Document of the Inter-American Development Bank

**Mexico**

**Geothermal Financing and Risk Transfer Program**

**(ME-L1148)**

**Fourth Individual Operation Under the Conditional**

**Credit Line for Investment Projects (CCLIP) to Support Business Development in Mexico**

**(ME-X1010)**

**and**

**Investment Grant for the Geothermal Financing and Risk Transfer Program**

**(ME-G1005)**

**Monitoring and Evaluation Plan**

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**ABBREVIATIONS**

|  |  |
| --- | --- |
| cclip | Conditional Credit Line for Investment Projects |
| CFE | Federal Electricity Commission |
| CO2e | Carbon dioxide equivalent |
| cre | *Comisión Reguladora de Energía* (Energy Regulatory Commission) |
| ctf | Clean Technology Fund |
| EA | Executing Agency |
| EUR | Euros |
| Ghg | Greenhouse Gas |
| GoM | Government of Mexico |
| idb | Inter-American Development Bank |
| IFIs | Intermediary Financial Institutions |
| kwh | Kilowatts Hour |
| mdb | Multilateral Development Bank |
| Mt | Million Tons |
| musd | Million US Dollars |
| NAFIN | Nacional Financiera |
| NPV | Net Present Value  |
| OC | Ordinary Capital  |
| pcr | Project Completion Report  |
| PIU | Project Implementation Unit |
| OR | Operating Regulations  |
| sener | Energy Ministry |  |
| unfccc | United Nations Framework Convention on Climate Change |
| usd | US Dollars |

1. **INTRODUCTION**
	1. **General framework**
	2. The main purpose of this document is to present the monitoring and evaluation plan of the CTF Geothermal Financing and Risk Transfer Program.
	3. The operation CTF-Geothermal Financing and Risk Transfer Program is conceptualized as a flexible instrument to support the development of private investment in geothermal energy, a sector of common interest between the Bank and the Government of Mexico (GoM) due to its high efficiency and positive environmental impacts.
	4. In the current context of global climate change, governments in emerging economies have to face the important challenge of responding to increasing demands for energy while maximizing their system’s security of supply, efficiency and sustainability. Investments in power generation from clean sources play a big role in this process, contributing to diversifying the countries’ energy matrixes and mitigating the negative environmental impacts of conventional power technologies.
	5. Mexico is the world’s thirteenth largest greenhouse gas (GHG) emitter and the second CO2 emitter in Latin America. The country has voluntarily committed to reducing its GHG emissions up to 30% by 2020, with respect to the business as usual scenario (LGCC)[[1]](#footnote-1). Almost 60% of the potential for these reductions comes from the energy sector, mainly transport and power generation. The LGCC also sets the specific target of achieving 35% of power generation from non-fossil-fuel-based sources of energy by 2024. But over 80% of Mexico’s electricity production still comes from fossil fuels, imposing the need for a transformation of the country’s power generation system in a sustainable and cost efficient way.
	6. According to a study carried out by INECC[[2]](#footnote-2), the potential for GHG emissions abatement through clean energy generation by 2020 is 86 MtCO2e, equivalent to 23% of theoretical reduction potential identified. But despite Mexico’s great potential for the use of clean power sources, most of it still remains relatively untapped. The study shows that the marginal cost of abatement of geothermal is very low compared to those based on fossil fuels use.
	7. Geothermal energy offers one of the most effective renewable and low carbon alternatives for electricity generation, opening up the possibility of increasing the share of clean sources in Mexico’s energy matrix. Furthermore, the role of geothermal power goes beyond its environmental contribution because it can produce significant economic and social benefits.
	8. The objective of the program is to increase power production from geothermal sources so as to contribute to the diversification of the energy matrix so as to reduce dependency on fossil fuels and GHG emissions in Mexico. To this end, the program intends to scale up investments in geothermal power generation projects by making available a range of financial mechanisms tailored to meet the specific needs for each project’s stage of development. This will include risk mitigation mechanisms as well as various forms of financing for exploration, drilling, field development and construction phases of geothermal projects.
	9. **Scheme for implementation and monitoring**
	10. The borrower and executing agency for the program will be Nacional Financiera, S.N.C. (NAFIN), with the United Mexican States serving as guarantor. NAFIN is a national credit institution established to promote savings and investment and to channel financial and technical support for Mexico’s industrial and economic development. NAFIN’s corporate goals and mandate include supporting projects related to the use of clean and efficient energy[[3]](#footnote-3). In this sense, NAFIN has been working on: i) the development of a portfolio of eligible projects, ii) improving their technical, financial and environmental capabilities, in both the energy and infrastructure sectors and with IDB support[[4]](#footnote-4), and iii) strengthening their network of intermediaries with capacity to channel funding to high risk projects.
	11. NAFIN is a solvent institution with exemplary risk management practices and the full backing of the Mexican government. NAFIN also has an excellent record of cooperation with the IDB, contributing actively to the acitivities included in the country program of the IDB with Mexico. So far, NAFIN has processed three operations for a total of US$250 million from the CCLIP ME-X1010[[5]](#footnote-5), proving to be an executor with extensive experience in the management of resources to support private sector projects focused on energy efficiency, energy generation from renewable sources and, in general, to promote sustainable development.
	12. NAFIN will implement the program under its current organizational structure. The operational rules governing the implementation of the program and the eligibility of individual credits or grants will be established in the program’s Operating Regulations (OR) agreed between the Bank and NAFIN, based on the rules, policies, laws, and financial practices prevailing in the country and the Bank's no objection.
	13. NAFIN will be the Executing Agency of the program and will rely on the following General Directorates for its implementation:

#### The Dirección de Tesorería shall: (i) select the funding sources and optimize the allocation of resources in NAFIN, (ii) administer the proceeds of the loan, (iii) prepare financial reporting, and (iv) make requests for disbursements of the loan and corresponding debt service and payments.

#### The Dirección de Organismos Financieros Internacionales (DOFI), in its capacity as coordination unit, will be the channel of communication and contact with the IDB. In this regard, it shall perform the following activities: (i) coordination and supervision of the activities (ii) monitoring compliance with contractual commitments, and (iii) coordination of visits and mission supervision. This Direction will be the de facto Project Implementation Unit (PIU).

#### The Dirección de Crédito and the Dirección de Riesgos will analyze the financial eligibility of the projects requesting funding from the program.

* 1. NAFIN will grant financing (using resources from the program) as established in the OR. These conditions will include a maximum amount of resources from the program to be used per project, a minimum amount of capital required from the developer, the preexistence of all necessary permits and compliance with all environmental and social safeguards, and the financial and technical capacity necessary to develop a project of this nature.
	2. All operations to be funded with the program must be approved by NAFIN, in accordance with its applicable regulations, and the Bank. It is the responsibility of NAFIN to ensure that the sub-borrower is eligible for funding from the program in accordance with the program’s eligibility criteria, as defined in the OR.
	3. The program will be executed under two components for which corresponding outputs and costs are indicated in the following table:

|  |
| --- |
| **Table 1.1.- Costs of the program by expected output (USD million)** |
| **Cost component** | **Y1** | **Y2** | **Y3** | **Y4** | **Y5** | **Y6** | **Total** |
| **Outputs Component I.** |  |  |  |  |  |  |  |
| Grants (in the form of loan guarantees) provided to geothermal projects with resources from the program | 4 | 6 | 4 | 2 | 2 | 2 | 20.0 |
| Insurance premiums for geothermal projects subsidized with resources from the program | 0 | 2.3 | 2.3 | 4.6 | 0 | 2.3 | 11.50 |
| **Output Component II.** |  |  |  |  |  |  |  |
| Loans granted to geothermal projects by the program at any stage of development. | 12 | 25 | 25 | 23.8 | 0 | 0 | 85.8 |
| **Total component costs** |  |  |  |  |  |  | **117.3** |
| Implementation costs and Technical Assistance activities | 0.6 | 0.9 | 0.5 | 0.4 | 0.4 | 0 | 2.8 |
| **Total program financing** | **16.6** | **34.2** | **31.8** | **30.8** | **2.4** | **4.3** | **120.1** |

* 1. Backup monitoring disbursements for eligible expenditures will be made ex-post by the Bank. The Bank, in coordination with NAFIN may schedule visits to sub-borrowers to verify compliance with contractual conditions of the program in terms of allocation of funds. NAFIN will allow the Bank or its representatives to inspect at any time the status of program implementation
	2. The authorized operations must be properly identified in NAFIN’s accounting systems. The accounting records should be in NAFIN’s accounting systems and adjusted as stated in the loan agreements. These accounting records must allow tracing the financial terms of the transaction (currency, term, interest rate), the value of the expenditure, recoveries, the balance of the operation and the specific default of the program if necessary.
	3. During the disbursement period, NAFIN is required to submit audited financial statements of the program within 180 days after the closing of each fiscal year, duly audited by an independent firm acceptable to the IDB and designated by the *Secretaría de la Función Pública*. The last report shall be submitted within 180 days after the end of the disbursement period. NAFIN’s audited financial statements are published on their website so its submission is not deemed necessary.
1. **MONITORING**
	1. **Indicators**
2. 1. The monitoring intends to follow up the execution of the program in order to identify the intermediate milestones achieved in each phase, identify corrective actions if necessary and evaluate its outcomes and fulfillment of proposed targets. The indicators to be monitored will be those included in the Results Matrix and in the Progress Monitoring Report (PMR). Table 2.1 summarizes them and includes information on the source and frequency of collection and reporting process.

**Table 2.1. Indicators**

|  |  |  |  |
| --- | --- | --- | --- |
| **Indicators** | **Unit**[[6]](#footnote-6) | **Frequency of measurement** | **Description / Source of verification** |
| **Outputs Component I** |  |  |  |
| Grants (in the form of loan guarantees) provided to geothermal projects with resources from the program | Number | Annual | Values based on guarantee agreements.Target is inclusive of all projects supported, both successful and failed.Source: Program report from NAFIN. Estimations consider that a beneficiary project that is successful during early exploration may be eligible for support from the program in the production drilling phase. |
| Insurance premiums for geothermal projects subsidized with resources from the program | Number | Annual | Values based on insurance policies issued.Target is inclusive of all projects supported, both successful and failed.Source: Program report from NAFIN. Estimations consider that a beneficiary project that is successful during early exploration may be eligible for support from the program in the production drilling phase. |
| **Outputs Component II** |  |  |  |
| Loans granted to geothermal projects by the program at any stage of development. | Number | Annual | Values based on loan agreements for financing funded with resources from the program. Figures consider loans at any stage of development including loans convertible to grants, insured loans, soft loans, and/or refinancing of projects that move on from early exploration to production drilling and to construction stages.Target is inclusive of all projects financed, both successful and failed.Source: Program report from NAFIN. |
| **RESULTS** |
| Geothermal projects financed that moved on from early exploration to production drilling | Number (%) | Once, at the end of execution period | Source: Program report from NAFIN. Percentage will be measured over the total amount of projects financed (at any stage) as of end of execution period. |
| Geothermal projects financed that moved on from production drilling to construction | Number (%) | Once, at the end of execution period | Source: Program report from NAFIN. Percentage will be measured over the total amount of projects financed (at any stage) as of end of execution period. |
| Total geothermal power projects financed at some stage by the program that are in operation (producing electricity) | Number | Once, at the end of execution period (inc. projected value for year 10) | Includes the total number of projects that are functioning in the year indicated. Due to the long maturities associated to these projects, projects financed from early exploration may not be fully operational until past the timeframe of monitoring (see target 2024).Source: Program report from NAFIN. |
| Geothermal power generation capacity installed in projects financed at some stage by the program | MWe | Once, at the end of execution period (inc. projected value for year 10) | Includes only capacity ready for production. Due to the long maturities associated to these projects, capacity resulting from projects financed from early exploration may not be installed until past the timeframe of monitoring (see target 2024).Source: Program report from NAFIN. |
| Electricity production from geothermal projects financed at some stage by the program | GWh/yr | Once, at the end of execution period (inc. projected value for year 10) | Source: Program report from NAFIN.Estimations based on the expected capacity installed, an average production factor in Mexico, 24 hours/day, 365 days/yr. |
| Greenhouse gas (GHG) emissions avoided by geothermal projects financed at some stage by the program | MtCO2e/yr | Once, at the end of execution period (inc. projected value for year 10) | Tons of GHG emissions that will be reduced or avoided once the plants financed by the program are commissioned.Source: IDB estimations made following IDB methodology, based on installed capacity (see indicator above), envisaged production, and a 0.5 average conversion factor for electricity generation in Mexico.MtCO2e = Millions of tons of CO2 equivalent |
| Additional financing from third parties mobilized to complete geothermal projects financed at some stage by the program | Millions of USD | Annual | Volume of third-party direct finance leveraged by the program for projects supported. Includes all financing from sources other than the IDB/CTF funding (government, NAFIN and other financial institutions). Does not include capital.Source: Program report from NAFIN.Estimations based on a 70:30 debt to equity ratio, investment costs of US$5 million per well and US$2 to 4 million per MW installed.  |

* 1. It should be noted that projects funded by the program may have environmental and social impacts that require an effective evaluation system for proper mitigation and management. To mitigate these risks, the IDB will define an Environmental and Social Management System (ESMS), integral to the OR, that will enable the identification of potential impacts and risks and ensure that the beneficiaries of the financing will implement environmental and social assessment, prevention, mitigation and management measures consistent with IDB safeguard policies (see [Environmental and Social Management Report](http://idbdocs.iadb.org/wsdocs/getdocument.aspx?docnum=38277344), ESMR). The ESMS will integrate all applicable Mexican norms. The loan agreement will include the following environmental and social requirements and the respective enabling, reporting and monitoring conditions: (i) NAFIN and the Bank will agree on an ESMS as further detailed in the ESMR to be included in the OR ; (ii) NAFIN will coordinate with SENER, the CFE and other pertinent agencies to facilitate the implementation of the ESMS; (iii) NAFIN will obtain the Bank’s non-objection to the categorization of each project and to the final approval and E&S management plans of all category A and High Risk Category B projects (including review of independent experts as required by the Bank) and will ensure that all projects financed by the program are implemented in full compliance with the requirements of the ESMS and; (iv) NAFIN will supervise the environmental and social performance of each project, provide the Bank with all pertinent reports and notifications and, in case of non-compliance, engage with beneficiaries to ensure that a corrective action plan is developed and implemented to the satisfaction of NAFIN and the IDB. The framework also includes guidelines for a consultation process that incorporate gender considerations, as per IDB’s policy on gender equality in development.
	2. **Data Collection and Instruments**
	3. NAFIN will collect the necessary data for monitoring and present annual reports to the IDB. In some cases, the IDB will make calculations required for some indicators, based on the information provided by NAFIN in the annual reports. The IDB must report annually to the Clean Technology Fund Trust Fund Committee (CTF TFC) on results or estimations/projections of results (in case of plants in state of construction and non operational as of reporting date). Table 2.1 presents the main indicators to be monitored during the execution period of the operation, the methodology to be used, source of information, and responsible of data gathering.
	4. From the Bank’s side, the project team composed by specialists from IFD/CMF, INE/CCS and INE/ENE, with support from the country office in Mexico, will be in charge of following up the execution, monitoring and evaluation of the program. The executing agency and the Bank have commited to carry out monitoring meetings according to a regular schedule to be agreed upon between the two parts (see Table 2.2 Monitoring Workplan for an indicative schedule).
	5. **Reporting Monitoring Results**
	6. The DOFI, in its capacity as Project Coordination Unit, will be the channel of communication and contact with the IDB. In this regard, it shall perform the following activities: (i) coordination and supervision of the activities, (ii) monitoring compliance with contractual commitments, and (iii) coordination of visits and mission supervision. The Direction will be the de facto Project Implementation Unit (PIU).
	7. NAFIN will report to IDB through annual reports including the defined indicators and any other relevant information on the performance of the program. Based on the information provided by these reports, NAFIN and the IDB could introduce adjustments to the program. The executing agency will deliver the reports within 60 calendar days after the end of each year of the program’s implementation. The reports will include information regarding the evolution of the indicators, as well as financial information regarding the use of the resources and the state of the program’s account. The Bank will be entitled to request additional information, if necessary.
	8. **Monitoring Coordination, Work Plan and Budget**
	9. NAFIN will be responsible for the supervision, technical and administrative coordination of the program. NAFIN will be responsible for the execution of the activities envisioned under the program, and performing the necessary reporting duties to the Bank.
	10. CTF/IDB resources are to be fully committed and disbursed within six years from the effective date of the loan agreement. Due to the phased approach of the program, resources from the IDB may be disbursed in a different schedule than CTF resources.
	11. The cost and planned schedules for the activitities are shown in Table 2.2. Resources to cover these costs will come from the the supervision budget included in the CTF funding plus any standard administrative costs associated to IDB and NAFIN staff involved in the project. The structuture of NAFIN and the proven capacity of its human resources ensures the compliance with all tasks and commitments related to this plan. It is estimated that the Bank will deidcate 0,5 FTE per year for program monitoring and NAFIN will dedicate the equivalent to 1 FTE. Third-party resources may be required as part of the supervision activities financed by the CTF resources or, if applcable, to the IDB operational budget.
	12. The Division of Climate Change and Susrainability (INE/CCS), in their role as focal point of the Clean Technology Fund within the IDB, will provide the relevant information on the CTF indicators to the CTF TFC.
	13. In addition, NAFIN is strengthening its administrative capacity in the area of Corporate Finance as part of the Technical Cooperation “Technical Support to Development Banks for the Mitigation of Climate Change” (ATN / MC -13341-RG), formalized between the Bank and NAFIN in August 2013 for a total amount of USD 135,000. It is also expected that the implementation of the program will generate information and knowledge on the geothermal energy sector, which could be the basis for the development of similar programs in the region and which should provide continuity to the development of the sector in Mexico. Besides, the program considers an allocation of around US$3 million for implementation costs and technical assistance activities, which will finance the contracting of expert services that will provide technical soundness to the program and help build capacity in NAFIN and SENER for the continued support of the industry.

**Table 2.2: Monitoring Working Plan**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Activities** | **Year 1**  | **Year 2** | **Year 3** | **Year 4** | **Year 5** | **Year 6** | **Responsible** | **Budget****(USD)** |
| **I** | **II** | **I** | **II** | **I** | **II** | **I** | **II** | **I** | **II** | **I** | **II** |
| **Coordination meetings and supervision visits** |  | X |  | X |  | X |  | X |  | X |  | X | NAFIN/IDB | **24,000[[7]](#footnote-7)** |
| **Collection of data for output indicators** |  |  |  |  |  |  |  |  |  |  |  |  |  | **20,000** |
| * **Component I**
 |  | X |  | X |  | X |  | X |  | X |  | X | NAFIN/IDB | 10,000 |
| * **Component II**
 |  | X |  | X |  | X |  | X |  | X |  | X | NAFIN/IDB | 10,000 |
| **Collection of data for outcome indicators** |  |  |  |  |  |  |  |  |  |  |  |  |  | **40,000** |
| * **Geothermal projects financed that moved on from early exploration to production drilling**
 |  |  |  |  |  |  |  |  |  |  |  | X | NAFIN | 5,000 |
| * **Geothermal projects financed that moved on from production drilling to construction**
 |  |  |  |  |  |  |  |  |  |  |  | X | NAFIN | 5,000 |
| * **Total geothermal power projects financed at some stage by the program that are in operation (producing electricity)**
 |  |  |  |  |  |  |  |  |  |  |  | X | NAFIN | 5,000 |
| * **Geothermal power generation capacity installed in projects financed at some stage by the program**
 |  |  |  |  |  |  |  |  |  |  |  | X | NAFIN | 5,000 |
| * **Electricity production from geothermal projects financed at some stage by the program**
 |  |  |  |  |  |  |  |  |  |  |  | X | IDB | 5,000 |
| * **Greenhouse gas (GHG) emissions avoided by geothermal projects financed at some stage by the program**
 |  |  |  |  |  |  |  |  |  |  |  | X | IDB | 5,000 |
| * **Additional financing from third parties mobilized to complete geothermal projects financed at some stage by the program**
 |  | X |  | X |  | X |  | X |  | X |  | X | NAFIN/IDB | 10,000 |
| **Final report (input for PCR)** |  |  |  |  |  |  |  |  |  |  |  | X | NAFIN/IDB | **30,000** |
|  |  |  |  |  |  | **Total** | **114.000** |

1. **EVALUATION**
2. **Main Evaluation Question(s)**
3. 1. This section aims at proposing a plan to carry out an evaluation of the impact of the program. The main evaluation questions are:

#### How many geothermal projects financed by the program moved [or are projected to move] from early exploration and production drilling stages to construction of plants and effective electricity generation?

#### What is the electricity production [current and projected] from geothermal projects financed at some stage by the program?

#### What is the impact of the program in therms of Greenhouse gas (GHG) emissions avoided and energy cost-savings by geothermal projects financed at some stage by the program?

#### How much additional resources (public and private) was the program able to leverage in the development of geothermal projects financed at some stage by the program?

* 1. The evaluation of the program will seek to measure the economic results of its implementation with regards to both the size of the induced investment and the benefits of the technology. To this end, the evaluation will use an ex-post economic analysis following the methodology used for the ex-ante economic analysis linked to the program proposal. The system will use in situ measurements in an annual basis during the six years after the first disbursement. After this, projections on the expected results will be made based on the collected data[[8]](#footnote-8).
	2. The results will be compared to a baseline value (see further details on the Results Matrix and the Monitoring section of this document).
1. **Existing Knowledge**
	1. There are several documents that have been developed in recent years focused on the development of geothermal energy in Mexico and its enormous potential. Among these, the “*Evaluación de la Energía Geotérmica en México*” (CFE-BID, 2011) makes an exhaustive analysis of the potential for geothermal energy and the legal aspects to its development in Mexico. Also, relevant information required to evaluate the benefits of these projects can be found in the document "*Costos y Parámetros de Referencia para la Formulación de Proyectos de Inversión del Sector Eléctrico*" (CFE, 2012), which includes the levelized costs of energy in Mexico, and is updated periodically to adjust for relevant changes in prices and technologies.
	2. Besides, geothermal is one of the seven areas of intervention underpinned in Mexico’s National Program for the Sustainable Use of Energy, on account of their cost effectiveness. In fact, the energy sector represents 60% of the GHG savings potential and imply investment costs by 2030 that are actually lower than the benefits accruing from the savings delivered[[9]](#footnote-9).
	3. The ex ante cost-benefit analysis[[10]](#footnote-10) found that the net cash flows discounted at a rate of 12% produce a net present value (NPV) for the program of US$194.53 million. Besides, the cost-efficiency analysis gave a very positive output of the program in terms of mitigation costs of renewable energy technologies. Based on estimated reductions of CO2 emissions over the course of a 30 year lifetime of projects financed, and using indicative total resources of US$54.3 million from the CTF, the cost of abatement is estimated at some: (i) US$1.64 per tCO2e considering CTF financing; (ii) US$3.63 considering total program financing (CTF, IDB and local); and (iii) US$36.24 when all project investment costs are considered.
	4. IDB’s previous experience with development banks in Mexico –specifically NAFIN– in the development of financing solutions for clean energy projects has proven viable and effective with a number of programs under the CCLIP ME-X1006 (ME-L1051, ME-L1081, ME-L1109 y ME-L1119), all of which had objectives related to the support of private sector investment in power generation using renewable sources[[11]](#footnote-11).
	5. This program is linked to a number of TCs (including ME-T1161, ME-T1164, ME-T1168 and ME-T1089, in execution both by the IDB and by NAFIN) intended to improve the regulatory framework on renewable energy –and geothermal specifically–, as well as to expand the diagnosis on the geothermal sector in Mexico, and to design innovative risk mitigation and financial products. Activities related to capacity building and dissemination of knowledge can also be financed with these TCs. In addition, the Regional TC “Apoyo Tecnico a Bancos de Desarrollo con Estrategias de Financiamiento para la Mitigación al Cambio Climatico” (ATN/MC-13341-RG) may complement this program with: i) the design and implementation of methodologies for assessment of geothermal projects by financing banks; ii) information and awareness of the various actors (financiers and potential investors) about the benefits associated with geothermal and effective ways to value them; and iii) compliance with national standards and IDB’s environmental and social safeguards policies.
	6. From the point of view of Mexico energy industry and the regulatory framework, the “*Estrategia Nacional de Energía 2013-2027*” (ENE) seeks a more inclusive growth target, which translates into an emphasis not only in production but also in energy savings. The ENE has a diagnosis of barriers to energy efficiency that highlights the financial problems. In addition, the overall goal called *México Prospero* incorporates the need to: (i) provide appropriate funding to the private sector, (ii) promote and guide a green and inclusive growth, and (iii) supply of energy at competitive prices and quality and efficiency along the supply chain.
	7. The Energy Reform raised by the new government proposes flexible operation of the local development banks with the aim of contributing to the expansion of credit, with special emphasis on the priority areas for national development, such as the energy sector.
2. **Key Outcome Indicators**
	1. Proposed indicators and their corresponding description, frequency of measurement and means of verification are listed in Table 3.1.

**Table 3.1: Indicators**

|  |  |  |  |
| --- | --- | --- | --- |
| **Indicators** | **Unit**[[12]](#footnote-12) | **Frequency of measurement** | **Description / Source of verification** |
| **Results** |  |  |  |
| Geothermal projects financed that moved on from early exploration to production drilling | Number (%) | Once, at the end of execution period | Source: Program report from NAFIN. Percentage will be measured over the total amount of projects financed (at any stage) as of end of execution period. |
| Geothermal projects financed that moved on from production drilling to construction | Number (%) | Once, at the end of execution period | Source: Program report from NAFIN. Percentage will be measured over the total amount of projects financed (at any stage) as of end of execution period. |
| Total geothermal power projects financed at some stage by the program that are in operation (producing electricity) | Number | Once, at the end of execution period (inc. projected value for year 10) | Includes the total number of projects that are functioning in the year indicated. Due to the long maturities associated to these projects, projects financed from early exploration may not be fully operational until past the timeframe of monitoring (see target 2024).Source: Program report from NAFIN. |
| Geothermal power generation capacity installed in projects financed at some stage by the program | MWe | Once, at the end of execution period (inc. projected value for year 10) | Includes only capacity ready for production. Due to the long maturities associated to these projects, capacity resulting from projects financed from early exploration may not be installed until past the timeframe of monitoring (see target 2024).Source: Program report from NAFIN. |
| Electricity production from geothermal projects financed at some stage by the program | GWh/yr | Once, at the end of execution period (inc. projected value for year 10) | Source: Program report from NAFIN.Estimations based on the expected capacity installed, an average production factor in Mexico, 24 hours/day, 365 days/yr. |
| Greenhouse gas (GHG) emissions avoided by geothermal projects financed at some stage by the program | MtCO2e/yr | Once, at the end of execution period (inc. projected value for year 10) | Tons of GHG emissions that will be reduced or avoided once the plants financed by the program are commissioned.Source: IDB estimations made following IDB methodology, based on installed capacity (see indicator above), envisaged production, and a 0.5 average conversion factor for electricity generation in Mexico.MtCO2e = Millions of tons of CO2 equivalent |
| Additional financing from third parties mobilized to complete geothermal projects financed at some stage by the program | Millions of USD | Annual | Volume of third-party direct finance leveraged by the program for projects supported. Includes all financing from sources other than the IDB/CTF funding (government, NAFIN and other financial institutions). Does not include capital.Source: Program report from NAFIN.Estimations based on a 70:30 debt to equity ratio, investment costs of US$5 million per well and US$2 to 4 million per MW installed.  |
| **Impacts** |  |  |  |
| Total geothermal capacity installed in Mexico | MWe | Twice, baseline and end of execution period (inc. projected value for year 10) | Source: SENER, Balance Nacional de Energia |
| Electricity production from geothermal sources in Mexico | GWh/yr | Twice, baseline and end of execution period (inc. projected value for year 10) | Source: Public information from CRE and CFE. Estimations based on the average production factor in Mexico. |
| Greenhouse gas (GHG) emissions in the Mexican energy sector | Mt CO2e | Twice, baseline and end of execution period (inc. projected value for year 10) | Source: IDB estimations based on Estrategia Nacional de Cambio Climático (ENACC) and Contribución sectorial a las emisiones, Quinta Comunicación al UNFCCC.MtCO2e = megatons of CO2 equivalent |

1. **Evaluation Methodology**
	1. For the economic analysis, the Net Present Value (NPV) and the Internal Rate of Return (IRR) are calculated for the lifespan of the program at a rate of 12%. This requires establishing the cost-benefit ratio. For the program, one type of cost is set: (i) investment. On the other side, there will be two types of benefits: (i) savings in electricity generation; and (ii) GHG emissions reduced.
	2. The evaluation will follow an ex-post cost-benefit analysis, based on the data collected by the set of indicators detailed above.
2. **Costs**
3. Investment Costs

Data of the annual progress reports, and any information relating to investments made during the program will be used. We have to distinguish between the financing of the program and the financing from third parties.

1. **Benefits[[13]](#footnote-13)**

The information for calculating the benefits of the program come from the power generation capacity installed via the projects and the contribution to reduction of GHG emissions. The Monitoring Progress Reports will be used to verify the benefits. Based on these targets, the benefits considered consist of:

1. SAVINGS IN ELECTRICITY

This benefit will compare the difference between the generation cost of a pool of renewable energies in Mexico and the generation cost of energy by geothermal technology, following the next steps:

Costs of Geothermal energy generation

1. Take the new installed capacity financed by the program since the plants start generating power.

 **Table 3.2: Data collection**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Project | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 | 2024 | … | 2044 |
| Geothermal 1 |  |  | DC | DC | DC | DC | P | P | P | P | … |  |
| Geothermal 2 |  |  |  |  | DC | DC | P | P | P | P | … |  |
| Geothermal 3 |  |  |  |  |  |  | P | P | P | P | … |  |
| Geothermal 4 |  |  |  |  |  |  |  | P | P | P | … |  |
| Geothermal 5 |  |  |  |  |  |  |  |  |  | P | … |  |
| Geothermal 6 |  |  |  |  |  |  |  |  |  |  |  |  |
| Start Generation | DC = Data Collection | P = Projections |

1. Calculate the cost of net MWh for each of the financed projects.

$$C\_{g}=\frac{MWh}{Inv}$$

1. Here, we can differentitate two stages,
	* When we have real data. For instance, in the plant Geothermal 1 from 2017 to 2020.
	* When we have to project the data based on information collected, that is, from 2021 to 2034.
2. Based on the information, real and projected, we can calculat the MWh/USD of each of the projects financed.

 Costs of the rest of renewable energy generation[[14]](#footnote-14)

1. Take the annual renewable electric generation distribution and calculate the percentage of each type[[15]](#footnote-15). For instance, the pool of renewable energies in Mexico and their percentage by technology generation in 2012[[16]](#footnote-16) were:

**Chart. 2.2 Distributions of renewable energy in Mexico**

1. Taking representative[[17]](#footnote-17) power plants of the different renewable sources, calculate the weighted average of the generation cost (MWh/USD[[18]](#footnote-18)). Bear in mind that the cost of renewabe energy technologies may vary in two cases:
	* Depending on the net generation of each of the financed geothermal plants (i.e. costs are not the same for a 90 MW than for a 25 MW geothermal plant); and
	* Depending on the percentage (share) and adjusted cost of generation of each renewable energy technology.
2. After 2020, we will have to project the renewable energy generation costs, based on historical data which is widely available in Mexico and worldwide.

 Savings

1. Finally, calculate the difference between the cost of geothermal power generation for each project/year and the cost of a representative pool of renewable energies from 2015 to 2044.
2. GHG EMISSIONS REDUCED

To calculare the GHG emissions reduced (number of metric tons of CO2 equivalent emissions averted) by the plants financed by the program, estimations will be made using the average emissions factor for electricity in Mexico (0.5 kgCO2/kWh) and a 84% load factor (also average in Mexico). The average emissions factor for electricity in Mexico will be validated yearly.

1. **Economic return and net present value of benefits**

The results obtained in this analysis are a comparison of the resources used by the Mexican economy "with" and "without" program. Based on the costs and benefits identified, the economic internal rate of return (IRR) is calculated by the program. Similarly, the costs and benefits identified were used to calculate the net present value (NPV) of the program, using a discount rate of 12% following IDB standards.

* 1. This method is appropriate because: (i) there is a relatively small population of companies/developers in the sector (a clear baseline could be established), and (ii) the availability and robustness of outcome indicators is very high.
	2. It will be the responsibility of the Bank, through its Division of Capital Markets and Financial Institutions (IFD/CMF) and Climate Change and Sustainability (INE/CCS), to supervise the execution of the ex post cost-benefit analysis from the data collected in accordance with the plan proposed. To this end, CMF and CCS will be supported by the Division of Energy (ENE) involved in the operation. It is noteworthy that CMF has a group of specialists focused on carbon finance that will underpin the final report. It is expected that the information needed to make such an evaluation will be available from national sources as indicated in Table 3.1. and from the final report produced by NAFIN and included in the monitoring activities.
	3. **Treatment and control groups**. The selected methodology does not require the assignment of treatment and control groups.
	4. **Data collection**. NAFIN will collect the necessary data from the information sources as indicated in Table 3.1, and by submitting annual reports to the IDB. Information systems and existing databases in NAFIN, the CRE and CFE, among others, are considered sufficient to monitor the proposed indicators. Institutions related to the energy sector in Mexico have extensive information that can serve the purpose of the proposed assessment, as well as a clear commitment to making this information public and use it for the purpose of improving and developing the initiatives planned for the future.
	5. The DOFI at NAFIN has access and regular contact with managers of external sources of information, in addition to rigorous information requirements for evaluating projects that apply for funding with program resources, so it is expected that this will facilitate the proposed analysis of the impact of the program. The DOFI will act as coordinator in the preparation of reports and liaison with the Bank.
	6. NAFIN makes systematic field visits to monitor the risk and monitor their financing programs. Supervision visits are also carried out by Bank’s staff members, an activity that is included in this monitoring and evaluation plan.
1. **Technical Aspects of Selected Methology**
	1. The execution of an ex-post cost benefit analysis is linked to the datta collection of indicators set out in the monitoring work plan. For the methodology to be effective it is key to have the information gathered for the monitoring indicators concerning the results matrix (see Table 3.1).
2. **Reporting Evaluation Results**
	1. The DOFI, in its capacity as Project Coordination Unit, will act as coordinator in the preparation of reports and liaison with the Bank.
	2. NAFIN will report to IDB through annual reports on the defined indicators and in the detailed performance of the program. Based on the conclusions of these reports, NAFIN and IDB could introduce adjustments to the program. The executing agency will deliver the reports within 60 calendar days after the end of each year of the program’s implementation. The reports will include information regarding the evolution of the evaluation indicators as well as any other information considered relevant to the performance of the program. The Bank will be entitled to request additional information, if necessary.
3. **Complementary evaluation (optional)**
	1. Besides the annual reports and the scheduled contacts for monitoring of the operations carried out under the program, the borrower and the Bank will conduct a midterm evaluation within 36 months from the date of the first disbursement of financing. The evaluation will assess progress in accomplishing program objectives and outcomes based on the Results Matrix, in order to identify any corrective action required.
	2. An extended project monitoring report (XPMR) and a Project Completion Report (PCR) have been planned, to be carried out six months after the disbursement conditions for the last operation under the program have been met. The PCR will evaluate the fulfillment of targets and review the results of the operation. The assumptions in the Results Matrix will be taken into consideration as well as the methodology explained in this document.
4. **Evaluation Coordination, Work Plan and Budget**
	1. NAFIN will be responsible for the supervision, technical and administrative coordination of the program and perform the necessary reporting duties to the Bank.
	2. For the implementation of this assessment, it is expected that NAFIN will use its own staff, with the supervision of the IDB, which are considered adequate and sufficient to ensure the quality and success of the evaluation work. For activities that require additional expertise, consultancy services may be hired by NAFIN or the IDB (see Table 3.2).
	3. The borrower and the Bank will conduct a midterm evaluation within 36 months from the date of the first disbursement of financing. The evaluation will assess progress in accomplishing program objectives and outcomes based on the Results Matrix in order to identify any corrective action required. Periodical monitoring meetings are also scheduled. The borrower will provide the information necessary for the Bank to conduct a Project Completion Report (PCR), to be carried out six months after the disbursement conditions for the last operation of the program have been met.
	4. The Bank, through its Division of IFD/CMF and INE/CCS, with support from the Office of Strategic Planning and Development Effectiveness (SPD), will collaborate with NAFIN in any aspects required and requested. The Bank may provide technical and financial support to carry out the activities of specialized analysis on the economic assessment.
	5. The costs of the activities listed in this plan will be financed by the supervision budget included in the CTF funding and/or with transactional budget of the CMF division. Its completion is expected by the end of the execution period of the program (see details in Table 3.2). NAFIN and the IDB have the structure and resources to ensure compliance with the tasks and commitments in this assessment plan. Any further evaluation with more specific purposes or seeking to determine externalities resulting from the execution of the program may be carried out if considered relevant, but will not be incorporated as part of this Monitoring and Evaluation Plan.

**Table 3.2. Evaluation Working Plan**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Activities** | **Year 1**  | **Year 2** | **Year 3** | **Year 4** | **Year 5** | **Year 6** | **Respon-sible** | **Budget****(USD)** |
| **I** | **II** | **I** | **II** | **I** | **II** | **I** | **II** | **I** | **II** | **I** | **II** |
| **Collection of data for outcome indicators** |  |  |  |  |  |  |  |  |  |  |  |  |  | **40,000** |
| * **Geothermal projects financed that moved on from early exploration to production drilling**
 |  |  |  |  |  |  |  |  |  |  |  | X | NAFIN | 5,000 |
| * **Geothermal projects financed that moved on from production drilling to construction**
 |  |  |  |  |  |  |  |  |  |  |  | X | NAFIN | 5,000 |
| * **Total geothermal power projects financed at some stage by the program that are in operation (producing electricity)**
 |  |  |  |  |  |  |  |  |  |  |  | X | NAFIN | 5,000 |
| * **Geothermal power generation capacity installed in projects financed at some stage by the program**
 |  |  |  |  |  |  |  |  |  |  |  | X | NAFIN | 5,000 |
| * **Electricity production from geothermal projects financed at some stage by the program**
 |  |  |  |  |  |  |  |  |  |  |  | X | IDB | 5,000 |
| * **Greenhouse gas (GHG) emissions avoided by geothermal projects financed at some stage by the program**
 |  |  |  |  |  |  |  |  |  |  |  | X | IDB | 5,000 |
| * **Additional financing from third parties mobilized to complete geothermal projects financed at some stage by the program**
 |  | X |  | X |  | X |  | X |  | X |  | X | NAFIN/ IDB | 10,000 |
| **Data Projections and Analysis**  |  |  |  |  |  |  |  |  |  |  |  | X | Consul-tant | **15,000** |
| **Final Evaluation: Cost-Benefit Analysis**  |  |  |  |  |  |  |  |  |  |  |  | X | (Consul-tant/Firm) | **20,000** |
| **Distribution and discussion of the report** |  |  |  |  |  |  |  |  |  |  |  | X | NAFIN/ IDB | **5,000** |
|  |  |  |  |  |  | **Total** | **80,000** |

1. [Ley General de Cambio Climático](http://www.diputados.gob.mx/LeyesBiblio/pdf/LGCC.pdf), 2012. [↑](#footnote-ref-1)
2. INECC. [Bases para una estrategia de desarrollo bajo en emisiones de México](http://bit.ly/BEDBEMex). 2012. [↑](#footnote-ref-2)
3. The Mexican government has designated NAFIN as one of the entities that will support its emission reduction efforts, mainly through their *Direccion de Proyectos Sustentables*. [↑](#footnote-ref-3)
4. In August 2013 the IDB granted US$135,000 of nonreimbursable funds to NAFIN as part of the Regional TC ATN/MC-13341-RG (see ¶3.8). [↑](#footnote-ref-4)
5. To this date, the results of these operations include: US$5,371 million investment in electricity generation from RE detonated, US$440 million of financing by third parties mobilized, 2,622 MW of RE installed capacity financed, and participation 13 financial intermediaries. [↑](#footnote-ref-5)
6. All figures are accumulated. [↑](#footnote-ref-6)
7. Includes travel and per diem costs of required supervision missions. [↑](#footnote-ref-7)
8. Due to the long-term nature of geothermal project development, some of the results will only happen after the end of the execution period. A long-term target is set for a timeframe of ten years from the beginning of the program (see Annex II: Results Matrix). [↑](#footnote-ref-8)
9. IDB Private Sector. CTF Proposal. [↑](#footnote-ref-9)
10. See [Optional Link: Cost Benefit Analysis](http://idbdocs.iadb.org/wsdocs/getdocument.aspx?docnum=38349576) [↑](#footnote-ref-10)
11. These interventions have contributed to wind sources having already gained momentum. Wind installed capacity in Mexico has risen from levels below 100 MW in 2006-08, to almost 600 MW in 2011 and over 1,000 MW in 2012. According to the Asociacion Mexicana de Energia Eolica (AMDEE) this is the result of a combination of factors, including the existence and availability of sources of financing, a solid legal and regulatory framework, and the high efficiency of the plants due to the quality of the resource in the country. Production costs have decreased significantly during the last 15 years, becoming competitive with conventional sources of energy (PwC, citing AMDEE). [↑](#footnote-ref-11)
12. All figures are accumulated. [↑](#footnote-ref-12)
13. For further information, see [Optional Link: Cost Benefit Analysis](http://idbdocs.iadb.org/wsdocs/getdocument.aspx?docnum=38349576). [↑](#footnote-ref-13)
14. The methodology considers comparing only to other renewables, as fossil fueled energy production costs do not consider the negative externalities that come with the use of them. [↑](#footnote-ref-14)
15. CFE. Sector Eléctrico Nacional. [↑](#footnote-ref-15)
16. CFE. [Sector Eléctrico Nacional. Generación Bruta.](http://idbdocs.iadb.org/wsdocs/getDocument.aspx?Docnum=38271059) 2012. [↑](#footnote-ref-16)
17. By representative we mean plants with the same net energy generation installed. [↑](#footnote-ref-17)
18. The total cost (investment, fuel, water, O&M) of the plants can be obtained from the annual document COPAR [↑](#footnote-ref-18)