

Terminal Evaluation Review form, GEF Independent Evaluation Office, APR 2017

1. Project Data

Summary project data			
GEF project ID		4138	
GEF Agency project ID		CO-X1009	
GEF Replenishment Phase		GEF-4	
Lead GEF Agency (include all for joint projects)		IDB	
Project name		Catalytic Investments for Geothermal Power	
Country/Countries		Colombia	
Region		LAC	
Focal area		Climate Change	
Operational Program or Strategic Priorities/Objectives		Strategic Program 3 (Promote Market Approaches for Renewable Energy)	
Executing agencies involved		Ministry of Mining and Energy; Isagen S.A. ESP (public company)	
NGOs/CBOs involvement		Academic/research institutions involved in project execution (Component 2), NGO involved in project execution (Component 1)	
Private sector involvement		Co-executing agency	
CEO Endorsement (FSP) /Approval date (MSP)		07/05/2011	
Effectiveness date / project start		10/11/2011	
Expected date of project completion (at start)		04/11/2015	
Actual date of project completion		04/11/2016	
Project Financing			
		At Endorsement (US \$M)	At Completion (US \$M)
Project Preparation Grant	GEF funding	0.0	0.0
	Co-financing	0.0	0.0
GEF Project Grant		2.73	1.53
Co-financing	IA own	0.90	2.10
	Government	0.20	0.30
	Other multi- /bi-laterals	0.0	0.0
	Private sector	22.65	2.60
	NGOs/CSOs	0.0	0.0
Total GEF funding		2.73	1.53
Total Co-financing		23.75	5.0
Total project funding (GEF grant(s) + co-financing)		26.48	6.53
Terminal evaluation/review information			
TE completion date		November 2016	
Author of TE		Jorge Luis Rodríguez Sanabria	
TER completion date		4/15/18	
TER prepared by		Nina Hamilton	
TER peer review by (if GEF IEO review)		Molly Sohn	

2. Summary of Project Ratings

Criteria	Final PIR	IA Terminal Evaluation	IA Evaluation Office Review	GEF IEO Review
Project Outcomes	S	HS	-	S
Sustainability of Outcomes		ML	-	ML
M&E Design		NR	-	S
M&E Implementation		S	-	S
Quality of Implementation		NR	-	S
Quality of Execution		NR	-	S
Quality of the Terminal Evaluation Report		-	-	S

3. Project Objectives

3.1 Global Environmental Objectives of the project:

The project's global environmental objectives are to (i) reduce and displace unrealized GhG emissions; (ii) foster a new source of energy (geothermal) that has remained unattended and unexploited due to a lack of technical knowledge in the country and to legal, institutional and financial constraints, and (iii) support the design and implementation of an Environmental and Social Management Report (ESMR), Health and Safety Plan and Emergency Plan that will improve the welfare of the local community in the area of the project (PD, pg. 12).

The project specifically aims to avoid 3,369,227 tCO₂ in direct CO₂ emissions over a period of 30 years as a result of the installation of a new geothermal power plant (PD, pg. 13).

3.2 Development Objectives of the project:

The overall development objective of the project is to “promote and support catalytic investments for geothermal power in Colombia through the strengthening of its regulatory framework and the development and implementation of a demonstrative geothermal project in the Macizo Volcanico del Ruiz” (PD, pg. 1). The specific objectives include (i) a white paper policy to promote use of untapped non-conventional renewable energy (such as geothermal, wind and solar/PV) and specific policy and regulatory measures recommendations; (ii) a model of the geothermal resource in the two selected areas and its temperature; (iii) identification of the type of geothermal resource and its potential capacity; (iv) recommendations concerning the geothermal resource exploration and development; (v) environmental and sociological studies according to the scope of these activities and (vi) development and implementation of the geothermal project.

3.3 Were there any **changes** in the Global Environmental Objectives, Development Objectives, or other activities during implementation?

The implementation of the geothermal power plant was removed from the project, as the MTR noted that “without finishing the studies considered in the Acquisitions Plan, it is too risky developing a geothermal power plant” (MTR, pg. 14). Therefore, Component 3 (Exploration Drilling and Geothermal Plant Construction) was removed, except for the activity on financial restructuring for plant construction.

The activities in component 2 (Subsurface Assessment Studies) were also adapted, and the budget was redistributed, to add the following activities: i) complementation of the environmental impact

assessment, ii) hydro climatological characterization and development of a methodology to estimate the temperature series for the reliability charge (ENFICC) and iii) study of the project's connection to the National Electric Grid (TE, pg. 12, 14-16).

4. GEF IEO assessment of Outcomes and Sustainability

Please refer to the GEF Terminal Evaluation Review Guidelines for detail on the criteria for ratings.

Relevance can receive either a Satisfactory or Unsatisfactory rating. For Effectiveness and Cost efficiency, a six point rating scale is used (Highly Satisfactory to Highly Unsatisfactory), or Unable to Assess. Sustainability ratings are assessed on a four-point scale: Likely=no or negligible risk; Moderately Likely=low risk; Moderately Unlikely=substantial risks; Unlikely=high risk. In assessing a Sustainability rating please note if, and to what degree, sustainability of project outcomes is threatened by financial, sociopolitical, institutional/governance, or environmental factors.

Please justify ratings in the space below each box.

4.1 Relevance	Rating: Satisfactory
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The TE rates relevance as highly satisfactory, and this TER rates relevance at **satisfactory** (on a binary scale) since the project's objectives are in line with Government of Colombia, GEF, and IDB priorities.

The Government of Colombia's National Development Plan includes objectives related to renewable energy, therefore providing "legal groundwork by which the Government can play a greater role in the development of the use of renewable energy" in order to reduce the dependency on hydropower and avoid potential energy restrictions in the future (PD, pg. 7). The Ministry of Mines and Energy (MME) is responsible for establishing incentives to allow the development of renewable energy, and the Planning Unit of the MME (UPME) has called for a plan to expand the generation system utilizing and optimizing the country's wind or geothermal resources.

The project is also in line with the strategic areas in Colombia's 2003-2020 energy policy, which include: (i) increased use of renewable energy to promote non-conventional generation sources; (ii) diversification of Colombia's energy matrix; (iii) development of low-carbon emitting technologies through the implementation of demonstrative-pilot projects; (iv) rational and efficient use of the energy resource; (v) reliable and secure supply of energy; and (vi) development of innovative technologies (PD, pg. 13).

This project is also consistent with the GEF Strategic Program 3 (Promote Market Approaches for Renewable Energy) and long-term objective 4 in that it provides "reliable, secure and environmentally-friendly geothermal energy and thus increases the basket of potential non-conventional clean energy sources while diversifying the country's generation mix" (PD, pg. 14). Furthermore, the project aligns with GEF's goal to "foster economic growth and sustainable development by enabling and supporting new markets and shifting away from carbon-intensive technologies" (PD, pg. 14).

The IDB priorities consistent with this project include the call for "explicit support to facilitate and develop opportunities based on renewable energy, rational use of energy and improvements of the regulatory framework" in Colombia (PD, pg. 15), in addition to the Country Investment Plan which is being formulated by Colombia's economic authorities with assistance from IDB. The national planning department and the Ministry of Finance have both expressed interest in endorsing electric generation from renewable energies in the Country Investment Plan. The project's objectives fit with those in the

IDB strategy for Colombia(GN-2474), including to “support national efforts to achieve sustained growth, promote employment, reduce poverty and improve standards of life, particularly helping to promote the competitiveness of the energy sector which represents a fundamental pillar of national economic development” (TE, pg. 6).

4.2 Effectiveness	Rating: Satisfactory
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The TE rates effectiveness as **highly satisfactory**, and this TE rates effectiveness as satisfactory due to a shortcoming in the financial structuring activity.

Component 1: Promote Market Approaches for Renewable Energy by contributing to the Removal of Barriers to the Development of Non- Conventional Renewable Energy

The project met all of the targets outputs and outcomes under Component 1, and met the objectives to “strengthen the regulatory framework, promote market approaches for renewable energy and remove barriers that obstruct the development of non-conventional sources of renewable energy (FNCER), [and] to foster the development of a favorable environment for the development and integration of FNCER in the Colombian energy matrix” (TE, pg. 28). The project’s major outcome in this component was the issuance of Law 1715 of 2014, through the Mining and Energy Planning Unit and the Ministry of Mines and Energy, which “aims to establish the legal framework and instruments for promotion of the use of non-conventional sources of renewable energy” and “fosters investment, research and development of clean technology for energy production, energy efficiency and response to demand, as part of the domestic energy policy” (TE, pg. 44). The law incorporated elements based on the barriers identified through this project, such as high investment costs, inability for auto-producers to inject or sell to the grid their surplus electricity, and lack of policy guidelines for renewable energy (TE, pg. 66).

Component 2: Subsurface Assessment Studies

The project successfully met the target outputs under Component 2, and met the objective to support completion of the necessary studies for the development and execution of a demonstrative geothermal project in the Nevado del Ruiz or Ruiz Volcanic Massif. The TE also notes that, “not only did it comply with the execution of the proposed activities, but it also increased the scope of the project to include not only the exploratory drilling, but also the use of the geothermal resource” (TE, pg. 28). Therefore, the project exceeded its expected outcomes under Component 2. Specifically, the project conducted 3D modeling of the geothermal and resistivity model, identified the type of geothermal resource and its potential capacity, provided recommendations regarding the exploration and exploitation of the geothermal resource, conducted environmental and social studies, defined sites to implement a 50 MW geothermal plant in the Ruiz Volcanic Massif, and made progress in the prospecting of resources for the plant and its financial structuring (TE, pg. 28-29).

However, the latter outcome (financial structuring) was not completed as planned by the time of project completion, since the procurement of a consultancy for financial structuring was delayed due to changes in regulations that affect the financing of renewable energy projects in Colombia and was finally was started in the last 6 months of the project (with an implementation duration of 12 months) (TE, pg. 53). This outcome was originally part of Component 3 as described in the PD, and is the only activity from Component 3 that was implemented and evaluated.

4.3 Efficiency	Rating: Moderately satisfactory
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The TE rates efficiency as highly satisfactory (Component 1) and moderately satisfactory (Component 2), and this TER rates efficiency as **moderately satisfactory** due to project delays from a number of shortcomings during project implementation.

The project was extended two times, first for one year and then an additional 6 months (TE, pg. 31).

Component 1's activities ended in March 2015 (compared to November 2014 expected completion date). The extension was necessary to allow enough time to complete project activities with proper execution, as well as the additional activities that emerged during the final 6 months, which included "hiring a tributary expert and extending the technical consultancy to address specific subjects of relevance in the Act 1715" (TE, pg. 13-14). However, the component's efficiency is improved by the fact that the additional studies were done without modifications (only redistribution) of the initial budget (TE, pg. 29). Furthermore, because of the commitment by the project's implementing agency, executing agency, and executing partners (including Conservation International), the project recovered from delays that occurred during project start-up, ensuring that the project fulfilled its objectives (TE, pg. 29).

Overall, the component's budget was well managed, and the project used 88% of the budget for activities related to the subcomponents and the remaining 12% for audits and project management (TE, pg. 13).

Component 2's activities ended in April 2016 (October 2014 expected completion date), however the TE notes that the "delays are justified by the need to fully achieve the agreement's objectives, technological appropriation, and capacity generation in the country" (TE, pg. 28). The TE notes many factors that caused delays, including: i) lack of professionals specialized in geothermal exploration in the country, ii) the procurement process of the magnetotelluric studies was declared void and therefore had to be restarted, iii) the magnetotelluric studies took longer than initially planned due to problems of electromagnetic noise because of volcanic activity, iv) additional activities to those initially planned were carried out in order to locate and measure the reservoir, and v) the environmental impact assessment was complemented to comply with the requirements requested by the environmental authority during the development of the project (TE, pg. 30-31). Despite these shortcomings, the expected results were achieved at a lower cost than planned since additional activities were included without modification to the budget.

Overall the project was under budget, since the original Project Document budgeted \$2.08 million in GEF funds for components 1 and 2, and the project spent \$1.527 million in GEF funds. The project also secured \$5 million in co-financing from the government, IDB, and private sector, compared to the \$1.85 million committed for components 1 and 2 in the Project Document.

4.4 Sustainability	Rating: Moderately likely
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The TE rates overall sustainability as **moderately likely**, and this TER maintains that rating.

The project addressed the key barriers noted in the Project Document, such as the regulatory barriers that "limit the development of non-conventional renewable energy projects and do not provide for special or differentiated norms for renewable energy pricing" (PD, pg. 7), however long-term sustainability will depend on the construction of a geothermal plant and sustainable financing.

Institutional frameworks – Moderately likely

As a result of the project, the “conditions and technical knowledge are available to advance in the exploratory drilling stage and to confirm the existence of the resource at depth, meaning that the construction of the first geothermal power plant in the country is viable” (TE, pg. 27). However, it is essential that the Ministry of Mines and Energy continues giving importance to the ruling procedure of Law 1715 to promote investments in non-conventional sources of renewable energy projects under the approach of a competitive market, and that “continued activities are performed following the proposed strategy and recommendations derived from this component, for the successful integration of these sources to the national energy” (TE, pg. 32). Overall, the establishment of a work team with technical capacity for the development of geothermal energy generation projects, as a result of this project, will help ensure the continued management, planning and development of this kind of project even after GEF’s support has ended.

At the time of the TE, there were a few additional risks to the continuity of institutional arrangements around the project’s activities. For example, there is a risk that the project’s successful Information and Knowledge Management System of Non-Conventional Renewable Energy (SGIC-FNCER) activity will not be sustained when there are no longer full-time personnel devoted to the platform (TE, pg. 33). Furthermore, the government’s participation in ISAGEN, the co-executing agency, was sold to a Canadian private investment fund (TE, pg. 33). As a result, the company is now a private enterprise without public participation and will rely on the commitment and buy-in from the new investment fund. However, ISAGEN has demonstrated commitment to the “medium and short-term development of power generation projects with conventional and non-conventional renewable energy sources” and has shown strong promotion and financial support of research for the development of the geothermal project (TE, pg. 41). Furthermore, ISAGEN has noted the need of further studies to confirm the existence of the geothermal resource in its Institutional Development Plan (TE, pg. 41), and there have been proposals within the company to start exploration activities in other geothermal areas of interest.

Financial – Moderately unlikely

At project completion, the project is ready to continue with activities related to power plant construction and the exploration drilling process, however this requires a significant amount of resources and is a high-risk investment (TE, pg. 33). Given this high-risk, “external support is still needed to give continuity to this kind of project and mitigate the related risk” (TE, pg. 35). Furthermore, the lower price of hydroelectric and fossil fuel resources for electricity generation in Colombia threaten the financial viability of geothermal energy generation, and therefore the “support of mitigation funds needs to be continued to try to reduce the costs and risks to make the technology competitive on the Colombian market” (TE, pg. 36). Since the financial structuring activity was not yet completed at the time of the TE, financial sustainability remains moderately unlikely.

Sociopolitical – Likely

Overall, the project had strong support from diverse stakeholders which will likely continue after project completion, and the project’s awareness-raising and capacity building activities have similarly enhanced the project’s sociopolitical sustainability. The project was particularly successful at raising awareness about the characteristics of geothermal energy, and its impacts, related risks and potentials, building the technical and scientific capacity of students, professionals and the community in general (TE, pg. 34).

The government has also expressed interest in further advancing with the promotion and exploitation of geothermal energy to diversify the country’s energy matrix, and has also demonstrated its commitment by continuing to lead the implementation and ruling procedure of Law 1715. Furthermore, non-conventional sources of renewable energy generation projects are being considered in different

scenarios of the Mining and Energy Planning Unit's Expansion Reference Generation and Transmission Plan for 2015-2029 and 2016-2030 (TE, pg. 48).

Among the public, the TE noted the "openness of the community in the project's area of influence and regional stakeholders to the development of the Ruiz Volcanic Massif Geothermal Plant Project" (TE, pg. 35) and found "very good acceptance and approval by the attendees of the information and communication meetings" (TE, pg. 50). Although they suggest improving outreach to ensure more residents are informed and able to participate, the buy-in from communities in the region of the proposal geothermal plant greatly enhances the sociopolitical sustainability of any future geothermal energy production activities. Overall, the community and landowners "expressed their willingness to help with the completion of the activities required to establish a geothermal plant" (TE, pg. 50).

The private sector has also demonstrated continued support for geothermal energy, since ISAGEN has had proposals within the company to start exploration activities in other geothermal areas of interest (TE, pg. 41), and additional power generation companies have also expressed interest in developing non-conventional sources of renewable energy projects (TE, pg. 34).

Environmental – Moderately likely

Since geothermal energy is a renewable, clean source of energy, the project's environmental sustainability is likely once a geothermal power plant is in operation and reducing overall greenhouse gas emissions. However, since the plant was not constructed in this project, the environmental sustainability strongly depends on the continuation of the project until the construction of the plant and eventual exploitation of geothermal energy.

5. Processes and factors affecting attainment of project outcomes

5.1 Co-financing. To what extent was the reported co-financing essential to the achievement of GEF objectives? If there was a difference in the level of expected co-financing and actual co-financing, then what were the reasons for it? Did the extent of materialization of co-financing affect project's outcomes and/or sustainability? If so, in what ways and through what causal linkages?

The materialized co-financing is not directly comparable to the co-financing noted in the Project Document, since most of Component 3 was dropped.

The project secured \$5 million in co-financing from the government, IDB, and private sector, compared to the \$1.85 million committed for components 1 and 2 in the Project Document. The large difference is mostly attributable to ISAGEN (the publicly owned company and co-executing agency), which contributed \$2.6 million compared to the original \$850,000 commitment (TE, pg. 45). The government also provided \$96,000 more in co-financing than originally committed. However, the TE does not discuss the effect of higher than expected co-financing (for Components 1 and 2) on project outcomes.

5.2 Project extensions and/or delays. If there were delays in project implementation and completion, then what were the reasons for it? Did the delay affect the project's outcomes and/or sustainability? If so, in what ways and through what causal linkages?

The project was extended two times, first for one year and then an additional 6 months (TE, pg. 31).

Component 1's activities ended in March 2015 (compared to November 2014 expected completion date). The extension was necessary to allow enough time to complete project activities with proper

execution, as well as the additional activities that emerged during the final 6 months, which included “hiring a tributary expert and extending the technical consultancy to address specific subjects of relevance in the Act 1715” (TE, pg. 13-14). As a result of the commitment by the project’s implementing agency, executing agency, and executing partners (including Conservation International), the project recovered from delays that occurred during project start-up, ensuring that the project fulfilled its objectives (TE, pg. 29).

Component 2’s activities ended in April 2016 (October 2014 expected completion date), however the TE notes that the “delays are justified by the need to fully achieve the agreement's objectives, technological appropriation, and capacity generation in the country” (TE, pg. 28). The TE notes many factors that caused delays, including: i) lack of professionals specialized in geothermal exploration in the country, ii) the procurement process of the magnetotelluric studies was declared void and therefore had to be restarted, iii) the magnetotelluric studies took longer than initially planned due to problems of electromagnetic noise because of volcanic activity, iv) additional activities to those initially planned were carried out in order to locate and measure the reservoir, and v) the environmental impact assessment was complemented to comply with the requirements requested by the environmental authority during the development of the project (TE, pg. 30-31).

Overall, the project outcomes were not affected by the project delays, except for the financial restructuring activity which was not completed at the time of project completion.

5.3 Country ownership. Assess the extent to which country ownership has affected project outcomes and sustainability? Describe the ways in which it affected outcomes and sustainability, highlighting the causal links:

Overall, the government and other relevant stakeholders showed strong ownership of the project during through their involvement and buy-in during project preparation and implementation. As noted in the TE, “the utilization of the skills and the experience of government organizations, non-governmental organizations, private sector entities, local government and academic entities were considered during design, execution and evaluation stages of the project” (TE, pg. 49). This ownership is essential for continued buy-in from stakeholder, which will be essential for the further development of geothermal energy production.

The government has expressed interest in continuing to advance the promotion and exploitation of non-conventional renewable energy sources, such as geothermal energy, to diversify the country's energy matrix and support programs that contribute to climate change mitigation (TE, pg. 35). The government demonstrated ownership of this project through its co-financing contribution, providing \$96,000 more in co-financing than originally committed. Furthermore, it is expected that the Mining and Energy Planning Unit, in collaboration with the Ministry of Mines and Energy, will continue leading the process of implementing and enforcing the new Law 1715 of 2014, which was issued with the support of this project (TE, pg. 26).

ISAGEN has also demonstrated ownership through its commitment to the “medium and short-term development of power generation projects with conventional and non-conventional renewable energy sources” and its promotion and financial support of research for the development of the geothermal project (TE, pg. 41), such as through its \$2.6 million contribution to this project compared to its original \$850,000 commitment. Furthermore, ISAGEN has noted the need of further studies to confirm the existence of the geothermal resource in its Institutional Development Plan (TE, pg. 41).

6. Assessment of project's Monitoring and Evaluation system

Ratings are assessed on a six point scale: Highly Satisfactory=no shortcomings in this M&E component; Satisfactory=minor shortcomings in this M&E component; Moderately Satisfactory=moderate shortcomings in this M&E component; Moderately Unsatisfactory=significant shortcomings in this M&E component; Unsatisfactory=major shortcomings in this M&E component; Highly Unsatisfactory=there were no project M&E systems.

Please justify ratings in the space below each box.

6.1 M&E Design at entry	Rating: Satisfactory
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The TE did not rate M&E design and this TER provides a rating of **satisfactory**.

The Project Document outlined a comprehensive M&E system with clearly defined responsibilities across the project's executing agencies, and a detailed results framework with outcome and output indicators and targets, including annual output targets to establish the project's expected timeline of results. The M&E system was to be coordinated by the Planning Unit of the Ministry of Mining and Energy for Component 1 and by ISAGEN for Components 2, 3, and financial structuring for the geothermal plant, which aligned with the entities responsible for project implementation for each component (PD, pg. 5). The PD also noted that baseline information would be collected within 6 months of the project's start, and M&E results would be shared with the project's other participating institutions, including the National University of Colombia (UNC) and the Colombian Institute of Geology and Mining (INGEOMINAS) as the project's research partners (PD, pg. 5).

However, the Project Document should have noted gender indicators to be monitored or considered as part of the project's social and environmental assessment activities, given the potential impact of geothermal energy production activities on communities.

6.2 M&E Implementation	Rating: Satisfactory
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The TE rates M&E implementation as **satisfactory**, and this TER maintains that rating.

The TE notes that project M&E documents were implemented and updated during the execution of both components, and the Mining and Energy Planning Unit and ISAGEN successfully prepared the mid-term evaluation report for the IDB, in addition to an external audit for December 2010 – December 2014 (TE, pg. 39). As part of the M&E system, the IDB also made inspection visits and held follow-up meetings to review the project's progress, budget execution, and assess the need for modifications to the project during implementation. The M&E plan was implemented as budgeted for Component 1, and since the cost of monitoring Component 2 was less than budgeted, the remaining budget was reallocated to meet the needs of new activities added during project implementation (TE, pg. 40).

7. Assessment of project implementation and execution

Quality of Implementation includes the quality of project design, as well as the quality of supervision and assistance provided by implementing agency(s) to execution agencies throughout project implementation. Quality of Execution covers the effectiveness of the executing agency(s) in performing its roles and responsibilities. In both instances, the focus is upon factors that are largely

within the control of the respective implementing and executing agency(s). A six point rating scale is used (Highly Satisfactory to Highly Unsatisfactory), or Unable to Assess.

Please justify ratings in the space below each box.

7.1 Quality of Project Implementation	Rating: Satisfactory
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The TE did not rate the quality of project implementation, and this TER provides a rating of **satisfactory**.

The project was to be monitored in accordance with IDB's established procedures, and the IDB office in Bogotá and IDB technical staff in Washington would provide ongoing backstopping, in addition to technical and fiduciary support Energy Division of the IDB (PD, pg. 18).

The TE notes that the implementing agency, IDB, provided sufficient support during project preparation and implementation, including training the project's executing agencies (Mining and Energy Planning Unit and ISAGEN) and other executing partners (Conservation International) on the bank's policies, regulations, processes and procedures to ensure smooth and timely project implementation (TE, pg. 52). The IDB also met regularly with the executing agencies, including visits to headquarters and to the project in the field, and provided timely approval of amendments to the acquisition plan to accommodate activities that were added during implementation.

7.2 Quality of Project Execution	Rating: Satisfactory
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The TE does not rate the quality of project execution, and this TER provides a rating of **satisfactory**.

For Component 1, the Mining and Energy Planning Unit was to enter into an agreement with a "qualified organization to perform the administrative and financial management of this Component, in accordance with IDB's relevant policies" to ensure that the project would be implemented in a timely manner (PD, pg. 18), and chose Conservation International to oversee this responsibility. For Components 2 and 3, the project would be developed by ISAGEN, a public majority-owned utility company in Colombia, including the design, construction and operation of the geothermal plant. However, the majority of activities in Component 3 (including the construction and operation of the plant) were dropped.

Overall, the project successfully implemented a decentralized approach to project execution, developing work "within the internal team with the assistance of expert individual consultants to be hired with such purpose, in addition to some specialized firms for specifics such as cost-benefit analyses" (TE, pg. 17). Project execution was also supported by a number of institutional entities such as the Colombian Geological Service, the Administrative Department of Science, Technology and Innovation, and the National University of Colombia, which worked with ISAGEN in the identification and classification of the geothermal resource in the Ruiz Volcanic Massif (TE, pg. 42). Through the involvement of these institutions, ISAGEN has acquired technical knowledge regarding geothermal exploration and formed a team specialized in geothermal energy to be at the forefront of the Ruiz Volcanic Massif Project and the prospecting of new areas (TE, pg. 42). Although ISAGEN experienced some difficulties at the project start regarding its technical knowledge and expertise, its technical capacity was successfully built to the point that it was considered adequate for project execution.

The executing agencies successfully adopted the IDB's policies for the procurement of the goods and services, and had the support of national and international consultants with "ample experience in the

environmental, social, technical, regulatory and/or financial sphere,” particularly for the various subsurface assessment studies under Component 2 (TE, pg. 12). For Component 1, the Mining and Energy Planning Unit effectively oversaw technical supervision, and CI effectively managed the administrative and financial aspects of all the studies contracted through this component. As noted in section 4.3, the project successfully overcame a number of implementation barriers and recovered the time lost from a delay at the beginning of Component 1 due to changes in administration at the Mining and Energy Planning Unit (TE, pg. 42).

8. Assessment of Project Impacts

Note - In instances where information on any impact related topic is not provided in the terminal evaluations, the reviewer should indicate in the relevant sections below that this is indeed the case and identify the information gaps. When providing information on topics related to impact, please cite the page number of the terminal evaluation from where the information is sourced.

8.1 Environmental Change. Describe the changes in environmental stress and environmental status that occurred by the end of the project. Include both quantitative and qualitative changes documented, sources of information for these changes, and how project activities contributed to or hindered these changes. Also include how contextual factors have contributed to or hindered these changes.

The project had no environmental impacts, since the geothermal plant was not constructed.

8.2 Socioeconomic change. Describe any changes in human well-being (income, education, health, community relationships, etc.) that occurred by the end of the project. Include both quantitative and qualitative changes documented, sources of information for these changes, and how project activities contributed to or hindered these changes. Also include how contextual factors have contributed to or hindered these changes.

The TE does not note any socioeconomic impacts of the project.

8.3 Capacity and governance changes. Describe notable changes in capacities and governance that can lead to large-scale action (both mass and legislative) bringing about positive environmental change. “Capacities” include awareness, knowledge, skills, infrastructure, and environmental monitoring systems, among others. “Governance” refers to decision-making processes, structures and systems, including access to and use of information, and thus would include laws, administrative bodies, trust-building and conflict resolution processes, information-sharing systems, etc. Indicate how project activities contributed to/ hindered these changes, as well as how contextual factors have influenced these changes.

a) Capacities

The project overall “allowed ISAGEN and the country to progress in the acquisition and incorporation of geothermal energy into the energy matrix” (TE, pg. 27). Furthermore, as a result of project activities, the “uncertainties regarding geothermal exploration have been reduced” and now the “conditions and technical knowledge are available to advance in the exploratory drilling stage and to confirm the

existence of the resource at depth, meaning that the construction of the first geothermal power plant in the country is viable” (TE, pg. 27).

The project was particularly successful at raising awareness about the characteristics of geothermal energy, and its impacts, related risks and potentials, building the capacity of the government, regulatory and academic entities, and the community to develop geothermal energy production in Colombia (TE, pg. 27). Furthermore, through the involvement of the Colombian Geological Service, the Administrative Department of Science, Technology and Innovation, and the National University of Colombia, ISAGEN successfully acquired technical knowledge regarding geothermal exploration, and now has a team specialized in geothermal energy at the forefront of the Ruiz Volcanic Massif Project and overseeing the prospecting of new areas (TE, pg. 42).

b) Governance

The project’s main governance impact was the issuance of Law 1715 of 2014, through the Mining and Energy Planning Unit and the Ministry of Mines and Energy, which “aims to establish the legal framework and instruments for promotion of the use of non-conventional sources of renewable energy” and “fosters investment, research and development of clean technology for energy production, energy efficiency and response to demand, as part of the domestic energy policy” (TE, pg. 44). The law incorporated elements based on the barriers identified through this project, such as high investment costs, inability for auto-producers to inject or sell to the grid their surplus electricity, and lack of policy guidelines for renewable energy (TE, pg. 66).

8.4 Unintended impacts. Describe any impacts not targeted by the project, whether positive or negative, affecting either ecological or social aspects. Indicate the factors that contributed to these unintended impacts occurring.

There were no unintended impacts.

8.5 Adoption of GEF initiatives at scale. Identify any initiatives (e.g. technologies, approaches, financing instruments, implementing bodies, legal frameworks, information systems) that have been mainstreamed, replicated and/or scaled up by government and other stakeholders by project end. Include the extent to which this broader adoption has taken place, e.g. if plans and resources have been established but no actual adoption has taken place, or if market change and large-scale environmental benefits have begun to occur. Indicate how project activities and other contextual factors contributed to these taking place. If broader adoption has not taken place as expected, indicate which factors (both project-related and contextual) have hindered this from happening.

There is no evidence of broader adoption at the time of the TE, however the TE notes that “ISAGEN is applying the knowledge and experience acquired during the execution of the Ruiz Volcanic Massif Project” to the implementation of the Tufiño-Chiles-Cerro Negro Binational Geothermal Power Plant along the Colombian and Ecuadorian border, which has been deemed an important, strategic project by both countries (TE, pg. 47).

9. Lessons and recommendations

9.1 Briefly describe the key lessons, good practices, or approaches mentioned in the terminal evaluation report that could have application for other GEF projects.

- The fact of having a technical staff team fully dedicated to the project, with direct day to day contact with Executing Agencies was key in developing the activities and achieving the results.
- The procurement times must be considered to schedule the activities and consultancies project's development more accurately. The procurement and authorization processes could be improved by making them clearer.
- As for the preparation of the term of reference for different contracts that are part of the procurement plan, the importance of clear and concise requirements that do not lead to double interpretations or subjective interpretations by the contractor and the contractor are also noted to be of paramount importance.
- The progress of the activities required for the development of FNCER projects in the country is often dependent on the time taken by the regulatory, administrative and/or environmental authorities to respond to the procedures required for the projects' continuity. The time taken is often very long and alters the planned schedules for the implementation of project activities.
- The areas with geothermal potential in the country are in places that are difficult to access, with extreme weather conditions and with complicated topography, which on some occasions may limit the completion of field activities in the previously stipulated times.
- The authorities, indigenous communities and the community in general are unaware of this geothermal technology's characteristics, and there is a general fear about its relation to earthquakes and volcanic eruptions. Intense work is required on education about the characteristics of geothermal energy.
- Successful progress in the exploration phase requires financing mechanisms, financial support, or partial or full hedging of the exploratory drilling phase, because of the risk of this project phase. For this kind of FNCER and clean technology, it is important to promote the development of alternative methods of financial assessment that include unvalued externalities or related intangibles.

9.2 Briefly describe the recommendations given in the terminal evaluation.

- Continue strengthening technical capacity in environmental, regulatory and financial institutions, i.e. all the participants in the energy market, through the development of technical assistance and training programs on the characteristics of FNCER, related environmental impacts and mitigation plans, risk assessment, and opportunities of this kind of energy, among others.
- Greater commitment from the Colombian Government is required for the promotion of FNCER, such as geothermal energy, by defining a master plan for the development of geothermal energy in Colombia; creating a risk mitigation fund and/or subsidies for the exploration phase (studies and drilling); and defining a plan to include geothermal energy (obligations or quotas) in the country's energy portfolio.
- Drive new financing mechanisms through multilateral banking, private banking, and mitigation funds that motivate private investors to develop FNCER projects in the country. Develop guarantee instruments for developing FNCER projects, mainly for geothermal projects that help to reduce the return required from this kind of project.

- In the case of the geothermal projects, there is limited scientific and technical staff for the development of this technology, and uncertainty about the resource's characteristics that increase the investment risk during the exploration stages. These aspects must be included in the planning of the financial, technical and technological resources required for the development of geothermal projects in the country.
- Given that the areas with geothermal potential in the country are mainly located in areas at high risk from volcanic activity and mudslides, the location of thermal gradient holes, exploration, production and reinjection wells, the geothermal plant, connection lines and flow lines must be carefully evaluated.
- Considering that the area required for geothermal development is small, it is recommended to allocate the free areas for the protection and recovery of the paramo, cloud forest, high Andean forest and/or related wildlife. Given that geothermal plants generate economic resources by legal transfer and other means, it is proposed to use these resources for purchasing land that is not in the geothermal field's area of intervention to use for conservation of the páramo.
- It is suggested to explore the potential of other uses for geothermal energy in the country in sectors including agriculture, aquaculture, heating, recreation and tourism, which could be jointly developed with power generation.

10. Quality of the Terminal Evaluation Report

A six point rating scale is used for each sub-criteria and overall rating of the terminal evaluation report (Highly Satisfactory to Highly Unsatisfactory)

Criteria	GEF IEO comments	Rating
To what extent does the report contain an assessment of relevant outcomes and impacts of the project and the achievement of the objectives?	The TE provides a comprehensive assessment of the project's outputs and outcomes. However, the project's progress was not presented in a consistent manner, as the assessment of Component 2's outputs was presented much more clearly (Annex 2) than for Component 1 (Annex 1).	MS
To what extent is the report internally consistent, the evidence presented complete and convincing, and ratings well substantiated?	The TE provides sufficient evidence to substantiate its ratings.	S
To what extent does the report properly assess project sustainability and/or project exit strategy?	The TE contains a detailed assessment of the sociopolitical, environmental, institutional, and financial sustainability of the project.	S
To what extent are the lessons learned supported by the evidence presented and are they comprehensive?	The TE gives a comprehensive list of lessons learned and recommendation that are well-supported by the evidence, however a number of them could be consolidated (e.g. those regarding administrative efficiency).	S
Does the report include the actual project costs (total and per activity) and actual co-financing used?	The materialized co-financing was not presented in a clear and consistent manner across project components, however it did include costs broken down by activity.	MU
Assess the quality of the report's evaluation of project M&E systems:	The TE provided a well-substantiated assessment of the project's M&E systems.	S
Overall TE Rating		S

11. Note any additional sources of information used in the preparation of the terminal evaluation report (excluding PIRs, TEs, and PADs).

No additional sources of information were used.