibility study			1	1	1.15	100%
Other wells (estimated)	0	9	63.60	63.60	73.14	100%
Construction						
Geothermal plant			60	58.68	69.00	78%
Fluids system			19.3	18.91	22.20	80%
Access ways			4.6	4.14	5.29	0%
Site			1	0.9	1.15	0%
Transmission line			7.381	7.00	8.49	48.3%
Administration			5	4.5	5.75	0%
Consultancy services			10	10	11.50	100%
		Cost	202.19	198.86	232.52	
Contingency			10.1	9.943	11.63	
Total CAPEX			**212.30**	**208.81**	**244.14**	
Wells during all the Project						
Mobile/Withdrawal			20.25	20.25	23.29	100%
Production wells			84.5	84.50	97.18	100%
Reinjection wells			45.5	45.50	52.33	100%
Pumps			2.4	2.40	2.76	100%
Platform			1.26	1.26	1.45	100%
Total wells			**153.91**	**153.91**	**177.00**	

Table 3: Investment costs of the 40 MWe (gross) project – Mombacho
Source: ACB model of Mombacho volcano – PELICAN, S.A

Project Mombacho's Economic Benefits

The investments' economic analyses, income and expenditures were made for two scenarios, with the construction of 30 and 40MWe generation plants. From the analysis made only one case was selected, that of 40MWe.

The project's assumed economic benefits are summarized as follows:

Benefits	Value
HFO price / IF0380 (oil invoice savings)	263 US$/ton (2016)
Thermal plant (HFO consumption, efficiency 38%)	226 ton/GWh
Substitution factor	100%
Emission factor	100%
Thermal plants' CO_2 emission	726 tCO2/GWh
Consumed vapor (geothermal efficiency)	300 TPH
Geothermal plants' CO_2 emissions	0.75%
Coal's social cost (tCO_2)	Under EPA scenario

Table 4: geothermal project's assumed economic benefits

The project's economic return is shown as follows, IRR_E *(Economical IRR, EIRR)*

Mombacho		Características			Inversión					Total de costos económicos	Beneficios económicos										Total de beneficios económicos
N°	Año	Potencia bruta	Generación		CAPEX Inicial	# pozos adicionales	Reinversión	Total inversión	O&M		Incrementales (con el proyecto)				No incremental: reducción CO2		No incrementales: ahorro de importaciones			Total	
			Bruta	Neta																	
	Año	1.1	1.2	1.3	3	4.1	4.2	5 = 3 + 4.2	6	7 = 5 + 6	8.1 MW incr.	8.2 MW base	8.3 Balance energ.	8.4 Valor $/MWh	9.1	9.2	10.1	10.2	10.3 HFO	11=8+9+10	8 = 11 - 7
		MW	GWh	GWh	MUS$	#	MUS$	MUS$	MUS$	MUS$					MUS$	$/tCO2	MUS$	% sub	US$/t		MUS$
C1	2016				1.86			1.86		1.86											-1.86
C2	2017				23.54			23.54		23.54											-23.54
C3	2018				3.44			3.44		3.44											-3.44
C4	2019				2.91			2.91		2.91											-2.91
C5	2020				52.51			52.51		52.51											-52.51
C6	2021				79.90			79.90		79.90											-79.90
C7	2022				44.64			44.64		44.64											-44.64
1	2023	40 MW	315.36	299.59		0	0	0.00	6.26	6.26	40.00	40.00	0	N/A	8.31	42.00	42.21	100%	622.59	50.51	44.25
2	2024	40 MW	315.36	299.59		0	0	0.00	6.26	6.26	40.00	40.00	0	N/A	8.47	42.80	43.19	100%	637.18	51.66	45.40
3	2025	40 MW	315.36	299.59		0	0	0.00	6.26	6.26	40.00	40.00	0	N/A	8.62	43.60	44.38	100%	654.64	53.00	46.74
4	2026	40 MW	315.36	299.59		2	15.67	15.67	6.26	21.93	40.00	40.00	0	N/A	8.78	44.40	45.85	100%	676.40	54.63	32.70
5	2027	40 MW	315.36	299.59		0	0	0.00	6.26	6.26	40.00	40.00	0	N/A	8.94	45.20	47.09	100%	694.62	56.03	49.76
6	2028	40 MW	315.36	299.59		0	0	0.00	6.26	6.26	40.00	40.00	0	N/A	9.10	46.00	48.13	100%	709.97	57.23	50.96
7	2029	40 MW	315.36	299.59		0	0	0.00	6.26	6.26	40.00	40.00	0	N/A	9.26	46.80	49.53	100%	730.66	58.79	52.52
8	2030	40 MW	315.36	299.59		1	8.87	8.87	6.26	15.13	40.00	40.00	0	N/A	9.41	47.60	50.39	100%	743.31	59.80	44.67
9	2031	40 MW	315.36	299.59		0	0	0.00	6.26	6.26	40.00	40.00	0	N/A	9.57	48.40	51.95	100%	766.40	61.53	55.26
10	2032	40 MW	315.36	299.59		0	0	0.00	6.26	6.26	40.00	40.00	0	N/A	9.73	49.20	53.54	100%	789.76	63.27	57.01
11	2033	40 MW	315.36	299.59		0	0	0.00	6.26	6.26	40.00	40.00	0	N/A	9.89	50.00	55.16	100%	813.71	65.05	58.79
12	2034	40 MW	315.36	299.59		2	15.67	15.67	6.26	21.93	40.00	40.00	0	N/A	10.05	50.80	56.88	100%	839.01	66.92	44.99
13	2035	40 MW	315.36	299.59		0	0	0.00	6.26	6.26	40.00	40.00	0	N/A	10.21	51.60	57.97	100%	855.15	68.18	61.91
14	2036	40 MW	315.36	299.59		0	0	0.00	6.26	6.26	40.00	40.00	0	N/A	10.36	52.40	59.74	100%	881.21	70.10	63.84
15	2037	40 MW	315.36	299.59		0	0	0.00	6.26	6.26	40.00	40.00	0	N/A	10.52	53.20	60.81	100%	897.08	71.34	65.07
16	2038	40 MW	315.36	299.59		0	0	0.00	6.26	6.26	40.00	40.00	0	N/A	10.88	55.00	62.61	100%	923.53	73.48	67.22
17	2039	40 MW	315.36	299.59		1	8.87	8.87	6.26	15.13	40.00	40.00	0	N/A	10.84	54.80	64.00	100%	944.05	74.84	59.70
18	2040	40 MW	315.36	299.59		0	0	0.00	6.26	6.26	40.00	40.00	0	N/A	11.00	55.60	66.00	100%	973.58	77.00	70.73
19	2041	40 MW	315.36	299.59		0	0	0.00	6.26	6.26	40.00	40.00	0	N/A	11.16	56.40	69.18	100%	1020.56	80.34	74.08
20	2042	40 MW	315.36	299.59		0	0	0.00	6.26	6.26	40.00	40.00	0	N/A	11.31	57.20	72.52	100%	1069.80	83.84	77.57
21	2043	40 MW	315.36	299.59		0	0	0.00	6.26	6.26	40.00	40.00	0	N/A	11.87	60.00	76.02	100%	1121.42	87.89	81.62
22	2044	40 MW	315.36	299.59		2	15.67	15.67	6.26	21.93	40.00	40.00	0	N/A	11.63	58.80	79.69	100%	1175.53	91.32	69.39
23	2045	40 MW	315.36	299.59		0	0	0.00	6.26	6.26	40.00	40.00	0	N/A	11.79	59.60	83.53	100%	1232.24	95.32	89.06
24	2046	40 MW	315.36	299.59		0	0	0.00	6.26	6.26	40.00	40.00	0	N/A	11.95	60.40	87.56	100%	1291.70	99.51	93.25
25	2047	40 MW	315.36	299.59		0	0	0.00	6.26	6.26	40.00	40.00	0	N/A	12.10	61.20	91.79	100%	1354.03	103.89	97.63
26	2048	40 MW	315.36	299.59		0	0	0.00	6.26	6.26	40.00	40.00	0	N/A	12.66	64.00	96.22	100%	1419.36	108.88	102.61
27	2049	40 MW	315.36	299.59		2	15.67	15.67	6.26	21.93	40.00	40.00	0	N/A	12.42	62.80	100.86	100%	1487.84	113.28	91.35
28	2050	40 MW	315.36	299.59		0	0	0.00	6.26	6.26	40.00	40.00	0	N/A	12.58	63.60	105.73	100%	1559.63	118.31	112.04
29	2051	40 MW	315.36	299.59		0	0	0.00	6.26	6.26	40.00	40.00	0	N/A	12.74	64.40	110.83	100%	1634.88	123.57	117.30
30	2052	40 MW	315.36	299.59		0	0	0.00	6.26	6.26	40.00	40.00	0	N/A	12.90	65.20	116.18	100%	1713.77	129.07	122.81
Total					208.80	10	162.91	289.22	187.93						319.04		2049.54			2368.58	1891.43
																				TIRE	17.69%
																				VANE	80.02

Table 5: Geothermal –Mombacho- project's economic return calculation

The project's financial return calculation is shown as follows, taking into account the project's real costs in order to calculate the IRR_E (*Financial IRR, FIRR)*, without taking into account an investor's IRR, with the possible positive effect that the project's financing could have (Project Finance).

Mombacho		Generación y Ventas			Ingresos			Inversión					O&M	Financiamiento					Impuestos				Gastos		Flujos proyecto	Flujos Equity
N°	Año	Potencia	Generación		PPA (Tarifa)	Peaje (Tarifa)	Total	CAPEX Inicial	CAPEX Desarrollador	# pozos adicionales	Reinversión	Total inversión	Costos	Deuda Const	Gastos de transacción	Repago al GNI	Deuda Sr	Depreciación fiscal	IR apalancado	IR sin apalanc.	IMI	Totales apalancados	Totales sin apalanc.	Netos sin apalanc.	Netos apalancados
		bruta	Bruta	Neta																						
		1.1	1.2	1.3	2.1	2.2	2.3	3.1	3.2	4.1	4.2	5 = 3 + 4.2	6	7.1	7.2	7.3	7.4	8	8.1a	8.1b	8.2	9 = 6+7+8	10 = 5+6+8	8 = 2 - 7	8 = 2 - 7
		MW	GWh	GWh	$/MWh		MUS$	MUS$	MUS$	#	MUS$	MUS$	MUS$	MUS$	MUS$	MUS$	MUS$	MUS$	MUS$	MUS$	MUS$	MUS$	MUS$	MUS$	MUS$	MUS$
C1	2016							1.89	0.00			1.89		0.00		0.00	0					0.00	1.89	-1.89	0.00
C2	2017							23.94	0.00			23.94		0.00		0.00	0					0.00	23.94	-23.94	0.00
C3	2018							3.50	0.00			3.50		0.00		0.00	0					0.00	3.50	-3.50	0.00
C4	2019							2.96	45.25			2.96		1.13		0.00	0					9.28	2.96	-2.96	-9.28
C5	2020							53.39	45.25			53.39		2.26		0.00	0					9.50	53.39	-53.39	-9.50
C6	2021							81.23	45.25			81.23		3.39		0.00	0					9.73	81.23	-81.23	-9.73
C7	2022							45.38	45.25			45.38		4.52	7.10	31.31	0					17.63	45.38	-45.38	-17.63
1	2023	40 MW	315.36	299.59	116.54	4.63	33.53			0	0.00	0.00	6.37	0.00		0.00	19.93	10.61	0.00	0.00	0.08	26.38	6.45	27.08	7.15
2	2024	40 MW	315.36	299.59	120.04	4.68	34.56			0	0.00	0.00	6.56	0.00		0.00	19.93	10.61	0.00	0.00	0.09	26.57	6.65	27.92	7.99
3	2025	40 MW	315.36	299.59	123.64	4.72	35.63			0	0.00	0.00	6.76	0.00		0.00	19.93	10.61	0.00	0.00	0.09	26.77	6.85	28.78	8.85
4	2026	40 MW	315.36	299.59	127.35	4.77	36.72			2	18.02	18.02	6.96	0.00		0.00	19.93	10.61	0.00	0.00	0.18	45.09	25.16	11.56	-8.37
5	2027	40 MW	315.36	299.59	131.17	4.82	37.85			0	0.00	0.00	7.17	0.00		0.00	19.93	10.61	0.00	0.00	0.19	27.28	7.36	30.50	10.57
6	2028	40 MW	315.36	299.59	135.11	4.87	39.02			0	0.00	0.00	7.38	0.00		0.00	19.93	10.61	0.00	0.00	0.20	27.51	7.58	31.44	11.51
7	2029	40 MW	315.36	299.59	139.16	4.91	40.22			0	0.00	0.00	7.60	0.00		0.00	19.93	10.61	0.00	0.00	0.20	27.73	7.81	32.41	12.49
8	2030	40 MW	315.36	299.59	143.33	4.96	41.45			1	10.20	10.20	7.83	0.00		0.00	19.93	10.61	3.69	10.09	0.21	41.86	28.33	13.13	-0.41
9	2031	40 MW	315.36	299.59	147.63	5.01	42.73			0	0.00	0.00	8.07	0.00		0.00	19.93	10.61	4.00	10.40	0.32	32.32	18.79	23.94	10.41
10	2032	40 MW	315.36	299.59	152.06	5.06	44.04			0	0.00	0.00	8.31	0.00		0.00	19.93	10.61	4.32	10.72	0.33	32.89	19.36	24.68	11.15
11	2033	40 MW	315.36	299.59	156.62	5.11	45.39			0	0.00	0.00	8.56	0.00		0.00	19.93	10.61	4.66	11.05	0.45	33.60	20.06	25.33	11.80
12	2034	40 MW	315.36	299.59	160.00	5.17	46.39			2	18.02	18.02	8.82	0.00		0.00	19.93	10.61	4.88	11.27	0.46	52.10	38.57	7.82	-5.72
13	2035	40 MW	315.36	299.59	160.00	5.22	46.37			0	0.00	0.00	9.08	0.00		0.00	19.93	10.61	4.79	11.19	0.46	34.26	20.73	25.64	12.11
14	2036	40 MW	315.36	299.59	160.00	5.27	46.36			0	0.00	0.00	9.35	0.00		0.00	19.93	10.61	4.71	11.10	0.46	34.45	20.92	25.44	11.91
15	2037	40 MW	315.36	299.59	160.00	5.32	46.34			0	0.00	0.00	9.63	0.00		0.00	19.93	10.61	4.62	11.01	0.46	34.64	21.11	25.23	11.70
16	2038	40 MW	315.36	299.59	160.00	5.38	46.32			0	0.00	0.00	9.92	0.00		0.00	19.93	10.61	4.53	10.92	0.46	34.84	21.31	25.02	11.49
17	2039	40 MW	315.36	299.59	160.00	5.43	46.31			1	10.20	10.20	10.22	0.00		0.00	19.93	10.61	4.43	10.83	0.46	45.24	31.71	14.60	1.07
18	2040	40 MW	315.36	299.59	160.00	5.48	46.29			0	0.00	0.00	10.53	0.00		0.00	19.93	10.61	4.34	10.73	0.46	35.25	21.72	24.57	11.04
19	2041	40 MW	315.36	299.59	160.00	5.54	46.28			0	0.00	0.00	10.84	0.00		0.00	19.93	10.61	4.24	10.63	0.46	35.47	21.94	24.34	10.81
20	2042	40 MW	315.36	299.59	160.00	5.59	46.26			0	0.00	0.00	11.17	0.00		0.00	19.93	10.61	4.13	10.53	0.46	35.69	22.16	24.10	10.57
21	2043	40 MW	315.36	299.59	160.00	5.65	46.24			0	0.00	0.00	11.50	0.00		0.00	0.00	0.00	10.42	10.42	0.46	22.39	22.39	23.86	23.86
22	2044	40 MW	315.36	299.59	160.00	5.71	46.23			2	18.02	18.02	11.85	0.00		0.00	0.00	0.00	10.31	10.31	0.46	40.64	40.64	5.58	5.58
23	2045	40 MW	315.36	299.59	160.00	5.76	46.21			0	0.00	0.00	12.20	0.00		0.00	0.00	0.00	10.20	10.20	0.46	22.87	22.87	23.34	23.34
24	2046	40 MW	315.36	299.59	160.00	5.82	46.19			0	0.00	0.00	12.57	0.00		0.00	0.00	0.00	10.09	10.09	0.46	23.12	23.12	23.07	23.07
25	2047	40 MW	315.36	299.59	160.00	5.88	46.17			0	0.00	0.00	12.95	0.00		0.00	0.00	0.00	9.97	9.97	0.46	23.38	23.38	22.80	22.80
26	2048	40 MW	315.36	299.59	160.00	5.94	46.16			0	0.00	0.00	13.34	0.00		0.00	0.00	0.00	9.85	9.85	0.46	23.64	23.64	22.51	22.51
27	2049	40 MW	315.36	299.59	160.00	6.00	46.14			2	18.02	18.02	13.74	0.00		0.00	0.00	0.00	9.72	9.72	0.46	41.94	41.94	4.20	4.20
28	2050	40 MW	315.36	299.59	160.00	6.06	46.12			0	0.00	0.00	14.15	0.00		0.00	0.00	0.00	9.59	9.59	0.46	24.20	24.20	21.92	21.92
29	2051	40 MW	315.36	299.59	160.00	6.12	46.10			0	0.00	0.00	14.57	0.00		0.00	0.00	0.00	9.46	9.46	0.46	24.49	24.49	21.61	21.61
30	2052	40 MW	315.36	299.59	160.00	6.18	46.08			0	0.00	0.00	15.01	0.00		0.00	0.00	0.00	9.32	9.32	0.46	24.79	24.79	21.29	21.29
Total							1309.70	212.29	180.99	10	197.55	304.78	303.00	11.31	7.10	31.31	398.53	212.29	156.27	239.39	11.13	1007.55	858.29	Sin apalanc.	Con apalanc.
																								TIRF	8.92%	13.84%
																								VANF	-29.00	5.01

CAPEX apalacando desarrollador 230.70

Table 6: Report on the geothermal project's financial return – Mombacho

Scenario	Production (gross)	Initial Investment CAPEX (local cost) US$ Millions	Tariff US/MWh	Economic Internal Rate of Return IRR_E %	Financial Internal Rate of Return IRR_F %
Mombacho 40 MW	40 MWe	US$ 212.29 M Over 30 years US$ 304.78 M	Energy $92/MWh Power: 0 All-in (2016): 92/MWh	17.69%	13.84%

Table 7: ACB Summary Mombacho

Source: Our own preparation based on studies and application of ACB models

Project Mombacho's sensibility analysis

The performed sensibility analysis allows concluding that the Mombacho 40 MW project turns out being economically feasible, even when facing changes in key variables assumed in the analysis. Independently, variations were analyzed in: the established tariff, and its impact on (a) the IRR_E , the average VAN_E by user and (c) the total VAN_E. The following are the analyzed variables and their impact:

Sensibilidad financiera: deuda senior

TIRf	Caso base 13.84%	Tasa de Deuda Senior (%) 7%	8%	9%	10%	11%
Tarifa 2015 "All-In" del PPA	74 US$/MWh	9.3%	8.1%	7.0%	5.9%	4.9%
	83 US$/MWh	13.1%	11.7%	10.3%	8.9%	7.7%
	92 US$/MWh	17.0%	15.4%	13.8%	12.2%	10.7%
	102 US$/MWh	21.4%	19.7%	18.0%	16.2%	14.4%
	120 US$/MWh	27.4%	25.7%	23.9%	22.0%	20.0%

TIRf	Caso base 13.84%	Plazo de Deuda Senior (años) 30	25	20	15	10
Tarifa 2015 "All-In" del PPA	74 US$/MWh	6.7%	6.9%	7.0%	7.1%	7.1%
	83 US$/MWh	11.4%	10.8%	10.3%	9.7%	9.3%
	92 US$/MWh	15.9%	15.0%	13.8%	12.6%	11.5%
	102 US$/MWh	20.5%	19.5%	18.0%	16.0%	14.0%
	120 US$/MWh	26.7%	25.6%	23.9%	21.2%	17.8%

Sensibilidad financiera: inversión

TIRf	Caso base 13.84%	Costo de inversión (Planta - $/W) 1.3	1.4	1.5	1.6	1.7
Tarifa 2015 "All-In" del PPA	74 US$/MWh	8.1%	7.6%	7.0%	6.5%	6.0%
	83 US$/MWh	11.7%	11.0%	10.3%	9.6%	9.0%
	92 US$/MWh	15.6%	14.7%	13.8%	13.0%	12.3%
	102 US$/MWh	20.0%	19.0%	18.0%	17.0%	16.1%
	120 US$/MWh	26.2%	25.1%	23.9%	22.8%	21.7%

TIRf	Caso base 13.84%	Costo de perforación (MUS$/pozo) 4.5	5.5	6.5	7.5	8.5
Tarifa 2015 "All-In" del PPA	74 US$/MWh	12.0%	9.3%	7.0%	5.0%	3.2%
	83 US$/MWh	16.3%	13.1%	10.3%	7.8%	5.7%
	92 US$/MWh	20.8%	17.1%	13.8%	10.9%	8.3%
	102 US$/MWh	25.5%	21.6%	18.0%	14.6%	11.4%
	120 US$/MWh	32.1%	27.9%	23.9%	20.0%	16.2%

Sensibilidad financiera: impuestos

TIRf	Caso base 13.84%	Tasa de IR (%) 0.0%	10%	20%	25%	30%
Tarifa 2015 "All-In" del PPA	74 US$/MWh	9.2%	8.6%	7.8%	7.4%	7.0%
	83 US$/MWh	12.6%	11.9%	11.1%	10.7%	10.3%
	92 US$/MWh	16.1%	15.4%	14.7%	14.3%	13.8%
	102 US$/MWh	20.0%	19.4%	18.7%	18.3%	18.0%
	120 US$/MWh	25.4%	24.9%	24.4%	24.2%	23.9%

TIRf	Caso base 13.84%	Años de exoneración de IR 30	25	20	15	10
Tarifa 2015 "All-In" del PPA	74 US$/MWh	9.2%	8.8%	8.1%	7.6%	7.2%
	83 US$/MWh	12.6%	12.4%	11.8%	11.4%	10.7%
	92 US$/MWh	16.1%	16.0%	15.6%	15.3%	14.5%
	102 US$/MWh	20.0%	19.9%	19.7%	19.5%	18.8%
	120 US$/MWh	25.4%	25.3%	25.2%	25.1%	24.7%

Sensibilidad económica: inversión

TIRe	Caso base 17.69%	Costo de inversión (Planta - $/W) 1.3	1.4	1.5	1.6	1.7
Costo de perforación (MUS$/pozo)	4.50	20.6%	20.2%	19.9%	19.5%	19.2%
	5.50	19.3%	19.0%	18.7%	18.4%	18.1%
	6.50	18.2%	18.0%	17.7%	17.4%	17.2%
	7.50	17.3%	17.0%	16.7%	16.5%	16.3%
	8.50	16.4%	16.1%	15.9%	15.7%	15.5%

Sensibilidad económica: HFO

VANe	80.02 MUS$	Precios tCO2 - Escenarios bajo, medio, alto Bajo	Medio	Alto
Tasa de descuento	8%	194.6 MUS$	238.8 MUS$	370.2 MUS$
	10%	109.3 MUS$	141.5 MUS$	236.1 MUS$
	12%	56.1 MUS$	80.0 MUS$	149.9 MUS$
	14%	22.3 MUS$	40.5 MUS$	93.3 MUS$
	16%	0.6 MUS$	14.7 MUS$	55.3 MUS$

Sensibilidad económica: HFO vs tCO2

TIRe	Caso base 17.69%	Precio tCO2 - Escenarios bajo, medio, alto Bajo	Medio	Alto
Precio HFO - Escenarios bajo, medio, alto	Bajo	13.35%	15.12%	19.71%
	Medio	16.08%	17.69%	21.90%
	Alto	18.53%	20.02%	23.94%

Sensibilidad económica: HFO

VANe	80.02 MUS$	Precio HFO - Escenarios bajo, medio, alto Bajo	Medio	Alto
Tasa de descuento	8%	164.4 MUS$	238.8 MUS$	313.2 MUS$
	10%	88.6 MUS$	141.5 MUS$	194.3 MUS$
	12%	41.4 MUS$	80.0 MUS$	118.6 MUS$
	14%	11.6 MUS$	40.5 MUS$	69.4 MUS$
	16%	-7.3 MUS$	14.7 MUS$	36.8 MUS$

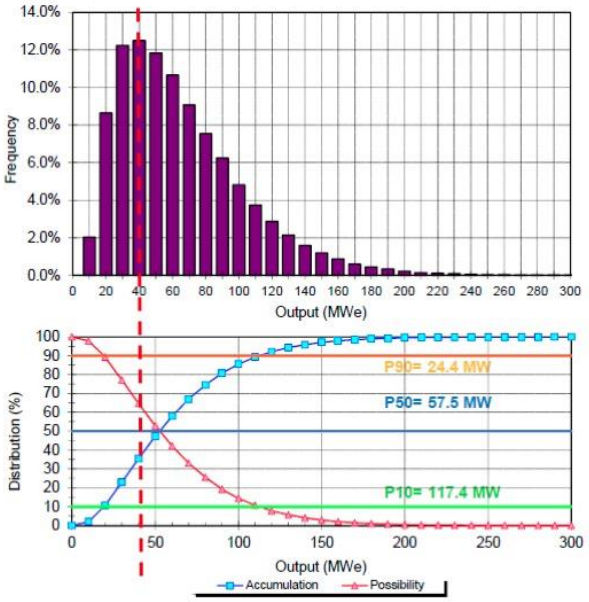
Table 8: Sensibility analysis - Mombacho

Source: Our own elaboration based on studies and application of ACB models

CALDERA DE APOYO

Cost-benefit analysis' methodology and results: Caldera de Apoyo (Spreadsheet)

For the **Caldera de Apoyo** field an estimate was made under the volumetric stored heat method combined with the Monte Carlo method, which proposes the following resource probabilities:



Input

Parameter	min.	most likely	max.
Reservoir Area (km^2)	2.98	-	15.79
Reservoir Thickness (m)	1000	-	2000
Rock Density (kg/m^3)	2400	2500	2600
Porosity (-)	0.05	0.10	0.15
Recovery factor (-)	0.125	0.250	0.375
Rock Specific Heat (kJ/kg°C)	-	1.00	-
Reservoir Average Temperature (°C)	200	230	280
Reservoir Average Pressure (MPa)	-	15.0	-
Heat-Electricity Conversion Factor (-)	0.045	0.072	0.105
Plant Life (year)	-	30	-
Load Factor (-)	-	0.85	-
Abandonment Temperature (°C)	-	160	-

Figure 3: Distribution of probabilities of the Caldera de Apoyo field (Monte Carlo)
Source: Pre-feasibility study West JEC, 2015

However, it was decided to minimize the geothermal potential's probability distribution, in view of the fact that half of the zone detected as source of resource is located outside the concession potential's zone and below the lake, at gross production of 20MW. This scenario has a higher than 90% probability.

Economic costs of the Caldera de Apoyo Project

The total economic cost consists of the net cost, taxes and subsidies. However, taxes and subsidies, at national economy, are simply transferred between the Project and the Government, for which reason, they are eliminated from total cost. Then, the net cost is the economic cost's basis. Besides, there is the tendency of over estimating the domestic costs by reason of the over valued rate of exchange type. Accordingly, in order to obtain economic costs it is necessary to adjust the type of exchange to the frontier's price, adjustment for which a conversion factor is used, one that was assumed discounting 10% of DAI

The considered project's investment assumptions are summarized in the following table:

Development	Slimholes Wells	Commercial Wells				
Environmental and social consultancies			0.5	0.45	0.58	0%
Civil works for the development stage			1.256	1.13	1.44	0%
Drilling for resource's evaluation (JICA)	0	0	0	0	0.00	100%
SREP support in drilling	0	0	0	0.00	0.00	100%
Feasibility study			1	1	1.15	100%
Other development wells (estimated)	0	10	70.10	70.10	80.62	100%
Construction						
Geothermal plant			44	43.032	50.60	78%
Fluids system			8.2	8.04	9.43	80%
Access ways			0.36	0.324	0.41	0%
Site			0.7	0.63	0.81	0%
Transmission line			4.703	4.46	5.41	48.3%
Administration			5	4.5	5.75	0%
Consultancy services			10	10	11.50	100%
		Cost	145.82	143.66	167.69	
Contingency			7.3	7.183	8.38	
Total CAPEX			**153.11**	**150.85**	**176.08**	
Wells during all the project						
Mobile/Withdrawal			15.75	15.75	18.11	100%
Production wells			71.5	71.50	82.23	100%
Reinjection wells			19.5	19.50	22.43	100%
Pumps			1.68	1.68	1.93	100%
Platform			0.54	0.54	0.62	100%
Total wells			**108.97**	**108.97**	**125.32**	

Table 9: Investment costs of 20 MWe (gross) project - Caldera de Apoyo
Source: ACB model of Caldera de Apoyo volcano – PELICAN, S.A.

Caldera de Apoyo Project's Economic Benefits

The investments' economic analyses, income and expenditures were made for two scenarios, with the construction of 30 and 40MWe generation plants. From the analysis made only one case was selected, that of 20MWe, in view of the awarded concession's actual size. The economic benefits' assumptions are summarized as follows:

Benefits	Value
HFO price / IF0380 (oil invoice savings)	263 US$/ton (2016)
Thermal plant (HFO consumption, efficiency 38%)	226 ton/GWh
Substitution factor	100%
Emission factor	100%
Thermal plants' CO_2 emissions	726 tCO2/GWh
Consumed vapor (geothermal efficiency)	300 TPH
Geothermal plants' CO_2 emissions	0.75%
Coal's social cost (tCO_2)	Under EPA scenario

Table 10: geothermal project's assumed economic benefits

The project's economic return is shown as follows: IRR_E (*Economical IRR, EIRR)*

Apoyo		Características			Inversión					Total de costos económicos	Beneficios económicos										Total de beneficios económicos
											Incrementales (con el proyecto)				No incremental: reducción CO2		No incrementales: ahorro de importaciones			Total	
N°	Año	Potencia bruta	Generación Bruta	Generación Neta	CAPEX Inicial	# pozos adicionales	Reinversión	Total inversión	O&M		8.1 MW incr.	8.2 MW base	8.3 Balance energ.	8.4 Valor $/MWh	9.1	9.2	10.1	10.2	10.3 HFO US$/t		
	Año	1.1	1.2	1.3	3	4.1	4.2	5 = 3 + 4.2	6	7 = 5 + 6										11=8+9+10	8 = 11 - 7
		MW	GWh	GWh	MUS$	#	MUS$	MUS$	MUS$	MUS$					MUS$	$/tCO2	MUS$	% sub			MUS$
C1	2016				1.34			1.34		1.34											-1.34
C2	2017				17.01			17.01		17.01											-17.01
C3	2018				2.48			2.48		2.48											-2.48
C4	2019				2.10			2.10		2.10											-2.10
C5	2020				37.93			37.93		37.93											-37.93
C6	2021				57.72			57.72		57.72											-57.72
C7	2022				32.25			32.25		32.25											-32.25
1	2023	20 MW	157.68	149.80		0	0	0.00	4.53	4.53	20.00	20.00	0	N/A	4.15	42.00	21.10	100%	622.59	25.26	20.73
2	2024	20 MW	157.68	149.80		0	0	0.00	4.53	4.53	20.00	20.00	0	N/A	4.23	42.80	21.60	100%	637.18	25.83	21.30
3	2025	20 MW	157.68	149.80		0	0	0.00	4.53	4.53	20.00	20.00	0	N/A	4.31	43.60	22.19	100%	654.64	26.50	21.98
4	2026	20 MW	157.68	149.80		1	8.87	8.87	4.53	13.40	20.00	20.00	0	N/A	4.39	44.40	22.93	100%	676.40	27.32	13.92
5	2027	20 MW	157.68	149.80		0	0	0.00	4.53	4.53	20.00	20.00	0	N/A	4.47	45.20	23.54	100%	694.62	28.01	23.49
6	2028	20 MW	157.68	149.80		0	0	0.00	4.53	4.53	20.00	20.00	0	N/A	4.55	46.00	24.06	100%	709.97	28.61	24.09
7	2029	20 MW	157.68	149.80		0	0	0.00	4.53	4.53	20.00	20.00	0	N/A	4.63	46.80	24.77	100%	730.66	29.39	24.87
8	2030	20 MW	157.68	149.80		1	8.87	8.87	4.53	13.40	20.00	20.00	0	N/A	4.71	47.60	25.19	100%	743.31	29.90	16.51
9	2031	20 MW	157.68	149.80		0	0	0.00	4.53	4.53	20.00	20.00	0	N/A	4.79	48.40	25.98	100%	766.40	30.76	26.24
10	2032	20 MW	157.68	149.80		0	0	0.00	4.53	4.53	20.00	20.00	0	N/A	4.87	49.20	26.77	100%	789.76	31.63	27.11
11	2033	20 MW	157.68	149.80		0	0	0.00	4.53	4.53	20.00	20.00	0	N/A	4.94	50.00	27.58	100%	813.71	32.53	28.00
12	2034	20 MW	157.68	149.80		0	0	0.00	4.53	4.53	20.00	20.00	0	N/A	5.02	50.80	28.44	100%	839.01	33.46	28.94
13	2035	20 MW	157.68	149.80		0	0	0.00	4.53	4.53	20.00	20.00	0	N/A	5.10	51.60	28.99	100%	855.15	34.09	29.56
14	2036	20 MW	157.68	149.80		0	0	0.00	4.53	4.53	20.00	20.00	0	N/A	5.18	52.40	29.87	100%	881.21	35.05	30.53
15	2037	20 MW	157.68	149.80		2	15.67	15.67	4.53	20.20	20.00	20.00	0	N/A	5.26	53.20	30.41	100%	897.08	35.67	15.47
16	2038	20 MW	157.68	149.80		0	0	0.00	4.53	4.53	20.00	20.00	0	N/A	5.44	55.00	31.30	100%	923.53	36.74	32.22
17	2039	20 MW	157.68	149.80		0	0	0.00	4.53	4.53	20.00	20.00	0	N/A	5.42	54.80	32.00	100%	944.05	37.42	32.89
18	2040	20 MW	157.68	149.80		0	0	0.00	4.53	4.53	20.00	20.00	0	N/A	5.50	55.60	33.00	100%	973.58	38.50	33.97
19	2041	20 MW	157.68	149.80		0	0	0.00	4.53	4.53	20.00	20.00	0	N/A	5.58	56.40	34.59	100%	1020.56	40.17	35.64
20	2042	20 MW	157.68	149.80		0	0	0.00	4.53	4.53	20.00	20.00	0	N/A	5.66	57.20	36.26	100%	1069.80	41.92	37.39
21	2043	20 MW	157.68	149.80		1	8.87	8.87	4.53	13.40	20.00	20.00	0	N/A	5.93	60.00	38.01	100%	1121.42	43.94	30.55
22	2044	20 MW	157.68	149.80		0	0	0.00	4.53	4.53	20.00	20.00	0	N/A	5.82	58.80	39.84	100%	1175.53	45.66	41.13
23	2045	20 MW	157.68	149.80		0	0	0.00	4.53	4.53	20.00	20.00	0	N/A	5.89	59.60	41.77	100%	1232.24	47.66	43.14
24	2046	20 MW	157.68	149.80		0	0	0.00	4.53	4.53	20.00	20.00	0	N/A	5.97	60.40	43.78	100%	1291.70	49.76	45.23
25	2047	20 MW	157.68	149.80		0	0	0.00	4.53	4.53	20.00	20.00	0	N/A	6.05	61.20	45.89	100%	1354.03	51.95	47.42
26	2048	20 MW	157.68	149.80		0	0	0.00	4.53	4.53	20.00	20.00	0	N/A	6.33	64.00	48.11	100%	1419.36	54.44	49.91
27	2049	20 MW	157.68	149.80		0	0	0.00	4.53	4.53	20.00	20.00	0	N/A	6.21	62.80	50.43	100%	1487.84	56.64	52.12
28	2050	20 MW	157.68	149.80		1	8.87	8.87	4.53	13.40	20.00	20.00	0	N/A	6.29	63.60	52.86	100%	1559.63	59.15	45.76
29	2051	20 MW	157.68	149.80		0	0	0.00	4.53	4.53	20.00	20.00	0	N/A	6.37	64.40	55.41	100%	1634.88	61.78	57.26
30	2052	20 MW	157.68	149.80		0	0	0.00	4.53	4.53	20.00	20.00	0	N/A	6.45	65.20	58.09	100%	1713.77	64.54	60.01
Total					**150.84**	**6**	**117.97**	**201.99**	**135.76**						**159.52**		**1024.77**			**1184.29**	**846.54**
																				TIRE	**12.88%**
																				VANE	**8.03**

Table 11: Caldera de Apoyo – geothermal project's economic return report

The project's financial report calculation is shown as follows, taking into account the project's real costs in order to calculate the IRR_E (*Economical IRR, EIRR)*, without taking into account an investor's IRR, with the possible effect that would have the project's financing (Project Finance).

Apoyo		Generación y Ventas			Ingresos			Inversión					O&M	Financiamiento				Impuestos				Gastos		Flujos proyecto	Flujos Equity
N°	Año	Potencia bruta	Generación Bruta	Generación Neta	PPA (Tarifa)	Peaje (Tarifa)	Total	CAPEX Inicial	CAPEX Desarrollador	# pozos adicionales	Reinversión	Total inversión	Costos	Deuda Const	Gastos de transacción	Repago al GNI	Deuda Sr	Depreciación fiscal	IR apalancado	IR sin apalanc.	IMI	Totales apalancados	Totales sin apalanc.	Netos sin apalanc.	Netos apalancados
		1.1	1.2	1.3	2.1	2.2	2.3	3.1	3.2	4.1	4.2	5 = 3 + 4.2	6	7.1	7.2	7.3	7.4	8	8.1a	8.1b	8.2	9 = 6+7+8	10 = 5+6+8	8 = 2 - 7	8 = 2 - 7
		MW	GWh	GWh	$/MWh		MUS$	MUS$	MUS$	#	MUS$	MUS$	MUS$	MUS$	MUS$	MUS$	MUS$	MUS$	MUS$	MUS$	MUS$	MUS$	MUS$	MUS$	MUS$
C1	2016							1.36	0.00			1.36		0.00		0.00	0					0.00	1.36	-1.36	0.00
C2	2017							17.26	0.00			17.26		0.00		0.00	0					0.00	17.26	-17.26	0.00
C3	2018							2.52	0.00			2.52		0.00		0.00	0					0.00	2.52	-2.52	0.00
C4	2019							2.14	37.59			2.14		0.94		0.00	0					7.71	2.14	-2.14	-7.71
C5	2020							38.50	37.59			38.50		1.88		0.00	0					7.89	38.50	-38.50	-7.89
C6	2021							58.59	37.59			58.59		2.82		0.00	0					8.08	58.59	-58.59	-8.08
C7	2022							32.73	37.59			32.73		3.76	5.67	2.76	0					9.96	32.73	-32.73	-9.96
1	2023	20 MW	157.68	149.80	116.54	4.63	16.76			0	0.00	0.00	4.59	0.00		0.00	14.53	7.66	0.00	0.00	0.04	19.16	4.64	12.13	-2.40
2	2024	20 MW	157.68	149.80	120.04	4.68	17.28			0	0.00	0.00	4.73	0.00		0.00	14.53	7.66	0.00	0.00	0.04	19.30	4.77	12.51	-2.02
3	2025	20 MW	157.68	149.80	123.64	4.72	17.81			0	0.00	0.00	4.87	0.00		0.00	14.53	7.66	0.00	0.00	0.04	19.44	4.92	12.90	-1.63
4	2026	20 MW	157.68	149.80	127.35	4.77	18.36			1	10.20	10.20	5.02	0.00		0.00	14.53	7.66	0.00	0.00	0.09	29.84	15.31	3.05	-11.48
5	2027	20 MW	157.68	149.80	131.17	4.82	18.93			0	0.00	0.00	5.17	0.00		0.00	14.53	7.66	0.00	0.00	0.09	19.79	5.26	13.66	-0.86
6	2028	20 MW	157.68	149.80	135.11	4.87	19.51			0	0.00	0.00	5.32	0.00		0.00	14.53	7.66	0.00	0.00	0.10	19.95	5.42	14.09	-0.44
7	2029	20 MW	157.68	149.80	139.16	4.91	20.11			0	0.00	0.00	5.48	0.00		0.00	14.53	7.66	0.00	0.00	0.10	20.11	5.59	14.52	0.00
8	2030	20 MW	157.68	149.80	143.33	4.96	20.73			1	10.20	10.20	5.65	0.00		0.00	14.53	7.66	0.00	4.52	0.10	30.48	20.48	0.25	-9.75
9	2031	20 MW	157.68	149.80	147.63	5.01	21.36			0	0.00	0.00	5.82	0.00		0.00	14.53	7.66	0.03	4.66	0.16	20.53	10.64	10.72	0.83
10	2032	20 MW	157.68	149.80	152.06	5.06	22.02			0	0.00	0.00	5.99	0.00		0.00	14.53	7.66	0.17	4.81	0.17	20.86	10.97	11.05	1.16
11	2033	20 MW	157.68	149.80	156.62	5.11	22.70			0	0.00	0.00	6.17	0.00		0.00	14.53	7.66	0.32	4.96	0.23	21.25	11.36	11.34	1.45
12	2034	20 MW	157.68	149.80	160.00	5.17	23.19			0	0.00	0.00	6.36	0.00		0.00	14.53	7.66	0.41	5.05	0.23	21.53	11.64	11.55	1.66
13	2035	20 MW	157.68	149.80	160.00	5.22	23.19			0	0.00	0.00	6.55	0.00		0.00	14.53	7.66	0.35	4.99	0.23	21.66	11.77	11.41	1.52
14	2036	20 MW	157.68	149.80	160.00	5.27	23.18			0	0.00	0.00	6.75	0.00		0.00	14.53	7.66	0.29	4.93	0.23	21.80	11.91	11.27	1.38
15	2037	20 MW	157.68	149.80	160.00	5.32	23.17			2	18.02	18.02	6.95	0.00		0.00	14.53	7.66	0.23	4.87	0.23	39.96	30.07	-6.90	-16.79
16	2038	20 MW	157.68	149.80	160.00	5.38	23.16			0	0.00	0.00	7.16	0.00		0.00	14.53	7.66	0.17	4.80	0.23	22.08	12.19	10.97	1.08
17	2039	20 MW	157.68	149.80	160.00	5.43	23.15			0	0.00	0.00	7.37	0.00		0.00	14.53	7.66	0.10	4.73	0.23	22.23	12.34	10.82	0.93
18	2040	20 MW	157.68	149.80	160.00	5.48	23.15			0	0.00	0.00	7.59	0.00		0.00	14.53	7.66	0.03	4.67	0.23	22.38	12.49	10.66	0.77
19	2041	20 MW	157.68	149.80	160.00	5.54	23.14			0	0.00	0.00	7.82	0.00		0.00	14.53	7.66	0.00	4.60	0.23	22.58	12.65	10.49	0.56
20	2042	20 MW	157.68	149.80	160.00	5.59	23.13			0	0.00	0.00	8.05	0.00		0.00	14.53	7.66	0.00	4.52	0.23	22.81	12.81	10.32	0.32
21	2043	20 MW	157.68	149.80	160.00	5.65	23.12			1	10.20	10.20	8.30	0.00		0.00	0.00	0.00	4.45	4.45	0.23	23.18	23.18	-0.05	-0.05
22	2044	20 MW	157.68	149.80	160.00	5.71	23.11			0	0.00	0.00	8.54	0.00		0.00	0.00	0.00	4.37	4.37	0.23	13.15	13.15	9.97	9.97
23	2045	20 MW	157.68	149.80	160.00	5.76	23.10			0	0.00	0.00	8.80	0.00		0.00	0.00	0.00	4.29	4.29	0.23	13.32	13.32	9.78	9.78
24	2046	20 MW	157.68	149.80	160.00	5.82	23.10			0	0.00	0.00	9.07	0.00		0.00	0.00	0.00	4.21	4.21	0.23	13.51	13.51	9.59	9.59
25	2047	20 MW	157.68	149.80	160.00	5.88	23.09			0	0.00	0.00	9.34	0.00		0.00	0.00	0.00	4.12	4.12	0.23	13.69	13.69	9.39	9.39
26	2048	20 MW	157.68	149.80	160.00	5.94	23.08			0	0.00	0.00	9.62	0.00		0.00	0.00	0.00	4.04	4.04	0.23	13.89	13.89	9.19	9.19
27	2049	20 MW	157.68	149.80	160.00	6.00	23.07			0	0.00	0.00	9.91	0.00		0.00	0.00	0.00	3.95	3.95	0.23	14.09	14.09	8.98	8.98
28	2050	20 MW	157.68	149.80	160.00	6.06	23.06			1	10.20	10.20	10.20	0.00		0.00	0.00	0.00	3.86	3.86	0.23	24.49	24.49	-1.43	-1.43
29	2051	20 MW	157.68	149.80	160.00	6.12	23.05			0	0.00	0.00	10.51	0.00		0.00	0.00	0.00	3.76	3.76	0.23	14.50	14.50	8.55	8.55
30	2052	20 MW	157.68	149.80	160.00	6.18	23.04			0	0.00	0.00	10.82	0.00		0.00	0.00	0.00	3.67	3.67	0.23	14.72	14.72	8.32	8.32
Total							**654.85**	**153.11**	**150.35**	**6**	**135.67**	**211.93**	**218.53**	**9.40**	**5.67**	**2.76**	**290.53**	**153.11**	**42.82**	**102.83**	**5.56**	**649.90**	**538.85**	**Sin apalanc.**	**Con apalanc.**
																								TIRF	**3.98%**	**0.31%**
																								VANF	**-47.38**	**-23.90**

CAPEX apalacando desarrollador: 168.18

Table 12: Caldera de Apoyo – geothermal project's financial return calculation report

Scenario	Production (gross)	Initial Investment CAPEX (local cost) US$ Millions	Tariff US/MWh	Economic Internal Rate of Return IRR_E %	Financial Internal Rate of Return IRR_F %
20 MW	20 MWe	US$ 153.11M Over 30 years: US$ 211.93M	Energy: $92/MWh Power: 0/kW-m All-in 2016: $92/MWh	12.88%	0.31%

Table 13: ACB Summary - Caldera de Apoyo

Source: Our own elaboration based on studies and ACB models application

Caldera de Apoyo Project's sensibility analysis

The performed sensibility analysis allows concluding that the Caldera de Apoyo 20 MW project turns out being economically feasible, even when facing changes in key variables assumed in the analysis. Independently, variations were analyzed in: (i) the investment cost; and (ii) the established tariff. And its impact on (a) the IRR_E , the average VAN_E by user and (c) the total VAN_E.

The following are the analyzed variables and their impact:

Sensibilidad financiera: deuda senior

TIRf	Caso base 0.31%	Tasa de Deuda Senior (%) 7%	8%	9%	10%	11%
Tarifa 2015 "All-In" del PPA	74 US$/MWh	N/A	N/A	N/A	N/A	N/A
	83 US$/MWh	0.9%	N/A	N/A	N/A	N/A
	92 US$/MWh	2.6%	1.4%	0.3%	N/A	N/A
	102 US$/MWh	4.4%	3.0%	1.7%	0.4%	N/A
	120 US$/MWh	7.0%	5.1%	3.4%	1.8%	0.2%

TIRf	Caso base 0.31%	Plazo de Deuda Senior (años) 30	25	20	15	10
Tarifa 2015 "All-In" del PPA	74 US$/MWh	N/A	N/A	N/A	N/A	0.5%
	83 US$/MWh	N/A	N/A	N/A	0.6%	1.8%
	92 US$/MWh	N/A	N/A	0.3%	1.9%	2.9%
	102 US$/MWh	N/A	N/A	1.7%	3.0%	3.9%
	120 US$/MWh	N/A	1.0%	3.4%	4.5%	5.2%

Sensibilidad financiera: inversión

TIRf	Caso base 0.31%	Costo de inversión (Planta - $/W) 1.8	2.0	2.2	2.4	2.6
Tarifa 2015 "All-In" del PPA	74 US$/MWh	N/A	N/A	N/A	N/A	N/A
	83 US$/MWh	0.3%	N/A	N/A	N/A	N/A
	92 US$/MWh	1.9%	1.1%	0.3%	N/A	N/A
	102 US$/MWh	3.5%	2.6%	1.7%	0.8%	N/A
	120 US$/MWh	5.8%	4.6%	3.4%	2.4%	1.3%

TIRf	Caso base 0.31%	Costo de perforación (MUS$/pozo) 4.5	5.5	6.5	7.5	8.5
Tarifa 2015 "All-In" del PPA	74 US$/MWh	1.4%	N/A	N/A	N/A	N/A
	83 US$/MWh	3.5%	1.1%	N/A	N/A	N/A
	92 US$/MWh	5.5%	2.7%	0.3%	N/A	N/A
	102 US$/MWh	7.8%	4.5%	1.7%	N/A	N/A
	120 US$/MWh	11.3%	7.0%	3.4%	0.2%	N/A

Sensibilidad financiera: impuestos

TIRf	Caso base 0.31%	Tasa de IR (%) 0.0%	10%	20%	25%	30%
Tarifa 2015 "All-In" del PPA	74 US$/MWh	N/A	N/A	N/A	N/A	N/A
	83 US$/MWh	1.0%	0.4%	N/A	N/A	N/A
	92 US$/MWh	2.4%	1.8%	1.1%	0.7%	0.3%
	102 US$/MWh	3.8%	3.2%	2.5%	2.1%	1.7%
	120 US$/MWh	5.6%	4.9%	4.3%	3.9%	3.4%

TIRf	Caso base 0.31%	Años de exoneración de IR 30	25	20	15	10
Tarifa 2015 "All-In" del PPA	74 US$/MWh	N/A	N/A	N/A	N/A	N/A
	83 US$/MWh	1.0%	0.1%	N/A	N/A	N/A
	92 US$/MWh	2.4%	1.6%	0.4%	0.4%	0.3%
	102 US$/MWh	3.8%	3.1%	1.9%	1.9%	1.8%
	120 US$/MWh	5.6%	4.9%	3.8%	3.8%	3.6%

Sensibilidad económica: inversión

TIRe	Caso base 12.88%	Costo de inversión (Planta - $/W) 1.3	1.4	1.5	1.6	1.7
Costo de perforación (MUS$/pozo)	4.50	16.8%	16.6%	16.3%	16.1%	15.9%
	5.50	15.6%	15.3%	15.1%	14.9%	14.7%
	6.50	14.4%	14.3%	14.1%	13.9%	13.7%
	7.50	13.4%	13.3%	13.1%	12.9%	12.8%
	8.50	12.5%	12.4%	12.2%	12.1%	12.0%

Sensibilidad económica: HFO

VANe	8.03 MUS$	Precios tCO2 - Escenarios bajo, medio, alto Bajo	Medio	Alto
Tasa de descuento	8%	54.8 MUS$	76.9 MUS$	142.6 MUS$
	10%	18.1 MUS$	34.2 MUS$	81.5 MUS$
	12%	-3.9 MUS$	8.0 MUS$	43.0 MUS$
	14%	-17.1 MUS$	-8.0 MUS$	18.4 MUS$
	16%	-24.9 MUS$	-17.9 MUS$	2.4 MUS$

Sensibilidad económica: HFO vs tCO2

TIRe	Caso base 12.88%	Precio tCO2 - Escenarios bajo, medio, alto Bajo	Medio	Alto
Precio HFO - Escenarios bajo, medio, alto	Bajo	9.23%	10.69%	14.54%
	Medio	11.56%	12.88%	16.40%
	Alto	13.63%	14.86%	18.13%

Sensibilidad económica: HFO

VANe	8.03 MUS$	Precio HFO - Escenarios bajo, medio, alto Bajo	Medio	Alto
Tasa de descuento	8%	39.7 MUS$	76.9 MUS$	114.2 MUS$
	10%	7.7 MUS$	34.2 MUS$	60.6 MUS$
	12%	-11.3 MUS$	8.0 MUS$	27.3 MUS$
	14%	-22.5 MUS$	-8.0 MUS$	6.4 MUS$
	16%	-28.9 MUS$	-17.9 MUS$	-6.8 MUS$

Table 14: Sensibility Analysis – Caldera de Apoyo

Source: Our own elaboration based on studies and application of ACB models

COSIGÜINA VOLCANO

Cost-Benefit analysis' methodology and results: Cosigüina Volcano. (Spreadsheet)

For the **Cosigüina** field, important previous studies were considered.

An estimate was made under the stored heat volumetric method combined with the Monte Carlo method, which proposes the below-described resource probabilities:

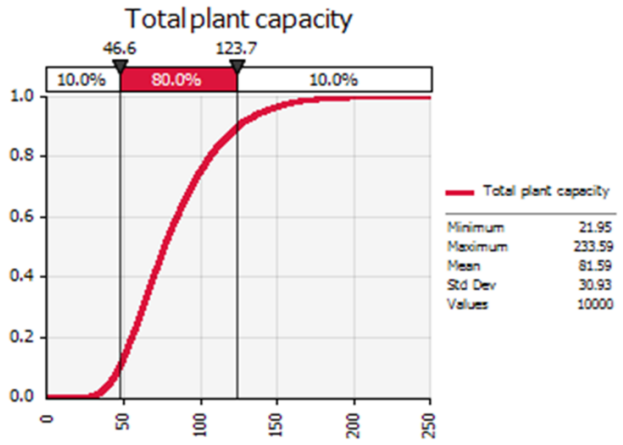


Figure 4: Distribution of probabilities of the Cosigüina field (Monte Carlo)
Source: Pre-feasibility study ACU-CAN/JACOBS. 2015

For this cost-benefit analysis, a 40 MWe scenario is selected, which has a higher than 90% probability.

Cosigüina Volcano's Project's Economic Costs

The total economic cost consists of the net cost, taxes and subsidies. However, taxes and subsidies, at national economy, are simply transferred between the Project and the Government, for which reason, they are eliminated from total cost. Then, the net cost is the economic cost's basis. Besides, there is the tendency of over estimating the domestic costs by reason of the over valued rate of exchange type, one that was assumed discounting 10% of DAI (it may be adjusted at 10%).

The considered project's investment costs are summarized at the following table:

Investment detail			Cost	Local coast	With VAT	% ext.
Development	**Slim wells**	**Commercial wells**				
Environmental and social consultancies			0.5	0.45	0.58	0%
Civil works for the development stage			1.256	1.13	1.44	0%
Drilling for resource's evaluation (PNESER)	3	0	3	3	3.45	100%
SREP support in drilling	0	5	35.05	35.05	40.31	100%
Feasibility Study			1	1	1.15	100%
Other development wells (estimated)	0	8	57.10	57.10	65.67	100%
Construction						
Geothermal plant			60	58.68	69.00	78%
Fluids system			19.3	18.91	22.20	80%
Access ways			3	2.7	3.45	0%
Site			1	0.9	1.15	0%

Transmission line (77 km to SE El Viejo)		16.7	15.84	19.21	48.3%
Administration		5	4.5	5.75	0%
Consultancy services		10	10	11.50	100%
	Cost	212.91	209.26	244.84	
Contingency		10.6	10.463	12.24	
Total CAPEX		**223.55**	**219.72**	**257.08**	
Wells during all the process					
Mobile/Withdrawal		20.25	20.25	23.29	100%
Production wells		104	104.00	119.60	100%
Reinjection wells		45.5	45.50	52.33	100%
Pumps		2.76	2.76	3.17	100%
Platform		1.26	1.26	1.45	100%
Total wells		**173.77**	**173.77**	**199.84**	

Table 15: Investment costs of 40 MWe (gross) – Cosigüina

Source: ACB model of Cosigüina volcano – PELICAN, S.A

Project Cosigüina's Economic Benefits

The economic analyses, benefits, the investments' income and expenditures were made for a sole case, that 40 MWe, in view of the actual awarded concession's and the estimated resource.

The project's assumed economic benefits are summarized as follows:

Benefits	**Value**
HFO price / IF0380 (oil invoice savings)	263 US$/ton (2016)
Thermal plant (HFO consumption, efficiency 38%)	226 ton/GWh
Substitution factor	100%
Emission factor	100%
Geothermal plants CO_2 emissions	726 tCO2/GWh
Consumed vapor (geothermal efficiency)	300 TPH
Geothermal plants' CO_2 emissions	0.75%
Coal's social; cost (tCO_2)	Under EPA scenario

Table 16: Geothermal project's assumed economic benefits

The project's economic return calculations is shown below, TIR_E (*Economical IRR, EiRR*)

Cosigüina		Características			Inversión					Total de costos económicos	Beneficios económicos										Total de beneficios económicos
N°	Año	Potencia bruta	Generación		CAPEX Inicial	# pozos adicionales	Reinversión	Total inversión	O&M		Incrementales (con el proyecto)				No incremental: reducción CO2		No incrementales: ahorro de importaciones			Total	
			Bruta	Neta							8.1 MW incr.	8.2 MW base	8.3 Balance energ.	8.4 Valor $/MWh	9.1	9.2	10.1	10.2	10.3 HFO US$/t		
	Año	1.1	1.2	1.3	3	4.1	4.2	5 = 3 + 4.2	6	7 = 5 + 6										11=8+9+10	8 = 11 - 7
		MW	GWh	GWh	MUS$	#	MUS$	MUS$	MUS$	MUS$											MUS$
C1	2016				1.96			1.96		1.96											-1.96
C2	2017				24.77			24.77		24.77											-24.77
C3	2018				3.62			3.62		3.62											-3.62
C4	2019				3.07			3.07		3.07											-3.07
C5	2020				55.26			55.26		55.26											-55.26
C6	2021				84.08			84.08		84.08											-84.08
C7	2022				46.97			46.97		46.97											-46.97
1	2023	40 MW	315.36	299.59		0	0	0.00	6.59	6.59	40.00	40.00	0	N/A	8.31	42.00	42.21	100%	622.59	50.51	43.92
2	2024	40 MW	315.36	299.59		0	0	0.00	6.59	6.59	40.00	40.00	0	N/A	8.47	42.80	43.19	100%	637.18	51.66	45.07
3	2025	40 MW	315.36	299.59		0	0	0.00	6.59	6.59	40.00	40.00	0	N/A	8.62	43.60	44.38	100%	654.64	53.00	46.41
4	2026	40 MW	315.36	299.59		2	15.67	15.67	6.59	22.26	40.00	40.00	0	N/A	8.78	44.40	45.85	100%	676.40	54.63	32.37
5	2027	40 MW	315.36	299.59		0	0	0.00	6.59	6.59	40.00	40.00	0	N/A	8.94	45.20	47.09	100%	694.62	56.03	49.44
6	2028	40 MW	315.36	299.59		0	0	0.00	6.59	6.59	40.00	40.00	0	N/A	9.10	46.00	48.13	100%	709.97	57.23	50.64
7	2029	40 MW	315.36	299.59		0	0	0.00	6.59	6.59	40.00	40.00	0	N/A	9.26	46.80	49.53	100%	730.66	58.79	52.20
8	2030	40 MW	315.36	299.59		1	8.87	8.87	6.59	15.46	40.00	40.00	0	N/A	9.41	47.60	50.39	100%	743.31	59.80	44.34
9	2031	40 MW	315.36	299.59		0	0	0.00	6.59	6.59	40.00	40.00	0	N/A	9.57	48.40	51.95	100%	766.40	61.53	54.94
10	2032	40 MW	315.36	299.59		0	0	0.00	6.59	6.59	40.00	40.00	0	N/A	9.73	49.20	53.54	100%	789.76	63.27	56.68
11	2033	40 MW	315.36	299.59		0	0	0.00	6.59	6.59	40.00	40.00	0	N/A	9.89	50.00	55.16	100%	813.71	65.05	58.46
12	2034	40 MW	315.36	299.59		2	15.67	15.67	6.59	22.26	40.00	40.00	0	N/A	10.05	50.80	56.88	100%	839.01	66.92	44.66
13	2035	40 MW	315.36	299.59		0	0	0.00	6.59	6.59	40.00	40.00	0	N/A	10.21	51.60	57.97	100%	855.15	68.18	61.59
14	2036	40 MW	315.36	299.59		0	0	0.00	6.59	6.59	40.00	40.00	0	N/A	10.36	52.40	59.74	100%	881.21	70.10	63.51
15	2037	40 MW	315.36	299.59		0	0	0.00	6.59	6.59	40.00	40.00	0	N/A	10.52	53.20	60.81	100%	897.08	71.34	64.74
16	2038	40 MW	315.36	299.59		0	0	0.00	6.59	6.59	40.00	40.00	0	N/A	10.88	55.00	62.61	100%	923.53	73.48	66.89
17	2039	40 MW	315.36	299.59		1	8.87	8.87	6.59	15.46	40.00	40.00	0	N/A	10.84	54.80	64.00	100%	944.05	74.84	59.37
18	2040	40 MW	315.36	299.59		0	0	0.00	6.59	6.59	40.00	40.00	0	N/A	11.00	55.60	66.00	100%	973.58	77.00	70.40
19	2041	40 MW	315.36	299.59		0	0	0.00	6.59	6.59	40.00	40.00	0	N/A	11.16	56.40	69.18	100%	1020.56	80.34	73.75
20	2042	40 MW	315.36	299.59		0	0	0.00	6.59	6.59	40.00	40.00	0	N/A	11.31	57.20	72.52	100%	1069.80	83.84	77.24
21	2043	40 MW	315.36	299.59		0	0	0.00	6.59	6.59	40.00	40.00	0	N/A	11.87	60.00	76.02	100%	1121.42	87.89	81.30
22	2044	40 MW	315.36	299.59		2	15.67	15.67	6.59	22.26	40.00	40.00	0	N/A	11.63	58.80	79.69	100%	1175.53	91.32	69.06
23	2045	40 MW	315.36	299.59		0	0	0.00	6.59	6.59	40.00	40.00	0	N/A	11.79	59.60	83.53	100%	1232.24	95.32	88.73
24	2046	40 MW	315.36	299.59		0	0	0.00	6.59	6.59	40.00	40.00	0	N/A	11.95	60.40	87.56	100%	1291.70	99.51	92.92
25	2047	40 MW	315.36	299.59		0	0	0.00	6.59	6.59	40.00	40.00	0	N/A	12.10	61.20	91.79	100%	1354.03	103.89	97.30
26	2048	40 MW	315.36	299.59		0	0	0.00	6.59	6.59	40.00	40.00	0	N/A	12.66	64.00	96.22	100%	1419.36	108.88	102.29
27	2049	40 MW	315.36	299.59		2	15.67	15.67	6.59	22.26	40.00	40.00	0	N/A	12.42	62.80	100.86	100%	1487.84	113.28	91.02
28	2050	40 MW	315.36	299.59		0	0	0.00	6.59	6.59	40.00	40.00	0	N/A	12.58	63.60	105.73	100%	1559.63	118.31	111.72
29	2051	40 MW	315.36	299.59		0	0	0.00	6.59	6.59	40.00	40.00	0	N/A	12.74	64.40	110.83	100%	1634.88	123.57	116.98
30	2052	40 MW	315.36	299.59		0	0	0.00	6.59	6.59	40.00	40.00	0	N/A	12.90	65.20	116.18	100%	1713.77	129.07	122.48
Total					219.72	10	189.52	300.14	197.75						319.04		2049.54			2368.58	1870.69
																				TIRE	16.99%
																				VANE	72.81

Table 17: Geothermal project's economic return calculation report– Cosigüina

The project's financial return is shown below, taking into account the project's real costs in order to calculate the IRR_F (*Financial IRR, FIRR)*, without taking into account an investor's IRR, with the possible positive effect that the project's financing (Project Finance). In the present case, it is deemed that the GNI only tries to recover 50% of the exploration costs (suported by PNESER and SREP)

Cosigüina		Generación y Ventas			Ingresos			Inversión					O&M	Financiamiento				Impuestos				Gastos		Flujos proyecto	Flujos Equity
N°	Año	Potencia bruta	Generación		PPA (Tarifa)	Peaje (Tarifa)	Total	CAPEX Inicial	CAPEX Desarrollador	# pozos adicionales	Reinversión	Total inversión	Costos	Deuda Const	Gastos de transacción	Repago al GNI	Deuda Sr	Depreciación fiscal	IR apalancado	IR sin apalanc.	IMI	Totales apalancados	Totales sin apalanc.	Netos sin apalanc.	Netos apalancados
		1.1	1.2	1.3	2.1	2.2	2.3	3.1	3.2	4.1	4.2	5 = 3 + 4.2	6	7.1	7.2	7.3	7.4	8	8.1a	8.1b	8.2	9 = 6+7+8	10 = 5+6+8	8 = 2 - 7	8 = 2 - 7
		MW	GWh	GWh	$/MWh		MUS$	MUS$	MUS$	#	MUS$	MUS$	MUS$	MUS$	MUS$	MUS$	MUS$	MUS$	MUS$	MUS$	MUS$	MUS$	MUS$	MUS$	MUS$
C1	2016							1.99	0.00			1.99		0.00		0.00	0					0.00	1.99	-1.99	0.00
C2	2017							25.21	0.00			25.21		0.00		0.00	0					0.00	25.21	-25.21	0.00
C3	2018							3.68	0.00			3.68		0.00		0.00	0					0.00	3.68	-3.68	0.00
C4	2019							3.12	45.69			3.12		1.14		0.00	0					9.37	3.12	-3.12	-9.37
C5	2020							56.22	45.69			56.22		2.28		0.00	0					9.59	56.22	-56.22	-9.59
C6	2021							85.54	45.69			85.54		3.43		0.00	0					9.82	85.54	-85.54	-9.82
C7	2022							47.79	45.69			47.79		4.57	7.37	20.40	0					15.60	47.79	-47.79	-15.60
1	2023	40 MW	315.36	299.59	116.54	4.63	33.53			0	0.00	0.00	6.71	0.00		0.00	19.17	11.18	0.00	0.00	0.08	25.96	6.79	26.74	7.57
2	2024	40 MW	315.36	299.59	120.04	4.68	34.56			0	0.00	0.00	6.91	0.00		0.00	19.17	11.18	0.00	0.00	0.09	26.16	6.99	27.57	8.40
3	2025	40 MW	315.36	299.59	123.64	4.72	35.63			0	0.00	0.00	7.11	0.00		0.00	19.17	11.18	0.00	0.00	0.09	26.37	7.20	28.42	9.25
4	2026	40 MW	315.36	299.59	127.35	4.77	36.72			2	18.02	18.02	7.33	0.00		0.00	19.17	11.18	0.00	0.00	0.18	44.70	25.53	11.19	-7.98
5	2027	40 MW	315.36	299.59	131.17	4.82	37.85			0	0.00	0.00	7.55	0.00		0.00	19.17	11.18	0.00	0.00	0.19	26.91	7.74	30.12	10.95
6	2028	40 MW	315.36	299.59	135.11	4.87	39.02			0	0.00	0.00	7.77	0.00		0.00	19.17	11.18	0.00	0.00	0.20	27.14	7.97	31.05	11.88
7	2029	40 MW	315.36	299.59	139.16	4.91	40.22			0	0.00	0.00	8.01	0.00		0.00	19.17	11.18	0.00	0.00	0.20	27.38	8.21	32.01	12.84
8	2030	40 MW	315.36	299.59	143.33	4.96	41.45			1	10.20	10.20	8.25	0.00		0.00	19.17	11.18	3.52	9.96	0.21	41.35	28.62	12.84	0.11
9	2031	40 MW	315.36	299.59	147.63	5.01	42.73			0	0.00	0.00	8.50	0.00		0.00	19.17	11.18	3.83	10.27	0.32	31.81	19.09	23.64	10.91
10	2032	40 MW	315.36	299.59	152.06	5.06	44.04			0	0.00	0.00	8.75	0.00		0.00	19.17	11.18	4.15	10.59	0.33	32.40	19.67	24.37	11.64
11	2033	40 MW	315.36	299.59	156.62	5.11	45.39			0	0.00	0.00	9.01	0.00		0.00	19.17	11.18	4.47	10.91	0.45	33.11	20.38	25.01	12.28
12	2034	40 MW	315.36	299.59	160.00	5.17	46.39			2	18.02	18.02	9.28	0.00		0.00	19.17	11.18	4.69	11.13	0.46	51.63	38.90	7.49	-5.24
13	2035	40 MW	315.36	299.59	160.00	5.22	46.37			0	0.00	0.00	9.56	0.00		0.00	19.17	11.18	4.60	11.04	0.46	33.80	21.07	25.30	12.57
14	2036	40 MW	315.36	299.59	160.00	5.27	46.36			0	0.00	0.00	9.85	0.00		0.00	19.17	11.18	4.51	10.95	0.46	33.99	21.26	25.09	12.36
15	2037	40 MW	315.36	299.59	160.00	5.32	46.34			0	0.00	0.00	10.14	0.00		0.00	19.17	11.18	4.42	10.86	0.46	34.19	21.47	24.87	12.15
16	2038	40 MW	315.36	299.59	160.00	5.38	46.32			0	0.00	0.00	10.45	0.00		0.00	19.17	11.18	4.32	10.76	0.46	34.40	21.67	24.65	11.92
17	2039	40 MW	315.36	299.59	160.00	5.43	46.31			1	10.20	10.20	10.76	0.00		0.00	19.17	11.18	4.22	10.66	0.46	44.82	32.09	14.22	1.49
18	2040	40 MW	315.36	299.59	160.00	5.48	46.29			0	0.00	0.00	11.08	0.00		0.00	19.17	11.18	4.12	10.56	0.46	34.84	22.11	24.18	11.45
19	2041	40 MW	315.36	299.59	160.00	5.54	46.28			0	0.00	0.00	11.42	0.00		0.00	19.17	11.18	4.02	10.46	0.46	35.07	22.34	23.94	11.21
20	2042	40 MW	315.36	299.59	160.00	5.59	46.26			0	0.00	0.00	11.76	0.00		0.00	19.17	11.18	3.91	10.35	0.46	35.30	22.57	23.69	10.96
21	2043	40 MW	315.36	299.59	160.00	5.65	46.24			0	0.00	0.00	12.11	0.00		0.00	0.00	0.00	10.24	10.24	0.46	22.81	22.81	23.43	23.43
22	2044	40 MW	315.36	299.59	160.00	5.71	46.23			2	18.02	18.02	12.48	0.00		0.00	0.00	0.00	10.12	10.12	0.46	41.08	41.08	5.14	5.14
23	2045	40 MW	315.36	299.59	160.00	5.76	46.21			0	0.00	0.00	12.85	0.00		0.00	0.00	0.00	10.01	10.01	0.46	23.32	23.32	22.89	22.89
24	2046	40 MW	315.36	299.59	160.00	5.82	46.19			0	0.00	0.00	13.24	0.00		0.00	0.00	0.00	9.89	9.89	0.46	23.58	23.58	22.61	22.61
25	2047	40 MW	315.36	299.59	160.00	5.88	46.17			0	0.00	0.00	13.63	0.00		0.00	0.00	0.00	9.76	9.76	0.46	23.86	23.86	22.32	22.32
26	2048	40 MW	315.36	299.59	160.00	5.94	46.16			0	0.00	0.00	14.04	0.00		0.00	0.00	0.00	9.63	9.63	0.46	24.14	24.14	22.02	22.02
27	2049	40 MW	315.36	299.59	160.00	6.00	46.14			2	18.02	18.02	14.46	0.00		0.00	0.00	0.00	9.50	9.50	0.46	42.45	42.45	3.69	3.69
28	2050	40 MW	315.36	299.59	160.00	6.06	46.12			0	0.00	0.00	14.90	0.00		0.00	0.00	0.00	9.37	9.37	0.46	24.73	24.73	21.39	21.39
29	2051	40 MW	315.36	299.59	160.00	6.12	46.10			0	0.00	0.00	15.34	0.00		0.00	0.00	0.00	9.23	9.23	0.46	25.03	25.03	21.07	21.07
30	2052	40 MW	315.36	299.59	160.00	6.18	46.08			0	0.00	0.00	15.80	0.00		0.00	0.00	0.00	9.08	9.08	0.46	25.35	25.35	20.73	20.73
Total							1309.70	223.55	182.75	10	217.95	316.03	319.07	11.42	7.37	20.40	383.39	223.55	151.62	235.35	11.13	1002.07	881.57	Sin apalanc.	Con apalanc.
																								TIRF	8.25%	14.67%
								CAPEX apalacando desarrollador		221.94														VANF	-36.52	7.07

Table 18: Cosigüina – geothermal project's financial return calculation

Scenario	Production (gross)	Initial Investment CAPEX (local cost) US$ Millions	Tariff US/MWh	Economic Internal Rate of Return IRR_E %	Financial Internal Rate of Return IRR_F %
40 MW	40 MWe	US$ 223.55 M Over 30 years: US$ 316.03M	Energy: $92/MWh Power: 0/kW-m All-in 2016: 92/MWh	16.99%	14.67%

Table 19: ACB Summary – Cosigüina

Source: Our own elaboration based on studies and ACB models' application

Cosigüina Project's sensibility analysis

The performed sensibility allows concluding that the Cosigüina 40 MW project turns out being economically feasible, even when facing changes in variable keys assumed in the analysis. Variations were independently analyzed at: (i) the investment cost; and (ii) the established tariff, and its impact on (a) the IRR_E, (b) the average VAN_E by user and (c) the total VAN_E. The following are the analyzed variations and their impact:

Sensibilidad financiera: deuda senior

TIRf	Caso base 14.67%	Tasa de Deuda Senior (%) 7%	8%	9%	10%	11%
Tarifa 2015 "All-In" del PPA	74 US$/MWh	9.3%	8.1%	7.0%	5.9%	4.9%
	83 US$/MWh	13.1%	11.7%	10.3%	8.9%	7.7%
	92 US$/MWh	17.0%	15.4%	13.8%	12.2%	10.7%
	102 US$/MWh	21.4%	19.7%	18.0%	16.2%	14.4%
	120 US$/MWh	27.4%	25.7%	23.9%	22.0%	20.0%

TIRf	Caso base 14.67%	Plazo de Deuda Senior (años) 30	25	20	15	10
Tarifa 2015 "All-In" del PPA	74 US$/MWh	6.7%	6.9%	7.0%	7.1%	7.1%
	83 US$/MWh	11.4%	10.8%	10.3%	9.7%	9.3%
	92 US$/MWh	15.9%	15.0%	13.8%	12.6%	11.5%
	102 US$/MWh	20.5%	19.5%	18.0%	16.0%	14.0%
	120 US$/MWh	26.7%	25.6%	23.9%	21.2%	17.8%

Sensibilidad financiera: inversión

TIRf	Caso base 14.67%	Costo de inversión (Planta - $/W) 1.3	1.4	1.5	1.6	1.7
Tarifa 2015 "All-In" del PPA	74 US$/MWh	8.1%	7.6%	7.0%	6.5%	6.0%
	83 US$/MWh	11.7%	11.0%	10.3%	9.6%	9.0%
	92 US$/MWh	15.6%	14.7%	13.8%	13.0%	12.3%
	102 US$/MWh	20.0%	19.0%	18.0%	17.0%	16.1%
	120 US$/MWh	26.2%	25.1%	23.9%	22.8%	21.7%

TIRf	Caso base 14.67%	Costo de perforación (MUS$/pozo) 4.5	5.5	6.5	7.5	8.5
Tarifa 2015 "All-In" del PPA	74 US$/MWh	12.0%	9.3%	7.0%	5.0%	3.2%
	83 US$/MWh	16.3%	13.1%	10.3%	7.8%	5.7%
	92 US$/MWh	20.8%	17.1%	13.8%	10.9%	8.3%
	102 US$/MWh	25.5%	21.6%	18.0%	14.6%	11.4%
	120 US$/MWh	32.1%	27.9%	23.9%	20.0%	16.2%

Sensibilidad financiera: impuestos

TIRf	Caso base 14.67%	Tasa de IR (%) 0.0%	10%	20%	25%	30%
Tarifa 2015 "All-In" del PPA	74 US$/MWh	9.2%	8.6%	7.8%	7.4%	7.0%
	83 US$/MWh	12.6%	11.9%	11.1%	10.7%	10.3%
	92 US$/MWh	16.1%	15.4%	14.7%	14.3%	13.8%
	102 US$/MWh	20.0%	19.4%	18.7%	18.3%	18.0%
	120 US$/MWh	25.4%	24.9%	24.4%	24.2%	23.9%

TIRf	Caso base 14.67%	Años de exoneración de IR 30	25	20	15	10
Tarifa 2015 "All-In" del PPA	74 US$/MWh	9.2%	8.8%	8.1%	7.6%	7.2%
	83 US$/MWh	12.6%	12.4%	11.8%	11.4%	10.7%
	92 US$/MWh	16.1%	16.0%	15.6%	15.3%	14.5%
	102 US$/MWh	20.0%	19.9%	19.7%	19.5%	18.8%
	120 US$/MWh	25.4%	25.3%	25.2%	25.1%	24.7%

Sensibilidad económica: inversión

TIRe	Caso base 18.33%	Costo de inversión (Planta - $/W) 1.3	1.4	1.5	1.6	1.7
Costo de perforación (MUS$/pozo)	4.50	20.6%	20.2%	19.9%	19.5%	19.2%
	5.50	19.3%	19.0%	18.7%	18.4%	18.1%
	6.50	18.2%	18.0%	17.7%	17.4%	17.2%
	7.50	17.3%	17.0%	16.7%	16.5%	16.3%
	8.50	16.4%	16.1%	15.9%	15.7%	15.5%

Sensibilidad económica: HFO

VANe	86.24 MUS$	Precios tCO2 - Escenarios bajo, medio, alto Bajo	Medio	Alto
Tasa de descuento	8%	194.6 MUS$	238.8 MUS$	370.2 MUS$
	10%	109.3 MUS$	141.5 MUS$	236.1 MUS$
	12%	56.1 MUS$	80.0 MUS$	149.9 MUS$
	14%	22.3 MUS$	40.5 MUS$	93.3 MUS$
	16%	0.6 MUS$	14.7 MUS$	55.3 MUS$

Sensibilidad económica: HFO vs tCO2

TIRe	Caso base 18.33%	Precio tCO2 - Escenarios bajo, medio, alto Bajo	Medio	Alto
Precio HFO - Escenarios bajo, medio, alto	Bajo	13.35%	15.12%	19.71%
	Medio	16.08%	17.69%	21.90%
	Alto	18.53%	20.02%	23.94%

Sensibilidad económica: HFO

VANe	86.24 MUS$	Precio HFO - Escenarios bajo, medio, alto Bajo	Medio	Alto
Tasa de descuento	8%	164.4 MUS$	238.8 MUS$	313.2 MUS$
	10%	88.6 MUS$	141.5 MUS$	194.3 MUS$
	12%	41.4 MUS$	80.0 MUS$	118.6 MUS$
	14%	11.6 MUS$	40.5 MUS$	69.4 MUS$
	16%	-7.3 MUS$	14.7 MUS$	36.8 MUS$

Table 20: Sensibility analysis – Cosigüina

Source: Our own elaboration based on studies and application of ACB models

Conclusions on the Geothermal Sector's Projects

In summary, the making of investments in the studied and proposed projects, promise reactivation of Nicaragua's geothermal sector. One may determine that the geophysical results are promising, due to the fact that they suggest the presence of high temperature geothermal reservoirs at each considered site.

If the required studies and the subsequent excavation of wells were developed, as foreseen, the Mombacho and Cosigüina sites would generate a promising cost effectiveness, the VAN_E is positive at a discount rate of 12% and the IRR_E at the order of 18% is attractive, generating long-term benefits enabling to recover the investment. The Caldera de Apoyo site is punished for its lower size, one that does not allow the generation of scale economies.

It is worth noticing that the geothermal resource at any of these sites may only be considered as viable for the production of electricity, once having been drilled and tested by means of deep wells' exploration, allowing to confirm the deposit conditions and the wells' productive capacity.

The introduction of geothermal generation would offer the opportunity of displacing the burning of fuels and would have the reduction of electrical tariff as a benefit, something that would help the population's lowest income sector of society and, when reducing the subsidy, would contribute to Nicaragua's economy's growth.

* * *

INTER-AMERICAN DEVELOPMENT BANK

NICARAGUA

NICARAGUA GEOTHERMAL EXPLORATION AND TRANSMISSION IMPROVEMENT PROGRAM UNDER THE PINIC

(NI-L1094)

Environmental category: A

ANNEX III: ENVIRONMENTAL AND SOCIAL MANAGEMENT REPORT (ESMR)

JULY 1, 2016

IMPORTANT: This document is a draft of the ESMR. Some of the key mitigation and compensation actions presented in this document still require documentation from the client. Only when such documentation is received, the ESMR can be finalized, circulated to the IDB, and published on the website of the IDB.

This document was prepared by the project team consisting of: Héctor Baldivieso (ENE/CNI) Team leader; Alberto Levy-Ferre, Alternate Team Leader; Christiaan Gischler; Carlos Trujillo; Shohei Tada; Rodrigo Aragón; Wilkferg Vanegas; Stephanie Suber (INE/ENE); Claudio Alatorre (INE/CCS); Paloma Marcos (SCL/GDI); María Cristina Landázuri (LEG/SGO); and Zachary Hurwitz and Rachel Atkinson (VPS/ESG); Juan Carlos Lazo; Santiago Castillo (FMP/CNI); Alma Reyna Selva (CID/CNI); Samar Rimawi (ENE/CNI).

ENVIRONMENTAL AND SOCIAL MANAGEMENT REPORT (ESMR)

Country	Nicaragua
Sector	ENERGY- Low Carbon Technologies
Name of Project	NICARAGUA GEOTHERMAL EXPLORATION AND TRANSMISSION IMPROVEMENT PROGRAM UNDER THE PINIC
Borrower and / or sponsor	Ministry of Energy and Mines (MEM)
Executing Agency or Company	Empresa Nacional de Transmisión Eléctrica (ENATREL) y Empresa Nicaragüense de Electricidad (ENEL)
Type of Transaction	Project Loan
Total Cost of the Program (in USD)	$104,393,000
IDB	$72.500.000
Co-financers	$24.974.0001
Local Counterpart	$6.919.000
Environmental category	A

[1] Financed with resources from ordinary capital in concessional terms under the Grant Leverage Mechanism (GLM).

TABLE OF CONTENTS

LIST OF ACRONYMS AND ABBREVIATIONS

ACN	Artículos y Construcciones Eléctricas de Nicaragua S.A.
AICA	Area of Importance for Bird Conservation / Área de Importancia para la Conservación de las Aves
BPCs	Polychlorinated Biphenyls /Bifenilos Policlorados
CTF	Clean Technology Fund
EEA	Evaluation of Cumulative Effects / Evaluación de Efectos Acumulativos
ENATREL	Empresa Nacional de Transmisión Eléctrica
ENEL	Empresa Nicaragüense de Electricidad
ERM	Environmental Resources Management
ESIA	Environmental and Social Impact Study / Estudio de Impacto Ambiental y Social
GHG	greenhouse gases
ICAS	Environmental and Social Performance Report / Informe de Cumplimiento Ambiental y Social
IDB	Inter-American Development Bank
IGAS	Environmental and Social Management Report / Informe de Gestión Ambiental y Social
INETER	Nicaraguan Institute of Territorial Studies / Instituto Nicaragüense de Estudios Territoriales
IUCN	International Union for the Conservation of Nature
MARENA	Ministry of the Environment and Natural Resources / Ministerio del Ambiente y los Recursos Naturales
MEM	Ministry of Energy and Mines
PAAS	Environmental and Social Action Plan / Plan de Acción Ambiental y Social
PAB	Biodiversity Action Plan / Plan de Acción para la Biodiversidad
PG	Geothermal Project / Proyecto Geotérmico
PGAS	Environmental and Social Management Plan / Plan de Gestión Ambiental y Social
PINIC	Investment Plan for Nicaragua / Plan de Inversiones para Nicaragua
PNESER	National Program of Sustainable electrification and Renewable Energy / Programa Nacional de Electrificación Sostenible y Energía Renovable
RNVC	Natural Reserve Cosigüina Volcano / Reserva Natural Volcán de Cosigüina
SINAP	National System Protected Areas / Sistema Nacional de Áreas Protegidas
VEC	Valuable Ecosystem Component / Componente Valioso del Ecosistema

1. EXECUTIVE SUMMARY

1. A new Lending Operation is considered that will permit the Government of Nicaragua the financing of the Program of the Extension of Renewable Energy for Countries of Low Income (The Program).

2. The Program was designed under the modality of a loan operation from the Ministry of Energy and Mines (MEM). The loan (NI-L1094) includes two components:

3. **Component 1** – Investment in the exploration of the Cosigüina camp with geothermic potential, which already has preliminary investigations on the surface. Exploration of the camp with a level of production feasibility in the Area of Geothermic of Cosigüina Volcano and (ii) **Component 2** – Improvements in the electric transmission infrastructure, including the construction and extension of the transmission and substation lines in 138 kW and 230 kW.

4. The Area of Geothermic Exploration of Component 1 will be located inside the Natural Reserve Volcano Cosigüina (RNVC), which at the same time is considered an Important Bird Area (IBA, in English, (#NI002), as well as a key area for biodiversity. The RNVC is located in the Chinandega province, 80 km northeast of Chinandega City, and 215 km northeast of the city of Managua .

5. The exploration activities for the Geothermic Volcano Cosigüina Project is divided in three stages. Stage 1, is currently being done by MEM and the contractor Artículos y Construcciones Eléctricas de Nicaragua, S.A. (ACN) under the Program PNESER (NI-L1040, NI-L1050, NI-L1063), contemplating the perforation of three (3) exploration wells (reduced diameter) with depth to 1000m, with the intention of obtaining information that will confirm or modify the preliminary conceptual model of the geothermic system. The activities for Stage 1 consists of 3 platforms (A;B;C) of 625 m^2 each one(1,875m^2 total area), reconstruction of 4 linear km of existing passage way of 3.5m of width, opening of 2 linear km new passage way of 3.5m in width with security bays, extraction and transportation of selected materials from the bank of materials, the installation of 6.25km of water pipes, the construction of a water pump station holding 400 m^2 of water, the propagation particle materials, gasses, and vibrations and redirection of the subterranean water flow.

6. Stage 2 will be executed by MEM with the technical support ENEL under the current Program (NI-L1094), it would contemplate three (3) new platforms (D, E, F) of 12,000m^2 each one, for three new exploration wells (commercial diameter) with a depth of up to 2000m, in order to confirm the results of Stage 1. According to the results, the wells D, E, and F could become production or reinjection wells. The construction of new passageways would also be contemplated, considering that the new wells would be perforated from new perforation platforms; these would be placed depending on the perforation results of Stage 1. Stage 2 will need the installation of 1km of additional water pipes for each section between pumping station and the platforms D, E, and F. All components of Stage 2 will be located within the geothermic area of Cosigüina.

7. Finally, if the resources in Stage 2 are found, an eventual Stage 3 would contemplate the preparation of platforms for additional production wells of commercial diameter and in

depth perforation, which could also turn into production and reinjection wells. Stage 3 will contemplate the construction of a geothermic plant, transmission lines that connect with the nearest substation, a cooling tower, lagoon reservoirs, passage ways and additional water pipes. These components have not been identified, and there is a required ESIA analysis with complete approval by MARENA, in case Stage 3 is materialized.

8. Component 2, to be executed by ENATREL, consists of four sub-projects: (i) Construction of a transmission line of 138 kW El Sauce- Villanueva and adjoining construction; (ii) Increasing the capacity of transmission on line of 230 kW property of ENATREL; (iii) Enlargement of the Substation Sebaco and (iv) the enlargement of the capacity of transmission of five substations of the National Transmission System (Acahualinca, Catarina, Diriamba, Ticuantepe I y San Benito).

9. Based on the information collected by the appropriate environmental and social diligence of IDB, the impact and risks more relevant associated with the Program are: 1) The fragmentation of the connectivity of the habitat and the effects on the border of the Natrual Volcano Reserve Cosigüina, including its importance in holding water; 2) A high risk of natural and induced disasters that could affect the viability of the Projects and the health and security of nearby communities; 3) Risks associated with the availability of superficial and subterranean water for exploration and eventual geothermic production and the quality of available water for nearby communities; 4) Impacts associated with the construction stage, such as: air pollution, noise pollution, and visual impacts; and 5) negative impacts on the economic potential of land proprietors nearby for example, ecotourism, as well as nearby communities. The environmental and social adverse impacts, if not lessened will be significant, and therefore, the Program was classified as "Category A" according to the Operative Policy OP-703 of IDB.

10. Up to this day, there is no existing ESIA for Stage 2 of the geothermic project. The ESIA prepared by ACN for Stage 1 has been approved by the national authorities, and the IDB considers it contains useful information for the realization of Stage 2. On the other hand, the Bank has identified significant breaches in the ESIA for Stage 1 in terms of complying with the instructions of IDB and its good international practices. In order to fill in these breaches, the IDB contracted the services of independent environmental consultants in order to complete additional studies with the purpose of assuring a social and sustainable environment of the Projects in compliance with the environmental protection policies of IDB. All complementary studies, as well as the previous ESIA, have been published accordingly to the Access Policy of Information of the Bank. At the same time, there are no ESIAs for subprojects of Component 2. The IDB requires that MEM/ENEL to complete an ESIA complementary for Stage 2, and the ENATREL complete ESIAs for the subprojects of component 2, before the respective initiation of the construction of each subproject.

11. Environmental and Social Plans of Action have been developed with the collaboration of the executers of Components 1 and 2. These plans, which respond to the impacts and risks key to the project, take into consideration as a base when possible the measures of environmental management that the ESIA of Stage 1 stated in its Plans of Environmental Management and the recommendations of the complementary environmental studies.

12. The strategy includes the compensatory restoration and reforestation of the RNVC, amongst other measures. The MEM, ENEL and ENATREL have the compromise to procure the

adequate implementation of the mitigation strategy, including obtaining the resources necessary. The contract documents will include requisites to this effect, in particular those reflected in the Plan de Acción Ambiental y Social (PAAS), and appropriate arrangements for the monitoring and supervision. After approval of the Project, the IDB will supervise actively the outcome of the measures on mitigation and environmental and social compensation.

13. Some of the requirements of the safeguard policies of IDB are not currently being complied with, specifically the B.4 (Other Factors of Risk) and B.5 (Environmental Evaluation) of OP-703 and OP-710 (Reinstallation). Other requirements of the policies are being complied with or waiting to be complied with through the implementation of adequate measures and systems of management and mitigation agreed upon. Due to a lack of information and risks associated to the subprojects of Components 1 and 2, some uncertainties continue in relation to the effectiveness of the measures of the mitigation and compensation planned, especially in relation to the availability of water for the geothermic project and its environmental and social risks associated with. Depending on the results obtained during the monitoring and supervision, adjustments may be required in the strategy of mitigation and/or implementation of corrective actions.

14. If Stage 3 is reached, the eventual operation of the geothermic project will be associated with a positive impact on the reduction of gas emissions that contribute to the greenhouse effect. The operation of the geothermic Project Cosigüina could contribute with avoiding the emissions of $Co_{2,}$ as well as generate jobs, improve infrastructures, improve the management of the Natural Volcano Reserve Volcano Cosigüina, and the strengthening of the connectivity and coverage of the wooded area both structurally and functionally.

2. PROGRAM DESCRIPTION

15. It is considered that a loan would permit the Government of Nicaragua the financing of the Geothermic Exploration Program and Improvements in transmission (Program), including the support of the Investment Plan for Nicaragua (PINIC) with the phase of exploration of geothermic resource in the area of Cosigüina in the Province of Chinandega, and investments in structures that improve the system of transmissions.

16. The Program is designed under the Grant Leverage Mechanism (GLM) for the PINIC, on the basis of the financing non-reimbursable anticipated for the Program of SREP and the Clean Technology Fund (CTF), with an operational loan which would be approved in 2016 for US$104.4 million and including two components: (i) **Component 1** – Investment in the exploration of the Cosigüina camp with geothermic potential that already has preliminary investigations of the surface. There will be a camp exploration at a feasibility level of production in the Geothermic Volcano Cosigüina Area; and (ii) **Component 2** – Improvements in the electric transmission infrastructure, including the construction and extension of the lines of transmissions and substations in 138kW and 20 kW. The total estimated cost of the program is US$104.4 million, of which IDB could finance US$72.5 million.

17. The report on Environmental and Social Management for the Program will be developed in two parts: (i) **Part A** deals with Component 1 of the Program, focused on the Geothermic

Volcano Cosigüina Project;[2] and (ii) **Part B** deals with Component 2 of the Program, which encompasses the impacts and risks of potentially less significance.

3. DESCRIPTION OF THE PROJECTS AND AREAS OF INFLUENCE

a) Key Components of infrastructure and Calendar of Works

18. **Component 1 (Geothermic Volcano Cosigüina Project):** The activities for exploration for the Geothermic Volcano Cosigüina Project are divided in three stages.[3] The activities of the prefeasibility stage (Stage 1) are part of the operations NI-L1040, NI-L1050, NI-L1063, and are being executed by MEM through the contractor Artículos y Construcciones Eléctricas de Nicaragua S.A. (ACN) under the Program PNESER. The Activities of Stage 1 include the perforation of three (3) wells and the exploration of the reduced diameter at a depth of up to 1000m, the confirmation of 3 platforms (A, B, C) of 625m^2 each one each one(1,875m^2 total area), rehabilitation of 4 linear km of existing passage way of 3.5m of width, opening of a 2 linear km new passage way of 3.5m in width with security bays, extraction and transportation of selected materials from the bank of materials, the installation of 6.25km of water pipes, the construction of a water pump station holding 400 m^2 of water, the propagation particle materials, gasses, and vibrations and redirection of the subterranean water flow. In **Figure 1** it is observed the immediate location of the three perforation platforms in the stage of prefeasibility (A, B, C). Stage 1 is anticipated to begin in 2016 and it would have duration of completion of approximately 31 months.

19. The activities in the feasibility stage (Stage 2) would be financed by the operation NI-L1094, whose executor is MEM with the technological support of ENEL. Stage 2 contemplates perforation of three (3) new wells of commercial diameter with a depth of up to 2000m, in order to obtain information that will allow confirm or modify the preliminary conceptual model of the geothermic system and to confirm the results of the exploration wells of Stage 1. The activities of Stage 2 also contemplate the preparation of three (3) new platforms (D, E, F) of 12,000m^2 each one, the construction of new access roads, considering that the new wells will be perforated from the new perforation platforms, which will be located depending on the perforation results of Stage 1. Stage 2 will need the installation of 1km of additional water pipes for each section between pumping station and the platforms D, E, and F. If the results obtained are positive in Stage 2, the three wells could become production and reinjection wells or they can perforate new wells of production and reinjection. All of the components of Stage 2 will be located within the geothermic area of Cosigüina. Stage 2 is anticipated to begin in 2018 and it would have duration of completion of approximately 25 months.

---

[2] This report of the Environmental and Social Management goes by the explicit understanding that the geothermic exploration activities of Component 1 of this Program contemplates only the geothermic exploration in the Cosigüina area. JICA is working on a parallel financing that will permit financing the geothermic exploration of the Mombacho area. Once JICA has defined the reach of the exploration it will begin the environmental studies necessary for that camp.

[3] The geothermal resource in Cosigüina can only be considered viable for the production stage of electricity once it has been perforated and tested through the exploration of the wells that will permit confirm the conditions of the reservoir and the productivity of the wells.

20. The stage of production (Stage 3) does not form part of NI-L1094, and it is understood that if it should occur, there would be a bid by a private company with the participation of MEM/ENEL. The activities of Stage 3 contemplate the preparation of additional platforms for commercial wells of production or reinjection of in depth perforation, and the construction of a geothermic plant of approximately 40MW, a transmission line of 77km of extension that sends out electricity to the substation El Viejo, a cooling tower, reservoir lagoon, additional water pipes, and the opening of new roads with additional access. These components have not been defined and their environmental and social impact and risks have not been studied. In case Stage 3 is done, an analysis will be required of the these in a complete ESIA approved by MARENA.

21. The area of exploitation of geothermic resource is estimated between 7.5 km^2 and 20 km^2, and the Area of Direct Influence of the Project is considered 20.0620 $km^{2.}$ It is estimated that the superficial infrastructure is approximately 0.1875 ha[4] of an area of unknown size being bought by five (5) proprietors to develop the Project in its totality (including Stage 1 and Stage 2). According to existing documentation, in preparation for Stage 1, the MEM and ACN have reached compensation agreements with proprietors of the land where the platforms A, B, and C will be built and the section where the new access roads will be drawn up; however, the levels of compensation may not correspond to the required by Nicaraguan law nor the IDB.

22. The Project will be situated within the Natural Volcano Cosigüina Reserve (RNVC) (See Figure 1), which at the same time is considered both an Important Bird Area (IBA, in English, #N1002)[5] and an area key to biodiversity, above all because there is a population of 14 red rodents (*Ara macao cyanoptera*). According to the latest RNVC of the National System of Protected Areas (SINAP), the Platforms "A" and "C" are located in the Intangible Zone of the RNVC, and Platform "B" in the Multiple Use Zone. The existing access roads to Platforms A, B and C are located in the, Multiple Use and Cushioning Zone of the RNVC. The total area of conversion for Stage 2 will be approximately 5.54 hectares for access and 3.60 hectares for the platforms of which, 1.49 hectares correspond to an untapped tropical forest and regenerating farming systems with significant important habitat diversity, including a dry tropical forest, gallery forests, temporary moist soils, pastures, forest areas of cultures and plantations.

23. For Stage 1, the calculations of maximum demand of water per well is 135m^3/day or 1.6 l/s. For Stages 2 and 3 it is estimated that the maximum demand of water per well is 20 l/s. The water take proposed for Stage 1 is located underneath a communal rock receptacle called "La Piscina" in the village of Potosí, used currently to provide water to the community, as recreation, and washing of clothes with water that overflows from the reciprocal **(see Figures 2 and 6)**. The supply for Stage 1 is planned through the use of cisterns for a route of 4km, which will be filling up using the water beneath "La Piscina" not interfering with the community. However, the volume of the receptacle is 259.2m^3/day or 30 l/s, which would

[4] Study on the Environmental and Social Impact for the Prefeasibility Geothermic Volcano Cosigüina Project Exploratory Perforation, ACN, 2015

[5] AICA refers to internationally recognized areas as important world habitats for the conservation of bird populations as considered to be at risk, with rank or restricted bioma, or congregation of species.

mean that the complete volume could take care of the maximum demand of Stages 2 and 3 only during 3.6 hours a day, depriving the community of its resource, and making Stages 2 and 3 unviable. That is how the perforation of water wells for extraction and consumption has been considered during Stage 2 of the geothermic project. During Due Diligence of IDB, it was determined that MEM/ENEL will hand in before the date of distribution to OPC a Complementary Study of Impacts that analyze both environmental and social impacts as well as accumulative impacts on the water availability, generated by the perforation of the water wells for use during Stage 2 of the Geothermic Project, and that offers measures that will avoid impacts and risks on natural habitats and bordering communities.

24. **Component 2 (Transmission Projects):** The component consists of four subprojects: (i) Construction of line of transmission of 138 kW El Sauce –Villanueva and other connections; (ii) Increasing the Capacity of Transmission on Line 230 kV property of ENATREL; (iii) Expansion of the Substation Sebaco and (iv) the Expansion of the Capacity of Transmission of Five Substations of the National System of Transmission (Acahualinca, Catarina, Diriamba, Ticuantepe II and Benito). The activities of each Project of Component 2 and its environmental and social context are described below.

Table 1. Contemplated Projects of Component 2 of the Program

Project	Activities	Environmental and Social Context
Transmission Line of 138 KW El Sauce-Villanueva and adjoining works	1.Substation Villanueva The activities contemplated in the acquisition of the land, the expansion of the control booth, the construction of a perimetral wall and bays of transformation 138 kW /24.9 kW and 138 kW/69 kW, and the installation of a transformer 25 MWA 138/69 kW. 2. Substation El Sauce The activities contemplate the construction of dos bays of line 138kW and one bay of attachment and the installation of 7 cells of distribution 24.9 kW and a system of communication, control and protection. 3. Line Transmission The activities contemplated in the construction of 37.2 km of simple line circuit in 138 kW from substation Viallanueva to the substation El Sauce, and the installation of on Dove Conductor caliber 556.5 kcmil ACSR and guarded thread OPGW type, mounted on tower lattice structures.	The Project will be executed in the Villanueva Municipality, Department of Chinandega, and Sauce Department of Leon. The main economic activity is agriculture. The mayor part of the community dedicates itself to cultivating basic grains like rice, corn, sesame and sorghum. There are no protected areas located in the area of influence of the Project. The majority of the influence area consists of low secondary intervened forests, meanwhile the primary forest is occupies a smaller percentage. The most important river in the area of influence of the Project is the Aquespalapa or Villanueva, that has a distance of 60 km.
Increasing Capacity of Line of Transmission 230 kW Project	The project consist of designing, and supplying equipment and materials, electro mechanic installation , transportation tests and service for: • The construction of 78 km of existing conductor change for CONDOR ACSS HTLS TW, insulators and iron work in the Leon line- bordering Honduras. The dismounting of the Condor ACSR existing conductor and its transportation to warehouses.	The project will be executed in diverse municipalities of the Chinandega, Leon, Managua, Granada and Rivas departments with a longitude of 307.5 lineal kilometers. There are no protected areas located in the area of influence of the Project. The majority of the influence area consists of low secondary intervened forests, dominated by agricultural activities and cattle-raising.

	• The construction of 19 km of existing change of conductor by CONDOR ACSS HTLS TW, insulators and ironwork of the Amayo Line bordering with Costa Rica. The dismounting of the existing Condor conductor ACSR and its transportation to warehouses. • The realization of the topographic survey LIDAR in 310 km of lines in existing 230 kW. • The retention of 230 km of existing line of 230 kV. • The change of structures and change of insulators and other jobs in order to increase the capacity of transportation.	
Expansion of Substation Sebaco Project	The project consist on the design and supply of equipment and materials, electro mechanic installation, tests and service of metallic structures (Porticos for the exiting of lines and bars), a bay of connecting bars in 138kW (circuit breakers, bus bar sections and TC), 3 tension transformers of bar measurement, 7 bar bus (6 in line plus 1 distribution transformer), control shelves, protection and measurement of new and telecommunication equipment. An expansion of existing land of the substation will encompass an area of 130 times 20m to accommodate the second line of transmission.	The project will be executed in the city of Sebaco, Department of Matagalpa. The main economic activity of the municipality is agriculture and mainly the cultivation of rice, sorghum, corn and some vegetables. Therefore, the area of influence of the Project is located in the secondary strongly intervened forest, and no existing protected areas. In the municipality resides the indigenous community of Valle de Sebaco that includes the municipalities of San Isidro, Ciudad Dario and Sebaco. The possession of the land is not independent but founded on the Real Ownership. However, the indigenous people of Nicaragua do not count on an Independent Law, and therefore, real ownerships are not recognized. In the expansion of the Area of Influence of the substation Sebaco, exists one sole proprietor who cultivates rice. However, the land of expansion does not affect his production. The habitat of that land is composed of grazing land intervened and currently unused. ENATREL will compensate the proprietor of the land. The proprietor of the land lives in USA.
Expansion of the Capacity of Transmission in Substations of SNT	<u>Acahualinca Substation</u> The activities contemplate the installation of 1 transformer of 40 MWA with relation to voltage 138/13.8kW; 1 bay of transformation 138/13.8kW (double bar); 7 Metaclad cells (Includes 4 distribution exits with its switches, entry cell of a potential transformer with its switch, the cell for measuring equipment and the cell for the transformer of self-service); the expansion of the bus bars of 138kW; one conductor and iron work for drain pipes and connections between equipment; the expansion of the network System Land and Air Armor-Plating of the Substation; the expansion of the Automated System of Control, Protection and Measurement: potential cables and control; and all the civil works of the new works (Equipment	The substations that form part of this project are existing infrastructures that are found in zones that are highly alterable due to human, urban, agricultural and uninhabitable activities. All the substation activities will take place in the existing areas where they are located.

	Foundations, Canalizations for cables, cement curbs, drainages and layers of gravel). Catarina Substation The activities contemplate the installation of 1 transformer of 40 MWA with relation to voltage 138/13.8kW; 1 bay of transformation 138/13.8kW 7 Metaclad cells (Includes 4 exit cells with its switches, entry cell of a potential transformer with its switch, the cell for the transformer of self- service), and the expansion of the booth. Diriamba Substation The activities contemplate the installation of 1 transformer of 40 MWA with relation to voltage 138/13.8kW; 1 bay of transformation 138/13.8kW. Ticuantepe II Substation The activities contemplate the installation of 1 transformer of30/ 40 MWA with relation to voltage 138/13.8kW; the change of transformers of currents in the high and low side of the transformer; potential and control cables; one conductor and ironwork for drainage and connection between equipment; the expansion of the network System Land and Air Armor-Plating of the Substation; the expansion of the Automated System of Control, Protection and Measurement; and all the civil works of the new works (Equipment Foundations, Canalizations for cables, cement curbs, drainages and layers of gravel). San Benito Substation The activities contemplate the installation of 1 transformer of 40 MWA with relation to voltage 138/13.8kW; 1 bay of transformation 138/13.8kW 7 Metaclad cells (Includes 4 exit cells with its switches, entry cell of a potential transformer with its switch, the cell for the transformer of self- service), and the expansion of the booth.	

b) Environmental and Social Context

25. **Component 1 (Proyecto Geotérmico Volcán Cosigüina):** *Natural Habitat*. The Natural Volcano Cosigüina Reserve was created in 1958 by decree No. 14 and the decree No. 1320 and it corresponds to a Natural Reserve Recognized in the *General Law Environment and the Norms of Protected Areas of Nicaragua.* Its objective is to conserve and restore all natural Ecosystems and terrestrial habitats and aquatic; produce goods and services in a sustainable form; promote the scientific investigation and promote and facilitate the development of infrastructure and tourist services. The RNVC, located in the Province of Chinandega, northeast of the country provides habitat and ecological and biogeographically functions to approximately 224 species of flora and fauna.

26. According to the information collected by SINAP and the Red List of the International Union for Conservation of Nature (IUCN)[6], at the RNVC one can find numerous species of interest like the red rodent (*Ara macao yanoptera*), big bass(*Crax rubra*), the *Pecari tajacu*, wild cat,(Felis wiedii *nicaragua*e), the small tiger (Feelis paradalis), colmenero bear (*Tamandua tetradactyla),* It has been reported the occasional presence of the jaguar (*Panthera onca*), the puma (*Puma concolor*), the spider monkey (*Ateles geoffroy*), congo monkey (*Alouatta palliate*) and the white faced monkey (*Cebus capucinus*), as well as the boa constrictor (*boa constrictor*). These species are confined to habitats that are less accessible inside the RNVC. The RNVC is an attractive ecotourism due to its landscape (the crater, and the coast) and in lesser measurement by its biodiversity and natural habitat. Even though, it is understood that RNVC has a high ecological value because of its geography and its hydrologic and volcanic importance, it is clear due to the information available that exists that there are certain breaches on the basis of the biodiversity of the RNVC, and that those value of the ecological services in this area are unknown.

27. The Geothermic camp is located in a secondary mature forest intervened with a significant important diverse habitats, including a dry tropical forest at the foot of the volcano (Semi-deciduous Forest Transitioning a Sub- tropical High Covered) the vegetation area is open with dry sporadic tropical forests, galleries of forests, moist grounds, pastures, areas of cultivation and forestry plantations. The superficial area to be intervened by Stage 1 constitutes approximately 0.1875 ha.

28. Historically, the RNVC was managed by the National System of Protected Areas (SINAP) from the Ministry of Environment and Natural Resources (MARENA) and the Foundation of Integrate Fighters of Development of the Region (LIDER), according to what is stipulated in the agreement signed on November 16, 2001[7]. However, the information obtained states that the Foundation LIDER handed that responsibility to the Rural Committee of the Municipality of the El Viejo Community in 2009. Currently the co- Management is being done by Mr. Daniel Pozos from the Committee of El Viejo city.

29. *Social Context*. The project will be executed in the area of influence of the El Mojado-El Capulin communities, in the El Viejo Municipality, in the Chinandega Department. The municipality has a population that totals Approximately 102,292 inhabitants[8]. According to the census presented to MARENA, the population closest to being affected by the Project is El Capulin-El Mojado community, given the location within the area of Cushioning of the RNVC and it has a population of 460 inhabitants, the majority of which are dedicated to agriculture and fishing. The majority of the houses of the Capulin community are located on the border of the access road and others are located within 50 to 100 meters from the main road, which is the road that goes along the Natural Volcano Cosigüina Reserve up to the Potosi community, where the communal water receptacle proposed to take water for the

---

[6] The Red list of the IUCN is a base of data recognized worldwide that presents information on the state of threat, danger, and extinction of the flora and fauna species. See http://www.iucnredlist.org/.

[7] Plan of Management of the Natural Volcano Cosigüina Reserve, Ministry of Environment and Natural Resources 2006.

[8] Social economic Study Project of Geothermic Exploration Cosigüina Volcano. "Community El Capulin-El Mojado" El Viejo, Chinandega Department, ACN, 2015.

Project. Potosi is the community of the zone with most presence of the state institutions and private organizations.

30. *Cultural Patrimony.* According to the available information, archeological findings have not been reported in the Area of Influence.

c) Alternative Analysis

31. *Options for the expansion of the electric generation.* In Nicaragua there are 12 Geothermic camps with the estimated potential of 1.500MW, but there are two (San Jacinto-Tizate and Momotombo) that have been able to be developed to this date, with the sole capacity installed of 155MW. The electricity produced by geothermal is considered viable by the MEM because of its ability to operate with accuracy (firm capacity) and dispatch base renewable non-polluting energy. The MEM has incorporated a design to its geothermic plants that minimize the Environmental and social effects, like small plazas only in the areas already degraded, eliminating the need to deforestation and construct small plazas. In the Geothermic Exploration Volcano Cosigüina Project, the MEM requires the cutting of around 5.5 ha of intervened and non-intervened forest, which looks to recuperate a plan of ecological restoration.

32. *Options for the expansion and reestablishment of the electric transmission grid*. The National System of Transmission counts on 663,2 km of transmission lines at 69kW; approximately 50% constructed on original wood structures that reach a time of service of more than 20 years, with conductors that surpassed their life use, that is why the lines suffer constant disconnections, affecting the quality of service. The effort to increment the coverage of electric service, the increment in the demand, the diversification of the energetic matrix and the need to continue deepening the compromise of the country and the regional integration, have brought pressure on the sections of the transmission system, affecting its reliability, limiting its capacity and impeding the connection of new users to the electric service.

33. *Alternatives for the design of the geothermic project.* The selection of sites for geothermic exploration is conditioned by the presence of the resource. In Nicaragua, the geothermic resource is located along the volcano belt that crosses the country from the northeast to the southwest. The location of the infrastructure of the Project of Geothermic Exploration Cosigüina Volcano continues with the presence of the resource, with the wells located towards the closest skirt of the Cosigüina Volcano. Within the area of the Project, the ENEL evaluated the positioning of the platforms and selected locations that minimize the deforestation of forests and the longitude of pipes and other infrastructures. For the Program, the geothermic camp Cosigüina Volcano is the one that counts with advanced studies for its exploration, when compared to two other camps, Mombacho and Apoyo.

4. THE STATE OF COMPLIANCE AND APPLICABLE POLICIES

a) Compliance of the national regulatory framework

34. Licenses and Permits Required by the National Norms (Components I and II). On December 23, 2015, MARENA issued an Environmental Permit for Stage of Exploration at a Pre-

feasibility for the Geothermic Volcano Cosigüina Project (Stage 1).[9] The feasibility stage (Stage 2) of the project has not obtained a license or environmental permit from MARENA. Of the projects of transmission contemplated in Component 2 of the Program, all have been categorized as "II" by MARENA and therefore are subject to obtaining an Environmental Permit. MARENA has not issued the respective Environmental Permits to this date.

Environmental and Social Evaluation Process

35. *Environmental Impact Studies (Component 1).* In September of 2015 Articles and Electrical Constructions of Nicaragua, S.A. (ACN) made a "Study of Environmental Impact for the Study of the Pre-feasibility for the Geothermic Volcano Cosigüina Project Exploratroy Perforation Phase" (Stage 1). ESIA analyzes the impacts and risks and has plans of management associated with the geothermic exploration activities "slim-hole", activities contemplated previously in the stage before financing of the Program. **Meanwhile since the company ACN is not part of the agency in charge and does not have a role in the Program, it is considered that the scope of ESIA in Stage 1 is appropriate for the exploration activities to be financed by the Program, since these activities have the same environmental and social context in the area of influence. However, some activities in in Stage 2 are different from Stage 1, since they contemplate the expansion of the diameter of the drill hole, and in depth perforation, an increase in the number of wells, location different from the others, and a mayor demand of water during Stage 2.** Therefore, the Bank has identified the significant breaches in the ESIA for Stage 1 in terms of the compliance of instructions from IDB. In order to begin filling out these breaches, IDB contracted the consulting services of independent environmentalists to begin additional studies with the goal of assuring the environmental and social sustainability of the Program and the compliance of the environmental and social safeguard policies of IDB. All the complementary studies, as well as the previous ESIA, have been published according to a Policy of Access to Information from the Bank.

36. *Report Summary (Component 1).* In December 2015, West Japan Engineering Consultants, Inc. and Mitsubishi Material Techno Corporation carried out a "Study of Investigation for the Gathering of Information in Relation to the Geothermic Development in the Southeast of the Republic of Nicaragua." In it, the environmental and social contexts of the geothermic areas of Mombacho and Caldera de Apoyo are described.

37. *Report on Public Consultation (Component 1).* In December 2015, the environmental consultant ACN carried out a public meeting about Stage 1 (exploration at a pre-feasibility level, "slim-hole") in the El Viejo, Chinandega Municipality. The meeting had the participation of approximately 78 representatives from civil society and the general public. Based on the audience the consultant wrote up a report of Public Consultation for the Study of Pre-Feasibility for the Geothermic Cosigüina Volcano Project Phase Exploratory Perforation (See comment 5.1 for complete discussion of public consultation).

38. *Environmental and Social Analysis (Component 1 and II).* In April 2016, a petition of IDB, the environmental consultant PELICAN, S.A. carried out two Environmental and Social

[9] Even though IDB will not finance subprojects of geothermic exploration in the areas of Mombacho and Caldera de Apoyo, we notice that these have not received the Environmental Permits up to this date.

analysis: "Program for the Expansion of Renewable Energy in Low Income Countries – SERP- Environmental and Social Management of Component 1: Geothermic," and "Expansion and Reinforcement in the Transmission System of Electricity of Nicaragua Component 2: Improvements in the Electric Transmission infrastructure: Environmental and Social Analysis Final Report." **The two reports analyzed the environmental and social context of each subproject, and their possible impact and risks associated, and recommend measures of mitigation, in line with the requisites of the safeguard policies of IDB for a Program of Category "B". Based on the information contained in the Environmental and Social Analysis for Component 1, especially in respect to the location of the geothermic projects within the natural reserves, the categorization risk was changed from Program "A".**

39. *Additional Complementary Studies (Component 1)* . In April 2016, IDB contracted the environmental consultant Environmental Resources Management (ERM) to carry out a Plan of Action for the Biodiversity, and a Study on the Accumulative Effects, for Stage 2 of the Geothermic Cosigüina Volcano Project.

40. *Due Diligence of IDB.* A specialist in Environmental Safeguards and one specialist in Biodiversity of IDB assigned to the Program carried out a mission on Due Diligence during June 2016 with the goal of confirming that all impacts and risks relevant to sub-projects of Components 1 and 2 of the Program be rightfully and adequately evaluated. **During the due diligence of IDB in June 2016, a second public consultation was carried out in relation to the project**, **presenting the contained information in the Complementary Biodiversity Plan of Action and The Study of Accumulative Impacts, carried out by the consultant ERM requested by IDB (**see comment 5.3 for a complete discussion of this public consultation.

IDB Applicable Policies and Instructions

41. In accordance with the norms of the Policy of the Environment and Compliance of the Safeguards (OP-703) from IDB, it is proposed that the Program be classified as Category "A". It is anticipated that the following instructions from the OP-703 be relevant in the case of the Project: B.02 (National Legislation and regulations); B03 (Pre- evaluation and classification); B.4 (Other risk factors); B.05 (Natural habitats and cultural places) because of the existence of natural critical habitats in the area of influence of the Project; B.10 (Dangerous materials), B.11 (Prevention and reduction of pollution); and B.12 (Construction of Project).

42. Other relevant Bank polices applicable to the Program are; (i) OP-102 of Information Access; (ii) OP-761 Gender Equality Development; and (iii) OP-704 of Management Risks of Natural Disasters. In accordance with the available information, included in the ESIA for Stage 1 of the Geothermic Volcano Cosigüina Exploration Project and the Environmental and Social Analysis for Components 1 and 2, of the Involuntary Relocation Policy (OP-710) will be applicable since the subproject imply negotiation processes not complete in order to obtain the properties and needed assistants necessary. There has not been any settlements identified as not wanting to relocate. In the preparation stage of the Program there has been the Indigenous Community Sebaco identified in the region of the Extension of the Substation Sebaco Project (Component 2), that is why the Policy OP-765 (Indigenous People). During the Due Diligence stage, it was confirmed that the Indigenous Community

Sebaco was not located in the Area of Influence of the project, since the project contemplates the expansion of the existing area of the substation in an area of 130m by 20m that is currently owned by one proprietor.

Table 2. Compliance of the Project with applicable policies from IDB

Policy/Guideline	Stage of Project Compliance (When Approved by the Board)	Required Actions for the Continued Compliance
OP-703 Environment Policy and Compliance of Safeguards		
Introduction (hierarchy of mitigation)	**Complied Requisites.** Key impacts identified. Strategies of mitigation have been agreed upon by ENEL and ENATREL, including compensation when impacts were not completely mitigated.	Development and adequate Implementation of mitigation strategies and agreed compensations.
B.1 Bank Policies	**Complied requisites.**	Monitoring
B.2 Laws and National Regulations	**The Program anticipates the compliance of the requisites by obtaining the Environmental Permits required by the Ministry of Environment (MARENA).** The subprojects of Component 2 are categorized as Category II by MARENA, requiring ESIAs and obtaining the Environmental Permits. ENATREL is in the process of obtaining those permits.	The carrying-out of the ESIAs and obtaining the Environmental Permits for the subprojects of Component 2, before the first payment.
B.3 Pre-evaluation and Classification	**Complied Requisites.**	Monitoring
B.4 Other Risk Factors	**The Program is expected to comply with the requisites through the carrying out of additional evaluations.** Due to the fact that the implementation of the Management Plans for Stage 2 of Component 1 depends on the positive outcome of third parties such as the executor of Stage 1 and like MARENA, there exists a risk that MEM will not be able to comply with the Management Plans during the implementation of the Program. Due to a low institutional capacity, there is a risk that MEM and ENEL will not adequately implement the Management Plans. Due to a lack of information of risks on available water during Stage 3 of the geothermic project, there exists a risk that the geothermic exploration with commercial diameter may not be viable, and the consumption of water during Stage 3 might affect bordering communities and the environment. Due to a lack of an environmental and	The carrying out of agreements between MEM and third parties and the monitoring and supervision by the Bank. Provides technical cooperation to MEM and ENEL for the management of environmental and social impacts on the geothermic projects. Carrying out of a Complementary Study of Impacts related to the availability of water for Stage 3 before the first payment. Implementation of an Environmental

	social evaluation for the production stage of the geothermic project, there exists the risk that the transmission line may cross the protected areas.	and Social Management Framework for Stage 3 of the geothermic project, 180 days before the initiation of the work for Stage 3.
B.5 Requisites of Environmental Evaluation	**The Program is expected to comply with the requisites through the carrying out of the complementary Management Plans.** Breaches were identified in the ESIA for Stage 1 of Component 1. IDB contracted the carrying out of additional studies that have been published on the IDB web site. However, due to the breach of information found during. Due Diligence, the IDB requires a Complementary Management Plan for Stage 2 of the geothermic project Cosigüina. Due to a lack of information of risks on available water during Stage 2 of the geothermic project, there exists a risk that the geothermic exploration with commercial diameter may not be viable, and the consumption of water during Stage 2 might affect bordering communities and the environment. The route for the Transmission Line, El Sauce-Villanueva (Component 2), is not defined, and there is no Management Plan to mitigate impacts and risks within the Area of Influence.	Carrying out of the Complementary Management Plan for Stage 2 of the geothermic project, Cosigüina with acceptable Terms of Reference for IDB, before the first payment. Before the distribution date to OPC,[10] a Complementary Study on Impacts on water availability during Stage 2 should be carried out. Before the date of distribution to OPC, there should be a Complementary Management Plan carried out for the Transmission Line El Sauce-Villanueva (Component 2). Develop a regional work table for the management of the cumulative effects 90 days before beginning perforation of the commercial diameter.
B.6 Consultations	**By the approval date by the IDB, the Program will have carried out public consultations necessary to comply with the requisites.** Two consultations were done adequately for Component 1. An additional public consultation is required on the management of impacts related to water availability during Stage 2 of Component 1. It is required that the carrying out of the public consultation on five subprojects be contemplated in Component 2. The time elapsed between public communication of the projects presents a residual risk during the execution of the Program.	Carrying out adequately a public consultation on the management of risks related to the water availability during Stage 2 of Component 1. Carrying out adequately a public consultation on the subprojects of Component 2 before the date of approval by the Executive Board. Implementation of an adequate Communication Social Plan during the life of the Program
B.7 Supervision and Compliance	**The Program is expected to be complied with the requisites through the adequate implementation of the management and mitigation**	Trimestral supervision will be carried out by an independent consultant and by MEM reports and supervision of IDB.

[10] The contract conditions previous to the distribution date to OPC refers to existing actions that are already implemented and have due dates before the internal process of IDB. In case they are complied with the IGAS will be revised and finalized, removing such conditions.

	measures and implementation system.	
B. 8 Cross-Border Impacts	**Complied Requisites.** It was determined during Due Diligence that there are no impacts or risks cross-border.	Monitoring
B.9 Natural Habitats and Cultural Sites	**The program is expected to comply with the requisites through the adequate implementation of the management and mitigation measures and the implementation system.** The Project are located in areas of natural critical habitats, including the Natural Volcano Cosigüina Reserve and an Area of Importance for the Conservation of Birds. The forest coverage of the RNVC plays an important part in the gathering and maintaining of water in the region. The adequate implementation of mitigation and compensation strategies on them would mitigate the impact on them.	Development and implementation of strategies of mitigation and compensation agreed upon (Restoration and Compensatory Reforestation Plan, Protection of Forests Plan, Fortification of Sustainable Native Living Resources, Agreement with MARENA to update and modify the Management Plan of RNVC, Fortification Plan of park rangers and Fire Brigades, Environmental Educational Program). Close supervision of IDB and implementation of corrective measures if necessary.
B.10 Hazardous Materials	**Complied Requisites.** MEM counts with Management Plans that present adequate measures for the management of hazardous materials.	Monitoring and Supervision.
B.11 Prevention and Reduction of Pollution	**The Program is expected to comply with the requisites through the adequate implementation of the management and mitigation measures and the implementation system.** MEM counts on Management Plans that more so present adequate measures to mitigate the impact during the construction stage. However, there exist breaches that could generate significant risks if they were not taken care of in an adequate manner.	Adequate implementation of the Complementary Management Plan for Component 1. Supervision by IDB
B.12 Project in Construction	**The Program is expected to comply with the requisites through the adequate implementation of the management and mitigation measures and the implementation system.** The execution of Stage 1 of the geothermic project is currently carried out by MEM through ACN, S.A.by PNESER with funds from NI-L1040, NI-L1050 and NI-L1063. If ACN does not implement its Environmental and Social Management Plans in an adequate form, MEM could acquire impacts and risks produced during Stage 1.	The implementation of a Complementary Management Plan that would include corrective actions to manage the impacts and risks acquired in Stage 1. Adequate implementation of Environmental and Social Management Plans for Stage 2. Monitoring and supervision.
OP-704 Management Policy of Risks and Natural Disasters		

	The Program is expected to comply with the requisites through the development and implementation of the Framework of Evaluation and Management Plan of Natural Disasters in order to minimize the risks of negative impacts on the Projects and bordering communities. The projects are located in areas of high-risk natural disasters (volcanic activity, earthquakes, storms, sinkable land, among others). The MEM counts on a Contingency Plan for Component 1 that manages the risks of some natural disasters but not all possible disasters. With the adequate implementation of an Evaluation and Management Plan of Natural Disasters the risks would minimize.	Hand in a Framework of Evaluation and Management Plan of Natural Disasters for both Components 1 and 2 before the approval of the Executive Board. Develop the Evaluation and Management Plan of Natural Disasters before the beginning of the work. Adequate Implementation of Management Plans. Monitoring and Supervision.
OP-710 Operational and Involuntary Resettlement Policy		
	The program is expected to comply with the requisites after obtaining the approval of an Appraisal of Previous Compensation for Component 1 and the carrying out of the compensation for Component 2. It is in the verifying process if the compensation to the proprietors of the area of influence of the geothermic Volcano Cosigüina project complies with the OP-710. For Component 2, ENATREL has not obtained the Rights of Ways for the transmission of lines. There exists a residual risk that the OP-710 will not be complied with if it does not acquire the necessary properties and compensates the proprietors in an adequate manner.	Hand in the Appraisal of the Previous Compensation in Component q, before the date of distribution to the OPC. Plan of Acquisition and Compensation for Component 2 before the first payment. Monitoring and Supervision.
OP-765 Operational Policy of Indigenous People		
	Complied requisites. It has been determined that during Due Diligence there did not exist impacts or risks on the Indigenous People in Components 1 and 2.	No required measure is needed.
OP-761 Operational Policy on Gender Equality and Development		
	Complied requisites. The Program has been inclusive and has taken into account the equal participation of genders in previous consultations and employment and training.	Adequate Implementation of human resource strategies from MEM, ENEL, ENATREL and the Environmental and Social Management Plan.
OP-102 Access to Information		
	Complied requisites. The ESIA, the Environmental and Social Analysis, and complementary studies have published on the IDB, ENEL and ENATREL web	Publication of the additional studies solicited by the Analysis Mission before the approval date of the Executive Board.

	sites. Before the Analysis Mission, The Complementary Impact Plan was not made known on the availability of water during Stage 2, the report on the public consultation for Component 2, nor the Management Plan on Natural Disasters. These and other additional studies were solicited as a result of the Analysis Mission and will be published before the approval date of the Executive Board.	Monitoring.

5. PUBLIC CONSULTATION

43. **Component 1**: In December of 2015, ACN carried out a public consultation on geothermic exploration in Cosigüina (pre-feasibility stage, "Slim-hole"). The resulting Report on Public Consultation describes the participation of approximately 78 people, which includes representatives from municipalities and council men, the Cabinet of the Family, Health and Life, youth and communal leaders from the El Viejo municipality, the Territorial Delegation of Chinandega, the General Board of Environmental Quality MARENA, and other State institutions and social groups. The Public Consultation Report does not include a detailed analysis on the composition of the participants in the meeting nor the summary of the main positions and concerns. The report does include the textual transcription of the commentaries expressed by the participants in the meeting, which reflect the concerns of the community's predominant needs and, in particular, the supply of drinking water.

44. The main concerns shared by the residents during the first consultation for Stage 1 were related to the contamination of residual waters, access to drinking water, the need to improve the infrastructure and services, the risks of emergencies or disasters related with the impact of the geology of the area, deforestation, possible contamination of soil, the access to tourist infrastructure by the operators of the zone, and the possibility of obtaining employment, among others.

45. According to the requisites of the Directive B.6 of the Policy OP-703 of IDB, it was necessary to bring about a second consultation on the activities of the Management Plans of Stage 1 and 2 of the Project. During Due Diligence of IDB, this second public consultation was carried out on the project and the continent of the additional complementary studies required by the IDB (Biodiversity Plan and Study of Cumulative Impacts). The Public consultation was carried out at 3:00 pm on June 2, 2016 in the Potosi community, and it had the participation of 43 people, including representatives of the Potosi communities, El Mojado, Capulin and El Viejo. It counted on the participation of the Environmental Management Group of ENEL, the Environmental Management Group of ACN, a representative of MARENA, two Safeguard Specialists from IDB, and one Biodiversity Specialist from the consultant ERM who presented the results of the complementary reports and responded to questions. The main concerns between those who assisted this public consultation were in relation to the amount of water required for the geothermal, the water quality after its use, the repair of the access roads that serve as vehicular traffic in Potosi, the emission of pollutant gasses, the creation of jobs, and the access to electricity.

46. **Component 2**: According to the Environmental and Social Analysis developed for Component 2, there has not been any public consultation on the four subprojects that contemplate this component.

47. **Complaint Mechanisms**: ENEL has a mechanism of centralized complaints for all of the company. ENATREL does not have its own complaint mechanism but it does receive the complaints by telephone. They are taken care of depending on the issue and depending on relevant group. Both ENEL like ENATREL respond to complaints, claims and requests by means of designating a person responsible to resolving this issue. At ENATREL the complaints are related to the staff are not managed by the Environmental Management Group, but by the Staff Unit.

6. MITIGATION OF IMPACTS AND KEY ENVIRONMENTAL AND SOCIAL RISKS

a) Natural Habitat and Biodiversity

48. *Summary of Impact*. There is a risk of fragmentation of a habitat within the National Reserve of the Cosigüina Volcano related to the geothermal exploration projects. There is a risk that the border effects and the fragmentation of connectivity will decrease the habitat and biodiversity, including the increase in the loss of forests, an increase in access to the zone and the hunting of animals, an alteration to the wild fauna, and the loss of local "ictio" fauna due to the murky and contaminated water, affecting the biological cycles of luminosity contamination, interruptions in the animal routes because of the impact in connectivity of the landscape, impacts on the aquatic ecosystem because of sedimentation, and increments on cloudiness and suspended solids.

49. Of particular importance is the potential adverse effect on the biodiversity, as the fragmentation and conversion of the habitat and possible affection of species key to the RNVC, such as the red rodent and the spider monkey. The works of the Project is found in a zone of high biodiversity transition (Semi-deciduous Forest in Transition to Subtropical Closed High). Historically, this forest is favorable to the reduction of vegetation and fragmentation of habitats given the number of interventions non tropical in the area. However, in the parts of the forest that forms a continuum along the long degrading altitudinal important interchange between species and micro ecosystems can be found in the area. The forest is also important because of its role in capturing the water as an environmental service. Therefore, it is important that the Project employs mitigation measures to prevent the removal of the vegetation and implementation of physical barriers that contribute to a mayor fragmentation and reduction of the natural critical habitat in which the project finds itself located in the areas of elevated ecological importance.

50. *Significant Findings*. The effects on the biodiversity have been studied profoundly in the Plan of Action for the Biodiversity carried out by ERM developed during the Due Diligence stage of the Project, according to the requisites stipulated in the guidelines, B.9 of the Policy OP-703 of IDB. The MEM has avoided impacts on the habitat once it located the platforms in the intervened areas of the secondary forest, and the ESIA of Stage 1 counts on a Monitoring Environmental Plan, a Training and Environmental Education Plan, and a Reforestation Plan. However, the Reforestation Plan of ESIA of Stage 1 does not contemplate the area to be forested from a habitat point of view of the RNVC. Therefore, the

other management plans should adapt around this vision and comply with the Plan of Action for the Biodiversity. There exists a plant nursery in the city of El Viejo that belongs to the sugar company, Pantaleon, and it is available to supply the native species for reforestation of the RNVC. Pantaleon works under the agreement with the El Viejo and MARENA County in the production of trees for reforestation.

51. *Mitigation Strategy*. The objective of the strategy of Component 1 is to assure the fortification of the connectivity of the habitat within the RNVC, measures like the net loss of the forest. For this means, **the MEM/ENEL will implement an Integral Management Plan on Biodiversity to improve the ecological connectivity in the RNVC, that continues the hierarchy of mitigation**[11] **and consists of the following activities:** To minimize impacts, (i) carry out a Program of Environmental Education with the cooperation of the Environmental Management Unit of the County El Viejo: (ii) Carry out a plan to fortify the park rangers and Fire Brigades and a Protection Forest Plan, in agreement with MARENA; (iii) carry out a Fortifying Plan of Sustainable Living Native Resources with MARENA; (iv) carry out a Program of Rescue and Relocation of the Flora and Fauna; (v) carry out a Monitoring Plan and Evaluation of Biodiversity. To restore the habitat and compensate for the direct and indirect impacts, (vi) carry out a Restoration and Reforestation Compensatory Plan in agreement with MARENA and the County of El Viejo; (vii) draw up an agreement with MARENA to update and modify the Managing Plan of the RNVC so that it includes the implementation of a Restoration of Ecosystem Service Plan with the objective of conserving the water sources, protecting against natural disaster, conserving the habitat of key species and providing the sustainable use of natural resources for the bordering communities; (viii) carry out a Plan of Abandonment (closing of wells, platforms or adjoining works) as part of the PGAS. This plan should include specification for the restoration of the ground, topography, and drainages, reforestation of areas and monitoring and maintenance to secure the success of the plan.

b) Summary of the Risks of Natural Disasters

52. **Component 1**. *Summary of Impact*. Generally, there exists a high risk of natural disaster that could provoke impacts on the projects and the bordering communities of Components I and II. During this stage of Due Diligence, there will be an evaluation completed on the risks of natural and induced disasters, its possible frequency, its possible impacts on the feasibility of the project both on the workers and bordering communities, and possible actions to minimize the risks, such as, the implementation of one Evaluation and Management Plan of Natural Disasters, one Plan of Emergency Replies, the sound practice of construction of civil works and perforation, and others. For this end of the Environmental and Social Strategy, the following key risks have been identified:

53. **The natural seismic action** is estimated as a medium risk, due to the fact the Project is located in the medium risk zone of the seismic map of the Ni Nicaraguan Institute of Territorial Studies (INTER).[12]

[11] Firstly, to avoid the creation of impacts; whenever the latter is not possible, minimize them; when this is not possible, to restore after the caused damage; and as a last alternative, to compensate for the damages.

[12] INETER, http://webserver2.ineter.gob.ni/sis/monitor.html

54. **The induced micro seismic action** is presented as a specific risk associated with geothermal projects, since the activities of drilling and Reinjection could destabilize the geological composition. It is estimated that the risk of induced micro seismicity is high during Stage 2 due to increased activity of re-injection and medium during Stage 1.

55. **The landslides and subsidence of the soil** are also considered of medium risk. The landslides can be caused by rain, earthquakes, or as a result of construction works. The subsidence of the ground can occur when large amounts of groundwater are extracted from certain types of rocks causing the pressure in the reservoir of geothermal energy to decline. Both the frequency and the intensity of the micro seismic events and the potential subsidence of the land are influenced by the geological conditions particular to the region and for the vegetation.

56. **The volcanic activity** is considered as a medium risk. The Cosigüina Volcano had its last explosive eruption in 1835, the largest recorded in the history of Nicaragua. According to the INETER in February1999 gas bubbles were observed coming out of the surface of the cratered lagoon along the northwestern edge and an eye of water located on the eastern flank of the volcano, near the people of Potosi, it had a temperature of 42 degree C, a production of water of 2 liters per second and a group of minerals of 100mg/l[13]. There have been no current data on the INETER volcanic activity in the Cosigüina volcano.

57. **The flood and drought** are estimated as high risks, since the Department of Chinandega has been featured among the areas of the country most vulnerable to flooding, according to the Civil Defense of the army of Nicaragua, and due to the occurrence of the Niño and the Niña climatic phenomena, which could exacerbate the conditions of precipitation in the area of influence of the Project.

58. **Climate change** is estimated as high risk, because this could generate extreme unpredictable events that negatively affect the subprojects in the Program and the affected communities.

59. **Component 2**. *Summary of the impact*. Natural disasters present risks to viability of the transmission projects as to the health and safety of workers and surrounding communities. The risk of seismic and natural volcanic activity is high and latent in the areas of direct influence of the subprojects of Component 2, which can produce adverse impacts on people, good, public services, and the environment.

60. *Significant Findings*. The Due Diligence process of the IDB verified the relevance and importance of the impacts and risks listed in this section. The ESIA Stage 1 of Component 1 already has a Contingency Environmental Plan which defines the measures to be taken in the event of forest fires and spills of toxic substances. However, the plan does not provide for the measures to be taken in case of other natural disasters, or actions to minimize impacts to the surrounding communities in the event of a failure of the physical security of the projects during a natural disaster, for example due to the explosion of a well or the spilling of waste liquids or solids. The ENATREL during does not have an Environmental Management Plan for the subprojects of Component 2.

[13] INETER, http://www.ineter.gob.ni/

61. *Mitigation Strategy*. With the objective of reducing the risks of impacts caused by natural or induced disasters by the sub-projects of the Program, **MEM/ENEL will implement an assessment and Management Plan of the Natural Disasters** for Component 1, that includes, in addition to the actions of the Environmental Contingency Plan, the following activities: (i) measures to be implemented in the event of earthquakes, extreme precipitation events , hurricanes and tornadoes, and volcanic eruptions; (ii) implement a system of warning to homeowners and communities located in the Area of Direct Influence to the geothermal project; (iii) a Program of Education and Training on the actions to take in the event of a natural disaster, including the location of routes for evacuation and access to health care facilities; (iv) implementation of physical signaling of evacuation routes and safety areas on the premises of the geothermal field and in the communities surrounding the geothermal field.

62. **ENATREL will implement an Evaluation and Plan of Management of the Natural Disasters** for Component 2, which includes the following activities: (i) Measures to help in case of earthquakes, events of extreme precipitation, hurricanes and tornadoes, and volcanic eruptions; (ii) to Implement a notice system for the owners and communities located in the field of Direct Influence of the subprojects; (iii) an Educational program and Training on the actions to take in case of a natural disaster, including the place of routes of evacuation and access to centers of medical attention; (iv) Implementation of physical signaling on the routes of evacuation and safety areas in the installations of the geothermic camps and the bordering communities to the subprojects.

c) Potential Impacts and Risks on Indigenous People

63. **Component 1.** *Significant findings.* The Due Diligence of the IDB confirmed that there are no indigenous communities located in the Area of influence of the subproject of component 1.

64. **Component 2**. *Summary of the impact*. The Social and Environmental Strategy for the Program identified a risk of that subproject expansion of the substation Sébaco of the Component 2 of the Program could lead to negative impacts on the indigenous community Sébaco.

65. *Significant findings*. Due Diligence of the IDB mission aimed to define if the indigenous community was located in the Area of Influence of the subproject. The results of mission of Due Diligence of the IDB indicate that the strip of expansion of the lot of the Substation Sebaco, of 130 m by 20 m, affects in a single property of holding private adjacent to the venue of the substation. The area of the property to be used is currently disused. It is covered by grass intervened, and there is no agricultural activity in the strip of any type. Thus, the Due Diligence found that there are no impacts or risks to indigenous people in the Area of Influence of the Substation Sébaco.

66. *Mitigation Strategy*. No mitigation measure is required.

d) Potential Impacts and Risks during the Construction Phase.

67. **Component 1**. *Summary of the Impact.* During the stages of exploration of the geothermal project, expected environmental impacts and associated risks to: (i) pollution of surface and groundwater and soils by the resulting mud holes (a suspension of a natural material of clay

- bentonite - with some additives); (ii) noise and vibration generated during drilling; (iii) the increase in the demand for water for the drilling of wells; (iv) the increase in heavy traffic; (v) the emissions of gases and dust; (vi) the erosion of soil and (v) the emissions of gases and dust; (vi) the erosion of soil and vegetation removal; (vii) potential contamination by inappropriate waste management; (viii) indirect impacts due to increased access to the areas of exploration; (ix) increase in workers in the area; and (x) occupational accidents.

68. *Significant findings.* MEM/ENEL already has a Solid Waste Management Plan; a Liquid Waste Management Plan; a Plan of Management of Teams; a Management Plan of Hydrocarbons; a Plan of Control of Atmospheric Emissions; a Water Storm Management Plan; a Plan of Toxic Management, Dangerous and Similar Substances; and a Plan for prevention and promotion in terms of hygiene and safety of work, mostly presenting measures suitable for the majority of the impacts listed above. However, there are breaches in Management Plans that could generate significant risk if not addressed adequately. For example, existing access roads that pass through the community of Potosi is in poor condition, and is used both by members of the community as their cattle without control measures.

69. *Mitigation strategy*. The IDB requires that the MEM / ENEL develop a Complementary Management Plan for the Stage 2 of the Component 1 that includes at least the following plans: (i) actions corrective for manage them impacts and risks acquired of the stage 1; (ii) a Traffic Management Plan to minimize the impacts of transport heavy in this or other access roads; (iii) a Community Monitoring of Water Quality Program. The MEM/ENEL must share the terms of reference for this complementary management with the IDB Plan to guide you in the creation of the same in compliance with the OP-703 B.5.

70. **Component 2.** *Summary of the impact.* It is considered that the potential environmental and social impacts of subprojects of Component 2 are manageable if appropriate measures are used. The phase of construction includes environmental and social potential impacts and risks associated mainly to obtaining the staff and the construction and expansion of lines of transmission and substations in 138 kW and 230 kW. The potential risks and impacts of these activities include: (i) the permanent alteration of the landscape, which includes areas of wooded grassland and forest intervened; (ii) the erosion of soil and vegetation removal; (iii) the disturbance to wildlife; (iv) the generation of dust, noise, gaseous pollutants, and solid waste and fluids during the construction phase, including toxic waste; (v) the disturbance of the surface water quality; (vi) impacts to the health and safety of workers; and (vii) impacts associated with access and the obtaining of the servitude, among others.

71. *Significant Findings*. During the Due Diligence, it was found that the path of the line of transmission El Sauce-Villanueva had not been identified. In the substations, it was found that the majority of activities will take place inside the existing sites. Also, it was found that there are no ESIAs or Management Plans for the subprojects in the Component 2. ENATREL has contracts with third parties who buy the solid and liquid wastes to treat them. It was found that there is no polychlorinated biphenyls (PCBS) in use in the substations of Component 2, since ENATREL has been changing the transformers, and stores the PCBS of the old transformers in a site of temporary provision in Managua. There is no agreement to send them to be treated in one of the countries certified to do so. The levels of decibels are low in the Substation Sébaco, since mufflers are used. The

construction of the Substation Sébaco will last for up to 2 years. There are invasions of land by the staff of the transmission lines.

72. *Mitigation Strategy*. In order to ensure that they are properly mitigated, and to comply with the Bank's policy OP-703**, the ENATREL will deliver a Complementary Management Plan for the line of transmission El Sauce- Villanueva of Component 2**, which includes an appropriate Management Plan to adequately mitigate the impacts mentioned above.

e) Potential Impacts and Risks during the Operation Phase

73. **Component 1**. *Summary of the impact*. During the operation phase, the main impacts and risks of geothermal projects are: (i) a possible increase of the micro seismic level in the region; (ii) an increase in the amount of water consumed by the project; (iii) the subsidence of land; (iv) pollution of groundwater and surface water due to accidental spills; (v) mud pollution; (vi) gas, primarily H2S emissions; (vii) health accidents and safety; and (viii) risk of explosions, bursts of wells, and accidents in pipelines, and their impact on the health and safety of workers and communities.

74. *Important Findings.* EM/ENEL uses the Management Plans of the Stage 1, presenting appropriate measures for most of the impacts listed above. However, there are several breaches in Management Plans that could generate significant risks if they are not addressed adequately.

75. *Mitigation Strategy.* The MEM/ENEL will develop a Complementary Management Plan for Stage 2 of Component 1 which includes at least the following plans:(i) corrective actions to manage the impacts and risks acquired from Stage 1; (ii) a Traffic Management Plan to minimize the impacts of heavy transport on this or other access roads; (iii) a Monitoring Community of Water Quality Program. The MEM/ENEL should share the Terms of Reference for this Complementary Management Plan with IDB to guide you in the creation of the same in compliance with the OP-703 B.5.

76. **Component 2.** *Summary of the impact*. It is considered that the potential environmental and social impacts of these projects are manageable if appropriate measures are used. The potential impacts and environmental and social risks of the phase of operation include: (i) the risk of collision for some species of birds; and (ii) vulnerability to the pre-existing infrastructure by natural forces, as wind, fire, floods, or the seismicity.

77. *Important Findings.* During the Due Diligence, no existing ESIAs nor Management Plans for subprojects of Component 2 were found.

78. *Mitigation Strategy*. With the objective of ensuring that they are adequately mitigated, and to comply with the policy OP-703 of the Bank**, ENATREL will develop ESIAs and Management Plans for the subprojects of Component 2**, which includes plans of appropriate management to mitigate the impacts mentioned above. The Terms of Reference for these ESIAs will be developed by MARENA, and ENATREL should share these with the IDB as a guide in the creation of the ESIAs in compliance with the OP-703 B.5.

f) Cumulative Effects

79. As part of the added value of IDB and having as a goal the compliance with its pertinent policies, the Bank hired an independent consultant to carry out a study of the cumulative

effects on the Valuable Ecosystem Components (VEC in English) generated by the Cosigüina Stage 2 Geothermal Exploration Project, in relation to other existing or planned projects in the zone of influence. The study was published in accordance with the Access to Information Policy (see link in **Annex I**).

80. *Summary of the impact*. The cumulative effects on air quality, and the landscape and visual quality, were classified as lower priority, because they are mainly affected by External Pressure Sources and it is not expected that Stage 2 of the project will significantly contribute to these effects. The cumulative effects to water resources, the forest coverage and the RNVC were classified as higher priority since the estimated cumulative effects are considered to be of greater significance. The EEA area has limited water resources and the External Pressure Sources are in greater use and/or a lower recharge of the water bearing. The use of water by Stage 2 would result in greater pressure on the limited availability of the water. Identification of the source of water should ensure that Stage 2 does not exceed the threshold of water availability or affect existing users. In the case of the forest coverage and the RNVC, External Pressure Sources cause a decrease in forest coverage and the conversion of natural habitats. It is not expected that Stage 2 contribute significantly to cumulative adverse effects and could even result in a positive effect if there is reforestation in a greater area than the affected.

Table 3. Valuable Environmental Components for Analysis of Cumulative Effect

VEC	Cumulative Estimated Effects	Significant Impact	Priority
Air Quality	The quality of air is mainly affected by the burning and forest fires. It is not expected that Stage 2 contribute with these cumulative effects.	No	Low
Water Resources	The area has limited resources and the External Pressure Source results in a mayor use and/or on less recharge to the aquifer. Stage 2 could result in mayor pressure over the availability of water.	Unknown	Mayor
Forest coverage and RNVC	The External Pressure Sources cause a reduction of forest coverage and the conversion of natural habitats. It is not expected that Stage 2 contribute significantly to cumulative adverse effects and may even result in a positive effect if reforestation is done in a larger area than the affected.	No	Mayor
Landscape and Visual Quality	The landscape is affected by the agricultural activity, resulting in an intervened landscape It is not expected that Stage 2 contribute to These cumulative effects.	No	Low

81. *Significant Findings.* The ENEL does not count on a Management Plan to mitigate the cumulative effects of the VECs generated by the Geothermic Exploration Cosigüina Volcano.

82. *Mitigation Strategy*. With the objective to minimize the consumption of water from the geothermal project Cosigüina, with funds from the IDB, the **MEM/ENEL will provide a Complementary Study of Impacts** that analyze both the environmental and social impacts direct, such as cumulative impacts on water availability, generated by drilling for water for use during Stage 2 of the geothermal energy project and to propose management measures that avoid impacts and risks to critical natural habitats and minimize impacts and risks to surrounding communities.

83. With the objective of managing the cumulative effects generated by the various activities in the region, with its own funds, the **MEM/ENEL will develop a regional working group for the management of the cumulative effects**. The objective of the work table will be to confirm the VECs major priority, share information and experiences, coordinate joint efforts for the mitigation of cumulative effects and promote or improve regional strategies and of the RNVC.

84. The work table should include the collective participation of interest groups related to the VECs, as well as the Stage 2 of the Project, which may include: governmental entities such as MARENA, the National System of Protected Areas (SINAP), MEM, and INAFOR; local governmental entities such as the City Hall of El Viejo and the Territorial Delegation MARENA Chinandega; the management of the RNVC and the Collaborative Management Committee; developers projects and activities such as ACN, agro-industries and eco-tourism; communities affected as El Mojado, El Capulín and Potosi; and non- governmental entities. The work table should ideally be led by a government entity and the developer of Stage 2 can use its best effort to involve relevant participants.

g) Other Impacts and Key Risks

85. *Summary of the impact.* There is a risk of damage to relations with the communities affected by the sub-projects of Components 1 and 2, due to the inconsistency of public consultations and communication, and to the relative lack of experience in environmental and social management in the sector of geothermal energy in Nicaragua since the Cosigüina Geothermal Project is the first geothermal project since the Momtombo in 1996, and a possible negative social perception on conservation areas near geothermal activities. Although the MEM/ENEL and ENATREL kept complaints mechanisms, there is a risk that these pass unnoticed by the population due to the lack of social communication.

86. *Significant Findings*. The MEM maintains communication with members of the affected communities, both through ACN and via ENEL. However, ACN communication on the activities of Stage 1 and the management of its environmental and social impacts, have not been regular. The Rural Committee of the County of the community El Viejo had no knowledge prior to Stage 1 or of Stage 2 of the geothermal project previous to the visit of the IDB. The lack of communication on the scope and progress of the activities as well as its environmental and social management, presents a risk of execution for the MEM.

87. *Mitigation Strategy.* With the objective of improving communication with affected communities and the follow-up on complaints raised by them, both **MEM/ENEL as ENATREL will implement a Plan of Social Communication**, which activities will include: (i) report publicly any technical, environmental, and social new developed for components 1 and 2; (ii) to promote its Complaint Mechanism, through web sites, radio ads, and other means; (iii) implement a media campaign to educate the public about the coexistence of the environment with geothermal energy, including the production of posters and brochures in hotels in the area; (iv) establish a plan for access to visitors within the geothermal camp, previously defined by MEM/ENEL geothermal field.

h) Positive Impacts

88. *Employment and Local Economy* - The Geothermal Project will benefit the employment market and the local economy. At the peak of construction during the construction phase of

Stage 2 of the Geothermal Exploration Project Cosigüina, foresees the employment of about 30 workers. It is expected that the majority of workers are local.

89. The local economy will benefit from the geothermal project in great part due to the proximity of the project to an area of interest and tourist potential. The Cosigüina Volcano is a tourist attraction for its location as a vantage point to three countries, by the relative ease of going up to the crater, and by the existence of flora and fauna, including the red rodent, that is symbolic in the region. There is already a market for tourism operators for the locals of Potosi, but it is expected that the geothermal project will improve the capabilities of the locals of the area through the implementation of training and environmental education, linked with the update of the Management Plan of the RNVC and reforestation of the reserve, in cooperation with MARENA and the County of El Viejo.

90. Furthermore, it is expected that the implementation of the geothermal project will bring forth improvement in the local economy and social services for the community of Potosi and the Municipality of El Viejo. Roads, bridges and walk ways and others will be constructed.

91. *Climate Change* – If the Stage 3 is reached (production), the geothermal project will have a positive impact associated with it in the reduction of greenhouse gas emissions.

7. FRAMEWORK OF ENVIRONMENTAL AND SOCIAL MANAGEMENT FOR THE GEOTHERMAL PRODUCTION (STAGE 3)

92. The IDB and MEM/ENEL have agreed to develop a Framework of Environmental and Social Management for the sub-projects of Component 1 (geothermal) that will explain the environmental and social mitigation strategies in the event that the MEM/ENEL gets to the exploration to the geothermal production. In this case, the IDB **will perform additional due diligence during the preparation of the production stage, and a new full ESIA having the appropriate Environmental and Social Management Plans will be required.** The objective of this Framework of Environmental and Social Management is help to the customer to develop its capacity to mitigate the impact and risks of geothermal production and ensure that their impacts and risks are mitigated adequately.

93. In the event that the project of geothermal exploration arrives to Stage 3 (production), the environmental and social impacts associated to this stage would be manageable if adequate measures and appropriate and monitoring is used. During Stage 3, environmental impacts and additional risks associated with the following activities are expected: (i) the construction of new access roads; (ii) the construction of new water pipelines; (iii) the construction of additional platforms; (iv) construction of additional production and reinjection wells; (v) deep drilling with commercial diameter; (vi) construction of reinjection lagoons; (vii) the construction of cooling towers; and (viii) the construction of generating plants, substations, or transmission lines.

94. Since the scope of these activities is greater than the scope of the exploration phases, there is the possibility of additional environmental and social impact and risks. Thus, additional procedures could be applied to mitigate these impacts and risks. The process to be followed is defined below, and shall be incorporated to the Operating Manual of the Program.

Milestone of the Production Stage	Risk of Impact	Deliverable
New access roads are built	Pollution from solid, liquid, and gas waste, noise, light Uncontrolled access Migration of workers and population Habitat fragmentation	Environmental and Social Management Plan
New water pipelines are built	Additional consumption of water	Additional Study of Impact related to Water Availability
Additional platforms are built	Habitat fragmentation Loss of forest covering Increase of animal hunting Inadequate compensation to owners Pollution from solid, liquid, and gas waste, noise, light	Environmental and Social Management Plan
Additional production and reinjection wells are used	Pollution from solids, liquids, and gases waste, noise, light Induced micro seismic Inadequate disposal of toxic waste Pollution of surface and subsurface water	Reinjection Plan
Deep perforation with commercial diameter is made	Pollution from solid, liquid, and gas waste, noise, light Inadequate disposition of solid waste Pollution of surface and subsurface water	Reinjection Plan Solid and Liquid Waste Management Plan Plan for the Monitoring of Water Quality
Reinjection lagoons are made	Pollution from solid, liquid, and gas waste, noise, light Pollution of surface and subsurface water	Environmental and Social Management Plan Monitoring Plan of Water Quality
Cooling towers are built	Pollution from solid, liquid, and gas waste, noise, light Emission of greenhouse effect gases and H_2S	Monitoring of emissions of greenhouse gas and H_2S
Power generation plants, substations or transmission lines are built	Pollution from solid, liquid, and gas waste, noise, light Pollution of surface and subsurface water Habitat fragmentation Mortality of birds Inadequate compensation to owners	Environmental and Social Management Plan Biodiversity Management Plan

8. EVALUATION OF THE ENVIRONMENTAL AND SOCIAL MANAGEMENT SYSTEM AND ABILITY TO IMPLEMENT

95. *The structure and capacity of MEM/ENEL for the environmental and social management of the Program.* ENEL has a centralized Unit for Environmental and Social Management that corresponds to all areas of generation. ENEL appoints a social and environmental specialist for each area of generation, for example, geothermic, hydropower, and others. The

environmental specialist shall be responsible both for the environmental management as for the social management of the projects. The MEM shall have its own Unit of Environmental Management, but shall be responsible for almost all environmental supervision of the generation projects. ENATREL has a Unit of Environmental Management, an Easement Unit, and a Unit for the Safety of the Works. Each unit shall have a head of team and technical personnel.

96. The potential impacts of Component 1 are significant. The implementation of the key strategies of mitigation is complex and requires specific experience and management adequate during the entire cycle of the Project. There is a risk that the ability of MEM/ENEL presents risks to achieve certain objectives, since the Momotombo geothermal project was the last to be executed in Nicaragua in 1996. In order to mitigate this risk, the **MEM/ENEL will improve their Systems of Environmental and Social Management by implementing the following activities:** (i) drafting a Procedure Manual for the performance of Environmental Impact Studies in line with the IDB guidelines and the best international practices; (ii) draft guidelines for environmental and social management for sectoral activities, including for geothermal energy; (iii) hire an external independent consultant to support and supervise the activities of the Improvement Plan, in agreement with the IDB.

97. *Supervision arrangements*. Internal monitoring will be conducted by the Unit of Environmental Management of the MEM with the technical support of ENEL for Component 1, and by the Unit of Environmental Management of ENATREL for Component 2. Additionally, an independent consultant should be hired to carry to out the external supervision of the compliance with the PAAS. The MEM shall deliver semi-annual reports to the Bank until the Completion of the Construction Project and during the first two years of operation and thereafter, annual reports. Specialists in Environmental Safeguards shall make semi-annual monitoring visits during the construction phase of the Project and annually during the first three years of the operation phase.

9. REQUIREMENTS TO BE INCLUDED IN THE LOAN AGREEMENT

a) Activities to be Performed

98. As part of the obligations provided in the General Rules of the Agreement, the Borrower shall perform the execution (preparation, construction and operation) of the activities contained in the Program in accordance with the environmental and social policies of the Bank, according to the specific provisions on environmental and social aspects set forth hereafter.

    a) To comply with the actions or requirements established in the environmental, social, labor or health and security permits, authorizations or licenses granted for the geothermal project as well as for the projects being financed under Component 2.

    b) Ensure that all subcontractors of the Borrower hired for construction or other activities of the Program comply with the environmental, social, labor and health and safety requirements applicable to them

    c) Immediately report to the Bank the occurrence of any breach of the environmental and social requirements set forth hereafter.

d) Inform and obtain the prior written consent of the Bank in case of relevant changes to the Projects that are included in the Program and/or its characteristics.

e) Implement a Corrective Action Plan agreed with the Bank, to mitigate, correct and to compensate for the adverse consequences that may arise from breaches in the implementation of the environmental and social commitments set forth hereafter, including breaches acquired in previous stages of the projects that were executed by third parties.

f) Allow the Bank, either by itself or through consulting services, to carry out supervision activities, including the environmental and social audits of the Program in order to confirm compliance with environmental and social commitments set forth hereafter.

b) Specific social and environmental obligations to be included in the special provisions of the agreement

1. Prior to the distribution date to OPC.[14]

99. The Borrower must submit all the following management plans, to be developed with the structure and the contents satisfactory to the IDB:

a) Construction and Operation (Component 2) - to meet the OP-703 (B11, B12) of the IDB, deliver prior to the distribution date to OPC, a Supplementary Management Plan for the transmission Line El Sauce-Villanueva of Component 2, including an adequate Management Plan.

b) Cumulative Impacts (Component 1) - deliver prior to the date of distribution to OPC a Supplementary Study of Impacts analyzing both the direct environmental and social impacts, as well as the cumulative impact to water availability, generated by the drilling of water wells for use during Stage 2 of the geothermal project, and to propose measures of the geothermal project, which proposes management measures that prevent impact and risk to critical natural habitats and minimize impact and risk to neighboring communities.

c) Acquisition of land and compensation (Component 1) — To meet OP-710 of the IDB, submit to the IDB prior to the OPC an Appraisal of Previous Compensation in Component 1 describing the compensation corresponding to the owners located in the Area of Geothermal Interest, taking into account the involvement of the platforms at the feasibility stage to productivity and the well-being of the owners , in compliance with the requirement of loss of profits of the Nicaraguan national law and the requirements of the Operational Policy OP-710 of Involuntary Resettlement of the IDB. The assessment should have documentation that supports the methodology used to calculate the compensation.

[14] The contractual conditions precedent to the distribution date to OPC refers to actions that are already underway with a compliance date prior to an internal process of the IDB. If they are met, the ESMR shall be revised and finalized, removing such conditions.

2. Previous to the approval date by the Executive Board of the Bank.

100. The Borrower shall submit all the following management plans, to be developed with the structure and satisfactory contents for the IDB

a) Natural Disasters (Component 1) - To comply with the IDB OP-704, perform with own funds and deliver to IDB prior to approval by the Executive Board a Framework for the Evaluation and Management Plan of the Natural Disasters for Component 1 that includes, in addition to the actions of the Environmental Contingency Plan, the following activities: (i) measures to be implemented in the event of earthquakes, events of extreme rainfall, hurricanes and tornadoes, and volcanic eruptions; (ii) implement a system of warning to homeowners and communities located in the Area of Direct Influence of the geothermal project; (iii) a Program of Education and Training on the actions to take in the event of a natural disaster, including the location of routes for evacuation and access to health care facilities; (iv) implementation of physical signaling of evacuation routes and safety areas on the premises of the geothermal field and in the communities surrounding the geothermal project.

b) Natural Disasters (Component 2) - To comply with the IDB OP-704, perform with own funds and deliver to IDB C a Framework for the Evaluation and Management Plan of the Natural Disasters for Component 2 that includes, in addition to the actions of the Environmental Contingency Plan, the following activities: (i) measures to be implemented in the event of earthquakes, events of extreme rainfall, hurricanes and tornadoes, and volcanic eruptions; (ii) implement a system of warning to homeowners and communities located in the Area of Direct Influence of the geothermal project; (iii) a Program of Education and Training on the actions to take in the event of a natural disaster, including the location of routes for evacuation and access to health care facilities; (iv) implementation of physical signaling of evacuation routesand safety areas on the premises of the geothermal field and in the communities surrounding the subprojects.

c) Cumulative impact (Component 1) - Deliver prior to the approval of the executive Board a Supplementary Study of Impacts analyzing both direct environmental and social impacts, such as cumulative impacts to water availability, generated by the drilling of water wells for use during the stage of production (Stage 3) of the geothermal project, which proposes management measures that avoid impact and risks to critical natural habitats and to minimize risks and impacts to neighboring communities.

d) Consultations (Component 1) – Provide a report that shows the performance of a public consultation about the availability of water for Component 1.

e) Consultations (Component 2) – Provide a report that shows the performance of a public consultation about the subprojects of Component 2.

3. Prior to the first disbursement of the financing resources by the Bank.

101. The Borrower must submit a final **Plan for Environmental and Social Action** (PAAS) and all the subsequent management plans, to be developed with a structure and contents satisfactory for the IDB.

a) Biodiversity (Component 1) – To comply with OP-703 (B9) of the IDB, implement a Plan of Comprehensive Management of Biodiversity with own funds to improve ecological connectivity in the RNVC, to be delivered to the IDB prior to the first disbursement, which follows the hierarchy of mitigation and which consists of the following activities: to minimize impacts, (i) perform an Environmental Education Program in cooperation with the Unit of Environmental Management of the El Viejo Mayor's Office; (ii) perform a Plan for the Strengthening of Park Rangers and Fire Brigades and a Plan of Forest Protection, in agreement with MARENA; (iii) perform a Plan for the Strengthening of the Sustainable Use of Native Living Resources in agreement with MARENA; (iv) conduct a Program for the Rescue and Relocation of Flora and Fauna; and (v) perform a Plan for the Monitoring and Evaluation of Biodiversity. To restore the habitat and compensate for the direct and indirect impacts, (vi) perform a Plan of Restoration and Compensatory Reforestation in agreement with MARENA and the Mayor's Office of El Viejo; (vii) make an agreement with MARENA to update and modify the Management Plan of the RNVC so that it includes the implementation of a Plan of Restoration of Ecosystem Services with the purpose of preserving water sources, protect against natural disasters, conserve habitat for key species, and provide the sustainable use of natural resources for local communities; and (viii) develop a Plan of Abandonment (closure of wells, platforms and associated works) as part of the PGAS of soil, topography and drainage, the reforestation of the areas and monitoring and maintenance to ensure the success of the Plan.

b) Construction (Component 1) – To comply with OP-703 (B11, B12) of the IDB, deliver, prior to the first disbursement a Plan of Complementary Management for Stage 2 of Component 1 which includes at least the following plans: (i) corrective actions to manage the impacts and risks acquired from Stage 1; (ii) a Traffic Management Plan to minimize the impacts of heavy transportation in this or other access roads; (iii) a Community Monitoring Program of Water Quality. The MEM/ENEL must share the Terms of Reference for this Complementary Management Plan with the IDB to serve as a guide in the creation of the same in compliance with the OP-703 B.5.

c) Operation (Component 1) – To comply with OP-703 (B11, B12) of the IDB, deliver, prior to the first disbursement, a Plan of Complementary Management for Stage 2 of Component 1 which includes at least the following plans: which includes at least the following plans: (i) corrective actions to manage the impacts and risks acquired from Stage 1; (ii) a Traffic Management Plan to minimize the impacts of heavy transportation in this or other access roads; (iii) a Community Monitoring Program of Water Quality. The MEM/ENEL must share the Terms of Reference for this Complementary Management Plan with the IDB to serve as a guide in the creation of the same in compliance with the OP-703 B.5.

d) Acquisition of Lands and Compensation (Component 2) – To comply with OP-710 of the IDB, file before the IDB a Plan of Acquisition and Compensation for Component 2 and a copy of the agreements executed with the owners to obtain properties for Component 2, in compliance with the loss of profits requirements of the Nicaraguan

national law and the requirements of the policy Operational Policy OP-710 of Involuntary Resettlement of the IDB.

e) Dismantling and Abandonment (Components 1 and 2) – To meet the Operational Policies of the IDB, file a Plan of Dismantling and Abandonment of the projects when they have reached the end of their useful life, which describes the procedures to determine (i) the renewal or termination of the concession; (ii) the rehabilitation of those projects, if necessary, and/or (iii) the dismantling and abandonment of the projects, if necessary.

f) Reporting, Monitoring and Supervision – To comply with OP-703 (B7) of the IDB, submit a Program Monitoring Plan, which includes the following components: (i) (Component 1) hire an independent consultant to carry out external monitoring of compliance with the PAAS; (ii) (Components 1 and 2) report to the IDB in an Environmental and Social Compliance Report (ICAS) the progress of the environmental and social management of all the projects of the Components 1 and 2.

102. File evidence of the actions to be performed in dates prior to the first disbursement of the Financing resources included in the PAAS and in the plans above set forth above, have been met in a satisfactory manner for the Bank.

103. Prior to the beginning of the civil works of the Components 1 and 2 project and in the following terms. The following conditions shall be met, respectively for each case:

104. Social Communication (Component 1 and 2)– To comply with IDB OP-703 (B6), 90 days prior to the start of the civil work, deliver a Plan of Social Communication, whose activities will include: (i) file publicly any new technical, environmental, and social developed for Components 1 and 2; (ii) promote a Complaint Mechanism, through a website, ads, radio ads, and other means; (iii) implement a media campaign to educate the public about the coexistence of the environment with geothermal energy, including the production of posters and brochures in hotels in the area; (iv) establish a plan for access to visitors within the geothermal field previously defined by MEM/ENEL.

105. At least 90 days calendar prior to the beginning of the work civil of the Geothermal Exploration Program of the Cosigüina Volcano (Stage 2), the Borrower must deliver to the IDB in satisfactory form and content satisfactory:

a) All the documentation that is required under the Environmental and Social Action Plan (PAAS) required to begin the civil work of the Program

b) Evidence of the implementation of the actions provided for in the following environmental and social programs: the Comprehensive Plan for Management of Biodiversity, the Comprehensive Plan of Risk of Management of Natural Disasters, the Supplementary Management Plan for Stage 2, and the Regional Work Table for Cumulative Effects.

106. Prior to drilling with a commercial diameter for the Geothermal Exploration Project of the Cosigüina volcano (Stage 2) and the following periods, the following conditions, respectively in each case be met:

107.4 At least 90 calendar days prior to drilling with a commercial diameter for the Geothermal Exploration Project of the Cosigüina volcano (Stage 2), the Borrower must deliver to the IDB in satisfactory form and substance:

a) Cumulative Impacts (Component 1) – Develop a regional work table for the management of the cumulative effects, and deliver evidence of its development 90 days before the start of drilling with a commercial diameter. The objective of the work table will be confirm the VECs of greater priority, share information and experiences, coordinate joint efforts joint for the mitigation of cumulative effects cumulative and foster or improve regional strategies and Those of the RNVC. The work table shall include the collective participation of interest groups related to the VECs, as well as of Phase 2 of the project, which may include: national governmental entities such as the MARENA, the National system of Protected Areas)SNAP), MEM and INAFOR; local governmental entities such as the Major's Office of el Viejo and the Territorial Delegation MARENA Chinandega; the management of the RNVC and the Collaborative Management Committee; developers of projects and activities such as ACN, agro-industries and eco-tourism; affected communities such as El Mojado, El Capulín and Potosi; and non-governmental entities. The work table shall be ideally led by a governmental entity and the developer of Stage 2 shall make its best efforts to involve its stakeholders.

b) All the documentation that according to the Environmental and Social Action Plan (PAAS) is required to start of drilling with commercial diameter.

c) Evidence of the implementation of the actions provided for in the following environmental and social programs: the Comprehensive Plan for Management of Biodiversity, the Comprehensive Plan of Risk of Management of Natural Disasters, the Supplementary Management Plan for Stage 2, the Regional Work Table for Cumulative Effects and the Social Communication Plan.

108. Prior to the beginning of the Civil Works of the Production Stage of the Geothermal Exploration Project of the Cosigüina volcano (stage 3) the following conditions shall be met, respectively for each case:

109. At least 180 calendar days prior to the start of the civil works of the Production Stage of the Geothermal Exploration Project of the Cosigüina volcano (stage 3), the Borrower shall deliver to the IDB in satisfactory form and substance:

a) A Framework of Environmental and Social Management for the Stage of Geothermal Production (Component 1) - In the case of advancing to the stage of geothermal production, develop a Framework of Environmental and Social Management that contains a new full ESIA and an environmental license of MARENA that meets Operational Policy 703 of the IDB, which evaluates in depth all the main impacts and environmental and social risks of the project and any associated infrastructure, defines the areas of influence and contains the corresponding Plans of Environmental and Social Management (PGAS).

b) Environmental and Social Management System – To comply with OP-703 (B5, B6, B7 and B11) of the IDB, MEM/ENEL shall improve with funds of an IDB technical cooperation, its Environmental and Social Management Systems through implementing the following activities: (i) drafting a Procedures Manual to carry out

Environmental Impact Studies pursuant to the guidelines of the IDB and best international practices; and (ii) draft management Environmental and social guidelines for sector activities sector, including geothermal energy; (iii) hire an independent external consultant to support and supervise the activities of the Improvements Plan, in agreement with the IDB. Evidence of compliance of these activities shall be delivered before the close of the geothermal project of Component 1.

110. Special execution condition. The Borrower shall agree to:

a) Implement the provided actions, at the times that are established in the PAAS and the management and mitigation plans set forth above and which will be presented in their final version as a precondition to the first disbursement of financing by the Bank.

b) Prior to the beginning of each work that is financed as part of the Program, file the respective Environmental and Social Management Plan (PGAS).

c) Appoint the necessary personnel to implement the actions provided in the PAAS and in the identified plans, at the times and in the manner established in the Plan of Monitoring and Evaluation of the Program.

d) Deliver to the IDB, if the IDB resources will be used to fund geothermal activities in the sites of Mombacho and/or Caldera de Apoyo, complete Environmental Impact Studies (ESIA) that have obtained their environmental licenses from MARENA and comply with Operational Policy 703 of the IDB, which evaluate in depth all the main impacts and environmental and social risks, clearly define the areas of influence and contain Environmental and Social Management Plans (PGAS), 180 days prior to the start of civil works in any of the two sites.

c) Reporting, Monitoring and Supervision

111. The Borrower shall file a Report of Environmental and Social Compliance (ICAS) in form and substance acceptable to the IDB, within the following timing:

a) File before the Bank a Final Report of Environmental and Social Compliance for the geothermal project within a period of sixty (60) days after the closing of the phase of construction.

b) With respect to each project of Components 1 and 2 in the following periods: (i) Quarterly, during the construction of each of the projects within 30 days from the end of the respective quarter; (ii) Quarterly, after the Completion of the Construction Phase of each project and during the first two years of operation of each project, within 30 days from the end of the respective quarter; and (iii) annually and during the term of the Loan Agreement, within 60 days from the close of each calendar year.

c) Additionally, Environmental Reports about environmental and social conditions that may have changed over time and are identified as part of measures provided in the Plan of Environmental and Social Monitoring.

ANNEX I. LIST OF DOCUMENTS PUBLISHED IN THE WEBSITE OF THE IDB AND THEIR WEB ADDRESSES

1. Evaluation of Social and Environmental Impact for the Geothermal Project Volcán Cosigüina – Drilling- Exploratory Phase (2015)– Published May 9, 2016.
http://www.iadb.org/Document.cfm?id=40273984

2. Social and Environmental Analysis Report (2016) – Published May 9, 2016

d) Component 1 (Geothermal):
http://www.iadb.org/Document.cfm?id=40273258

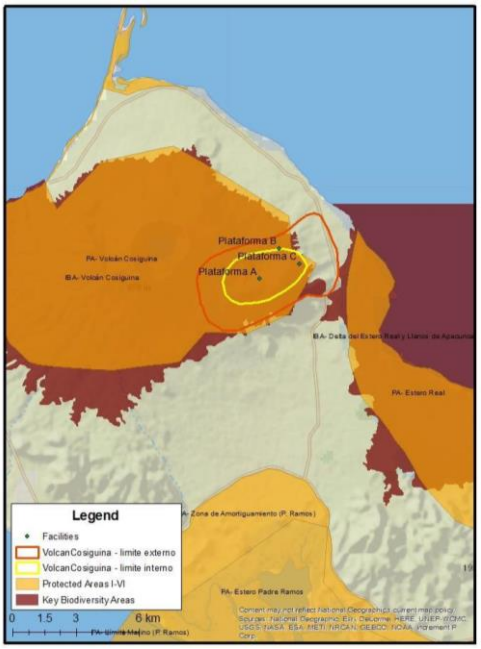
e) Component 2 (Transmission):
http://www.iadb.org/Document.cfm?id=40273225

3. Supplemental Evaluation and Action Plan for Biodiversity for Stage 2 of the Geothermal Project Volcán Cosigüina – Published May 9, 2016
http://www.iadb.org/Document.cfm?id=40273975

4. Evaluation of Accumulative effects of Stage 2 of the Geothermal Project Volcán Cosigüina – Published May 9, 2016
http://www.iadb.org/Document.cfm?id=40273969

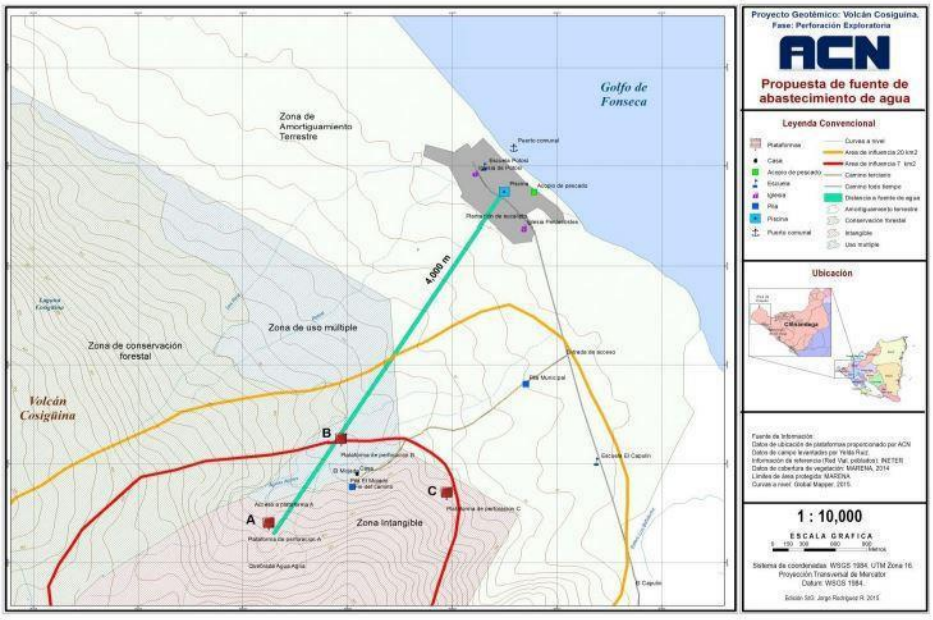
ANNEX II. FIGURES MENTIONED IN THE ENVIRONMENTAL AND SOCIAL MANAGEMENT REPORT (ESMR)

Figure 1. Location of the Geothermal Exploration Volcán Cosigüina Stages 1 and 2 in relation to the Natural Reserve Volcán Cosigüina



Source: IDB, 2016

Figure 2. Proposed area for the supply of water of the Geothermal Project Volcán Cosigüina Stages 1 and 2



Source: ESIA, ACN, 2015.

ANNEX III. PICTURES

Figure 3. House of the owner located beside the Area of Platform B, of the Geothermal Project Volcán Cosigüina Stage 1

Source: IDB Mission, June 2016

Figure 4. Patch of the dry tropical forest intervened close to Platform C Geothermal Project Volcán Cosigüina Stage 1

Source: IDB Mission, June 2016

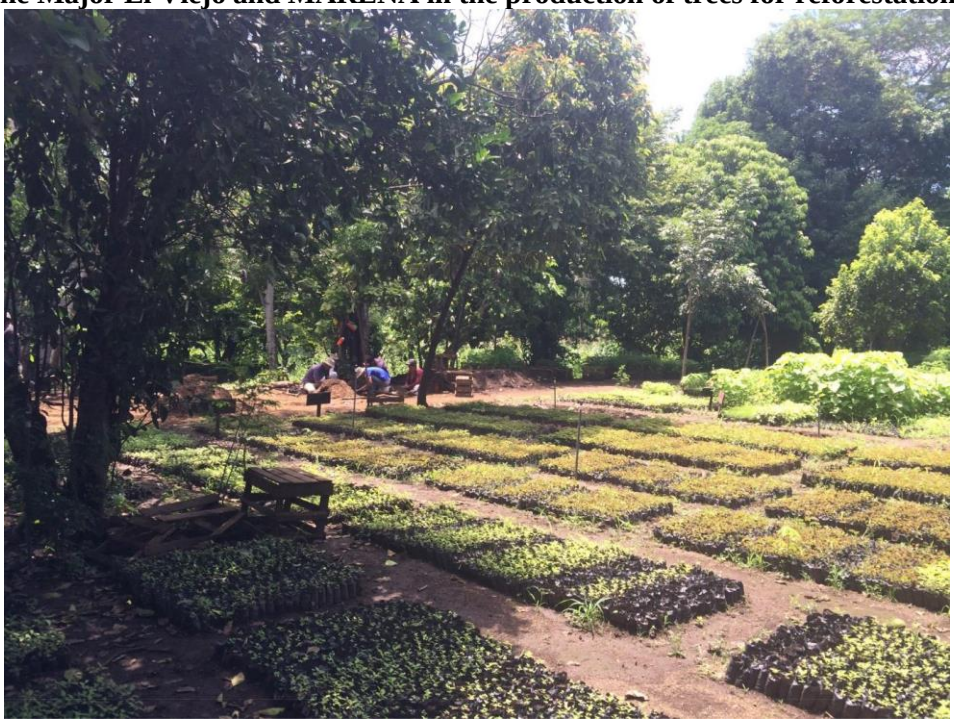
Figure 5. Current condition of the access road to Platform B, Component 1.

Source: IDB Mission, June 2016

Figure 6. Community fountain "La Piscina" at Potosí. There is a proposal to locate a water tapping point under the fountain to provide water to the Geothermal Project Volcán Cosigüina Stage 1.

Source: IDB Mission, June 2016

Figure 7. Nursery of the sugar company Pantaleón which works under agreement with the Office of the Major El Viejo and MARENA in the production of trees for reforestation.



Source: IDB Mission, June 2016

Figure 8. Public consultation made at the Potosí on June 2, 2016, about the additional studies Action Plan for Biodiversity and Study of Cumulative Effects for the Geothermal Project Volcán Cosigüina Stage 1.

Source: IDB Mission, June 2016

Figure 9. Current land use by the owner affected by the expansion of the Sébaco Substation, Component 2.

Source: IDB Mission, June 2016

ANNEX IV. ENVIRONMENTAL AND SOCIAL ACTION PLAN (ESAP) DRAFT FOR NI-L1094

Topic	Actions to be Taken	Evidence	Expected Date
Environmental Evaluation Requirements/ IADB O.P. 703 (B5)			
1.1 There are information gaps in the Management Plan for Stage 1 to be used by MEM for Component's 1 Stage 2.	With MEM funds, perform a Complementary Management Plan for Stage 2 in accordance with Terms of Reference acceptable by IDB,	Deliver the Terms of Reference and Complementary Management Plan for Component's 1 Stage 2.	Before the first disbursement
1.2 There is not an ESIA or Management Plans for the new El Sauce Villanueva Transmission Line (Component 2) of which the route has not been identified.	With MEM funds, perform a Complementary Management Plan for the El Sauce-Villanueva Transmission Line (Component 2)	Deliver the Complementary Management Plan for Component 2.	Before the OPC Distribution date
Environmental and Social Management Plan / IADB O.P. 703 (B5,B6, B7 y B11)			
2.1 ENEL counts with a centralized Environmental and Social Management Unit corresponding to all the generation areas. ENEL appoints an environmental and social specialist for each generation area, f.i. geothermal, hydro, etc. Such person is responsible for both environmental and social management. MEM is responsible for the generation projects' supervision. The MARENA is responsible for the projects' monitoring. There is a risk that ENEL's environmental and social management may suffer a drop of capacity for responsibilities' overload. Besides, the Cosigüina Geothermal Project is the first geothermal managed by ENEL's UGA for over 20 years. The UGA could be benefited with improvements in its knowledge of good practices in the environmental and social management of geothermal projects, as well as with IDB policies	By means of a technical cooperation, create procedures for geothermal projects' environmental and social management. Adjust ands line-up internal procedures to comply with the sector's good practices and with the IDB policies.	Give IDB copy of the new management procedures Ln. line with IDB policies.	180 days prior to the initiation of the Volcán Cosigüina's Geothermal Project's commencement of the production stage's civil works. (Stage 3)

Biodiversity Conservation and Sustainable Management of Natural Resources / IADB O.P 703 (B.9)			
2.2 The effects on biodiversity have been deeply studied in the Action for Biodiversity Plan carried out by ERM and developed during the project's Due Diligence stage, in accordance with the requirements set at Decision B.9 of IDB's Policy OP-703, The MEM has already prevented impacts on the habitat when placing the platforms on intervened areas and with secondary wood, and Stage 1 ESIA has an Environmental Monitoring Plan and an Environmental Training and Educational Plan and a Reforestation Plan. However, the Stage 1 ESIA's Reforestation Plan does not contemplate the area to be reforested from a RNCV habitat' s vision. Thus, the other management plans shall have to suit themselves around this vision, and meet the Action for Biodiversity Plan. There is a nursery garden at the city of El Viejo belonging to RNVC's Pantaleón sugar company. Pantaleón works with the El Viejo Mayoralty and MARENA in the production of trees for reforestation.	Perform a Full Biodiversity Management Plan following the mitigation hierarchy and including the mentioned activities below.	Deliver to the IDB a Full Biodiversity Management Plan.	Prior to first disbursement
2.3 There is plenty interest in revitalizing RNVC in the nearby vicinities; but the is little financing capacity.	Adequate the ESIA Environmental Education Plan for Stage 1 in order that it meets the recommendations of the of the Biodiversity Action Plan made by ERM.	Deliver to the IDB a Full Biodiversity Management Plan	Prior to first disbursement
2.4 The Cosigüina geothermal project could generate side effects at the habitat of the Cosigüina Volcano's Natural Reservation.	With MEM's funds, make a Woods Protection Plan.	Deliver to the IDB a Full Biodiversity Management Plan	Prior to first disbursement
2.5 Important flora and fauna species of the	With MEM's funds, make a Rescue and Relocation	Deliver to the IDB a Full Biodiversity Management	Prior to first disbursement

Influence Area could be affected	Plan of Flora and Fauna, being already part of the license.	Plan	
2.6 The Cosigüina Volcano's Natural Reservation's Management is weakened since there is a lot of intervention in the intangible zone and conservation zone. The RNVC Handling Plan has not been updated, and there lacks definition on the activities allowed at the use zones. MARENA has the intention of updating the Handling Plan, yet id does not have financing. 2.7 The water shortage at the RNVC and Cosigüina could be mitigated by means of the wood's reforestation and restoration.	With MEM's funds, update and modify the RNVC Handling Plan, in agreement with MARENA, including the implementation of a Restoration of Eco-Systemic Services aiming at keeping the hydric sources, protect against natural disasters, preserve key species' habitat, and provide sustainable use of natural resources for the nearby communities.	Deliver to IDB the agreement between MARENA and MEM/ENEL for the updating of the RNVC Handling Plan and the Terms of Reference for a consultant in order to perform the process. Updated Handling Plan and annual budget and resources' sources identified for its implementation.	Prior to first disbursement Before the Components' Civil Work
2.8 The ACN EIA already has a 1:10 Reforestation Plan but the reforestation area has not been designed with habitat vision.	With MEM's funds, perform a compensatory Reforestation Plan based on lost habitat.	Deliver to IDB the Full Biodiversity's Management Plan.	Prior to first disbursement
2.9 Human intervention at the RNVC degrades the native live resources at the RNVC intangible zone	With MEM's funds, perform a Strengthening Plan of the Sustainable Use of Native Live Resources in agreement with MARENA/	Deliver to IDB the Full Biodiversity's Management Plan.	Prior to first disbursement
2.10 The access control at the RNVC is low. The RNVC' s degradation is due to the arrival of not allowed human activities'	With MEM's funds, perform a Parks' Wardens and Against Fire Brigades Plan in agreement with MARENA.	Deliver to IDB the Full Biodiversity's Management Plan.	Prior to first disbursement
2.11 In the event that the geothermal exploration with commercial diameter does not offer positive results, there could be negative impacts if the wells, platform and annex works are not closed.	The Proposer of the Project's Stage 2 must develop a wells', platforms' and annex works' plan, as part of the ESMP to be developed in order to get the environmental permit. This plan must include specification for the soils', topography and drainage physical restoration of the areas and monitoring and maintenance in order to ensure the plan's success.	Deliver the Complementary Management Plan for Component's 1 Stage 2.	Prior to first disbursement
2.12 The occurrence of key species and the	With MEM's funds, perform a Biodiversity Monitoring	Deliver to IDB the Report on Biodiversity Monitoring	On a quarterly basis during the construction stages

wood's covering area at the RNVC should be monitored in order to take adaptive management actions.	Plan.	as part of the Environmental and Social Management Report (ESMR).	and during the two first operation years, annually during the loan agreement's life term.
Natural and induced Disasters IADB O.P. 704			
3.1. **Component 1**. The risk of natural and induced disasters is high for the Program. The MEM has already the Contingency Plan defining the measures to be adopted in the events of fires and toxic substance spills, yet not of other natural and induced ones.	With MEM funds, do a Frame for the Evaluation and Management Plan of the Natural Disasters for Component 1, including, besides the Environmental Contingency Plan, the following activities: (i) Measures to adopt in the event of seism, extreme precipitation events, hurricanes and tornadoes and volcanic eruptions; (ii) implementation of a warning system for owners and communities located at the geothermal project's Direct influence area; (iii) an Educational and Training Program on the actions to be adopted in the event of natural disaster, including the placement of evacuation routes and access to medical attention centers; (iv) implementation of physical signalization on evacuation routes and security areas at the geothermal field's facilities and communities close to the geothermal project.	Deliver to IDB a frame for the Evaluation and Management Plan of Natural Disasters for Component 1.	Prior to approval date by the Board of Executive Directors
3.2 **Component 2**. The risk of natural and induced disasters is high for he program. ENATREL does not have Management Plana for the Sub-Projects.	With MEM funds, do a Frame for the Evaluation and Management Plan of the Natural Disasters for Component 2, including the following activities: (i) Measures to adopt in the event of seism, extreme precipitation events, hurricanes and tornadoes and volcanic eruptions; (ii) implementation of a warning system for owners and communities located at the geothermal sub-project's Direct influence area; (iii) an Educational and Training Program on the actions to be adopted in the event of natural disaster, including the	Deliver to IDB a frame for the Evaluation and Management Plan of Natural Disasters for Component 2.	Prior to approval date by the Board of Executive Directors

	placement of evacuation routes and access to medical attention centers; (iv) implementation of physical signalization on evacuation routes and security areas at the geothermal field's facilities and communities close to the geothermal sub-project.		
Indigenous people's / IADB O.P. 765			
4.1 The Sébaco Station of Component 2 will not generate risks or negative impacts to the Sébaco Valley Indigenous Community. The Sébaco Sub-Station's area of influence would only affect the private owner adjacent to the sub-station.	No measures related to Indigenous Peoples' are required, since it has been it has been established that there will not impacts or risks of the Sébaco Sub-Station to the Sébaco Indigenous Community.	N/A	N/A
Gender Equality in Development / ADB O.P. 761			
5.1 There could be gender discrimination during the Program's sub-projects execution.	ENEL is creating a Gender Management Division aimed to be formed through Component 1.	Deliver Structure and Work Plan from the Gender Division's	Prior to civil work for Component 1.
Reduction and Prevention of Pollution / IADB O.P. (B11 & B12)			
6.1 MEM/ENEL already has Management Plans whish most of them show adequate measure for most of the impacts during the construction stage. However, there are gaps that could generate significant risks if not taken care of in an adequate manner.	With MEM funds, make a Complementary Management Plan for Stage 2 including the following activities: (i) a Traffic Management Plan in order to minimize the impact of heavy transportation at this or other access ways; (ii) a Community Monitoring Program of the Water's Quality.	Deliver to the IDB the Complementary Management Plan for Stage 2.	Prior to the first disbursement.
Accrued Effects / IADB O.P. (B11 & B12)			
7.1 The water availability at the zone is reduced, and the location of the source or sources providing a sufficient water level during all the Cosigüina geothermal project's stages has not been established.	Identify a water source based on an integral hydrologic and hydro-geologic evaluation at basin-level considering the actual uses. (i.e., water balance) and the climate change (i.e., changes in water availability) in other to warrant that Stage 2 does not exceed the threshold of water availability or affect actual users or diversity. Obtain the ANA use permit for water sources.	7.1 (a) Deliver to the IDB a Study of Impacts and Management Plan for the Availability of Water for Stage 2. 7.1 (b) Deliver to the IDB a Study of Impacts and Management Plan for the Availability of Water for Stage 3.	Prior to the distribution date to OPC. Prior to the approval date by the Board of Executive Directors.
7.2 Jointly with the external pressure sources, the geothermal project	With MEM funds, develop a work a regional worktable for the management of	Deliver the IDB agreements established by participants in work groups	90 days prior to starting drilling with commercial diameter (Stage 2).

generates accrued significant effects for the hydric resources, the forest coverage and the RNVC.	accrued effect, on line with the recommendations of the Evaluation of Accrued Effects made by the ERM consultancy for the program.	and budget that demonstrates their sustainability over time and calendar meetings.	
Social Consultation and Communication IADB O.P. 703 (B6)			
8.1 There has not been a public consultation on the Management of impacts and risks associated to the chosen water source of the Component's 1 Stage 2.	With MEM funds, make a public consultation on the management of impacts and risks associated to the chosen water source for the Component's Stage 2.	Deliver to the IDB a report evidencing the realization of public consultation.	Prior to the approval date by the Board of Executive Directors
8.2 There has not been a public consultation on the sub-projects of Component 2.	With MEM funds, make a public consultation on the sub-projects of Component 2.	Deliver to the IDB a report evidencing the realization of public consultation.	Prior to the approval date by the Board of Executive Directors.
8.3 There is a lack of communication between the Program's executors and those dwelling at the influence Areas.	With MEM funds, make a social communication plan. ENEL has its Public Information Access Office and Public Press Disclosure Area.	Deliver to the IDB the Social Communication Plan as part of the ESIA complementary to Stage 2.	Prior to the commencement of the civil work for Component 1.
Lands' Acquisition and Involuntary Relocation / IADP O.P. 710			
8.3 **Component 1:** The compensation of the five owners in the Influence Area of Stage 1 Platforms was not satisfactory. Negotiation has not begun for compensating owners at the Stage 2 Platforms' Influence Area.	**Component 1:** MEM/ENEL shall review and re-adequate the compensation to owners located at the Stage 2 Influence Area	Deliver to the IDB an evaluation of the Previous Compensation in Component 1.	Prior to the distribution date to OPC
8.4 **Component 2**. The negotiation to compensate owners located at the sub-projects Influence Areas has not begun, mainly at transmission lines.	**Component 2:** ENATREL shall adequately compensate the owners located at the sub-projects' Influence Areas.	Deliver to the IDB an Acquisition and Compensation Plan for Component 2 and copies of signed agreements with the owners.	Prior to the first disbursement.
Environmental and Social Framework for the eventual geothermal production stage / IADP O.P. 703			
9.1 If the geothermal exploration stage with commercial diameter turns out being positive, ENEL could use IDB's resources in order to finance activities of the geothermal production stage of the Cosigüina Volcano Geothermal Project, as for example the construction of transmission lines, sub-stations, cooling lagoons, additional access ways,	In the event that the MEM advances to Stage 3, a full ESIA, an environmental license from MARENA complying with IDB's 703 Operational Policy, deeply evaluating all the main environmental and (ESMP) social impacts and risks of the project and any associated infrastructure, defining the influence areas an having corresponding management and social management.	Deliver to the IDB the ESIA and Management Plan, and environmental license issued by MARENA, for Stage 3.	180 days prior to the initiation of the civil work of the Cosigüina Volcano's Production Geothermal Project (Stage 3).

additional water provision pipelines, and others.			
9.2 The IDB's resources could be used in order to finance activities of the exploration stages and/o geothermal production of the Volcano Mombacho's geothermal production project and/or the Caldera de Apoyo Volcano Geothermal Project.	Completed Environmental Impact Studies (ESIA) will be required having obtained their MARENA environmental licenses and complying with IDB 703 Policy, deeply evaluating all the main environmental impacts and social risks, clearing defining the influence areas and having corresponding Environmental and Social Management Plans (ESMP)	Deliver to the IDB the ESIA, the environmental licenses issued by MARENA, and the corresponding Management Plans.	180 days prior to the initiation of the civil work for the geothermal exploration stage at Mombacho and/or Caldera de Apoyo.
Dismantling and Abandonment / IADB O.P. 703 (B7)			
9.3 There is no Abandonment Plan describing the procedures for the dismantling of the sub-projects both of Component 1 and of Component 2.	With MEM funds, make a Dismantling Plan of the Consigüina geothermal project and annex works when culminating their useful life, describing the procedures in order to establish (i) the concession's renewal or termination; (ii) the rehabilitation of projects, should it be necessary, and/or (iii) the dismantling of projects, should it be necessary.	9.3 (a) Deliver to the IDB the Complementary Management Plan for Stage 2 of Component 1. 9.3b (b) Deliver to the IDB the ESIA for the sub-projects of Component 2.	Prior to the first disbursement. Prior to the first disbursement.
Reporting, Handling and Supervision / IADB O.P. 703 (B7)			
10.1 It is required that the Borrower monitors the implementation of the PAAS, and that an external independent consultant supervises PAAS compliance.	With MEM funds, perform a Program's Monitoring Plan, including the following components: (i) offer access to an external independent consultant to carry-out the supervision of PAAS compliance. (ii) Report to the IDB in a single Environmental and Social Compliance Report (ESCR) of all the sub-program's I and II projects. The two components shall be carried out semiannually during the construction and operation stages of each project for the two first operation years, and annually after two years of each project's operation.	10.1 (a) Produce the agreement signed by the external consultant. 10.1 (b) Environmental and Social Compliance Report (ESCR) produced with form and contents acceptable by the Bank.	Prior to the first disbursement. On a quarterly basis during the construction stages and during the first two years of operation, and annually during the Loan Contract´s Life Term.