

DOCUMENT OF THE INTER-AMERICAN DEVELOPMENT BANK

COLOMBIA

FINANCING AND RISK TRANSFER PROGRAM FOR GEOTHERMAL POWER

(CO-G1007)

INVESTMENT GRANT

PROJECT PROFILE

The project team consisting of prepared this document: Joan Prats, IFD/CMF, Team leader; Jose Ramón Gómez, ENE/CCO, Alternate team leader; Claudio Alatorre, INE/CCS; Enrique Rodríguez Flores, ENE/CPE; Jose Juan Gomes, Ramón Guzmán, Isabel Haro, Isabelle Braly-Cartillier, Pablo Carrión, Gloria Lugo and Cecilia Bernedo, IFD/CMF; Alvaro Concha, CMF/CCO; Escarlata Baza, LEG/SGO; Colin McKee, VPS/ESG; Mónica Rojas, CAN/CCO; Miguel Angel Orellana, Claudia Cárdenas García and Gabriele del Monte, FMP/CCO.

Under the Access to Information Policy, this document is subject to Public Disclosure.

PROJECT PROFILE

COLOMBIA

INVESTMENT GRANT

I. BASIC DATA

Project Name:	Financing and Risk Transfer Program for Geothermal Power
Project Number:	CO-G1007
Project Team:	Joan Prats, IFD/CMF, Team leader; Jose Ramón Gómez, ENE/CCO, Alternate team leader; Claudio Alatorre, INE/CCS; Enrique Rodríguez Flores, ENE/CPE; Jose Juan Gomes, Ramón Guzmán, Isabel Haro, Isabelle Braly-Cartillier, Pablo Carrión, Gloria Lugo and Cecilia Bernedo, IFD/CMF; Alvaro Concha, CMF/CCO; Escarlata Baza, LEG/SGO; Colin McKee, VPS/ESG; Mónica Rojas, CAN/CCO; Miguel Angel Orellana, Claudia Cárdenas García and Gabriele del Monte, FMP/CCO.
Executing Agency:	<i>Banco de Comercio Exterior de Colombia S.A.</i> (Bancóldex)
Financial Plan:	IDB (Clean Technology Fund (CTF Grant)): US\$9.53 million
Safeguards:	Policies triggered: B.13 Classification: Not required

II. GENERAL JUSTIFICATION AND OBJECTIVES

A. Background and justification

- 2.1 **Colombia's energy matrix and geothermal resource.** Around 80% of Colombia's electricity production is based on hydroelectric power, being the remaining 20% natural gas and coal. Dependence on water resource may pose a significant vulnerability, particularly under changing weather conditions, due to uncertainties in the costs associated to managing backup supplies of energy. This translates into a need for transforming the country's power generation system into a more sustainable and efficient mix.¹
- 2.2 Colombia is located in one of the regions with highest geothermal potential in the world.² Part of its territory is situated within the so-called Ring of Fire, in the basin of the Pacific Ocean, where subsurface temperatures are abnormally high and important volcanic activity occurs. There is evidence of geothermal resource with potential for electricity production in various areas near volcanoes of the region.³ However, despite several efforts, the country has yet to attain an effective way to tackle this potential.

B. Financial risk as a barrier to investment in geothermal power

- 2.3 Geothermal power can have significant long term benefits. The absence of fuel and other variable costs over the long life of geothermal projects⁴ give

¹ Electricity demand is estimated to increase 1.8% annually over the next ten years (Dewhurst Group, 2014). As of December 2014, installed capacity was 13,886 MW and projections for 2020 are to increase capacity to 14,971 MW (*Unidad de Planeación Minero Energética* (UPME)). In depth analysis of the technical and economic benefit of geothermal energy production in Colombia will be provided in the Proposal for Operation Development (POD).

² Total potential is estimated in a range of 1,340 to 2,210 MW (ENE, 2014).

³ Sector Nevado del Ruiz (Nevado del Ruiz, Cerro Bravo, Santa Rosa de Cabal), Sector Nariño (Tufiño Chiles-Cerro Negro, Cumbal, Azufral, Galeras), Sector Paipa Iza, and Sector Nevado del Tolima (Dewhurst Group, 2014).

⁴ Sustainably managed reservoirs can maintain energy production for decades, even over 50 years.

geothermal power one of the lowest levelized cost⁵ when compared to other technologies, making it a competitive renewable energy source. It is also a reliable source of power: geothermal facilities can produce electricity 24 hours a day, 7 days a week. The US Energy Information Administration lists geothermal power as having a capacity factor of 92%, higher than coal (85%), natural gas (87%), and biomass (83%).

- 2.4 However, for an investor or developer –public or private–, geothermal projects also entail substantial risks. These risks are higher in the initial stages of the project, those related to finding and developing the geothermal resource. Any greenfield geothermal power project requires: (i) relatively long lead time to discover, confirm, and develop the resource: like oil and gas, geothermal resource requires exploration, but once it is discovered, it cannot generate a return on investment until a suitable power plant is constructed (roughly 5 to 7 years before any revenue can be realized); and (ii) high upfront capital for the drilling and exploration phases,⁶ where most of the risk is undertaken: significant financial commitment needs to be made before the characteristics of the resource can be fully known. Reliable and vast information about subsurface conditions can improve significantly the odds of success in initial exploratory wells, but resource uncertainty and risk will remain high until deep wells actually penetrate the geothermal reservoir.
- 2.5 The risks described have an adverse impact on the willingness to finance these projects. In a great part, the financial constraint explains why this technology remains largely underdeveloped. Debt financing is typically unavailable during the early stages of the project (in general, industry experts estimate that around 50% of investment has to be made prior to accessing typical debt funding), increasing the need to rely on more costly options such as equity capital (GEA, 2014). A private sector developer would either self-finance or enter into a partnership to share the drilling risk among multiple parties. But even well-capitalized, geothermal-focused developers may struggle to internally justify greenfield projects, and only those capable of diversifying risk and absorbing the losses can carry out these projects from such an early stage. On the other hand, equity partnerships or joint ventures require alternative structures if debt finance is to be used (i.e. project finance), which makes projects riskier from a financier's perspective.
- 2.6 With currently no geothermal capacity installed in Colombia, there is still very limited experience in the country⁷, and the volcanic regions where the resource is located usually lack infrastructure for accessing them, making it more difficult for developers to structure the projects. In addition, due to the incipient nature of the industry, local norms and regulation related to the use of the resource have yet to evolve to facilitate the development of this technology. These factors add uncertainty and inhibit financiers even further.

⁵ The levelized cost of energy represents the per-kilowatt hour cost (in real dollars) of building and operating a power plant over an assumed financial life and duty cycle.

⁶ Geothermal well field exploration is estimated to account for 35% to 40% of the total capital costs of an average geothermal power project. A single well may cost between US\$1 million and US\$7 million (IFC, 2013) depending on the geographic location and local geology.

⁷ Colombia has a broad technical experience in exploration and development in the oil sector that is very useful in the context of geothermal energy exploration and mitigates the technical problems associated to these project stages.

C. Intervention proposed and program objectives

- 2.7 The IDB has already a good record of support to Colombia in the geothermal sector. Resources have been provided for institutional strengthening and development of technical capacity at the local level.⁸ Under the scheme proposed, the program will continue these efforts by providing incentives to financial intermediaries in order to increase debt and equity financing for geothermal developers.
- 2.8 The [Clean Technology Fund](#) (CTF) provides scaled-up financing for public and private sector projects that contribute to the demonstration, deployment, and transfer of low-carbon technologies with significant potential for Green House Gas (GHG) emission reductions. Investments for the promotion of renewable energy, sustainable transport and energy efficiency are eligible under the CTF. Resources from the CTF are transferred to the IDB, acting as implementing agency, under a Financial Procedures Agreement and are administered by the IDB in a trust fund created at the IDB (IDB-CTF Trust Fund). In October 2013, the Trust Fund Committee approved funding for [Dedicated Private Sector Programs](#) (DPSP) to be deployed. Under the DPSP, a utility-scale renewable energy program proposes to focus initially on geothermal energy and more specifically on addressing the geothermal resource risk through well drillings. Consistent with CTF practice, DPSP is intended to make use of a range of financing instruments taking risks that commercial lenders are not able to bear. An initial US\$115 million were assigned to existing CTF countries, namely Chile, Colombia, Turkey, and Mexico.
- 2.9 **Objective.** The objective of the program is to scale up investment in geothermal power generation projects by making available a financial mechanism tailored to meet the specific needs of a project's earliest development stages, specifically at the exploration phase. This is expected to trigger power production from geothermal sources and, thus, contribute to the reduction of GHG emissions in Colombia. This will be delivered through two components:
- 2.10 **Component I. Risk mitigation for geothermal projects in the early stages of exploration and test drilling.** Under this component, resources will be used for the financing by Bancóldex of a contingent recovery grant⁹ that will be used to guarantee the credits provided by financial intermediaries to the eligible beneficiaries of the program for the drilling at the initial stage where the aforementioned risks inhibit financing and investment. Resources provided under each contingent recovery grant will be used to guarantee the credit component of the funding incurred by the developer provided that there has been an unsuccessful drilling at the initial stage. By providing resource risk coverage to loans granted by financial intermediaries to projects in early drilling stages,¹⁰ this component aims to contribute to overcoming geothermal reservoir risks and enabling projects to advance towards subsequent phases

⁸ This includes equipment for exploration activities, communication and dissemination activities, trainings, workshops, participation in seminars and international conferences, etc. See *Emprendimiento de la energía geotérmica en Colombia*, Marzolf, Natacha C., IDB.

⁹ The term contingent recovery grant obeys to the fact that the CTF will recover the funds of the grant facility if at the end of the executing period (10 years), there are funds remaining.

¹⁰ Early stage refers to first exploration wells drilled, after significant knowledge of the geothermal resource has been attained. Developer must present due diligence of surface studies and have them certified by an independent consultant in order to be eligible.

of development.¹¹ The intended beneficiaries of the facilitated credits will be developers of geothermal power generation projects¹². Where needed, grants may be used to partially cover insurance and insured credits premiums and rates.¹³ The rules to access the grant funds will be developed in the Proposal for Operation Development (POD) and, in particular in the credit regulations of the program. These rules will specify the technical, regulatory and financial access criteria of the resources so as to optimize the use of the funds and guarantee compliance with the Bank policies, especially the Environment and Safeguards Compliance Policy.

- 2.11 **Component II. Implementation and technical assistance activities.** CTF resources will finance independent third party expertise to provide advice on the technical validation of eligibility of projects and to carry out the required studies, as well as verifying success and failures on drillings. If needed resources could also be used to provide technical cooperation to the authorities in order to support their efforts in updating the required regulation. These resources will help guarantee a sound and efficient program, while also ensuring local capacity building of their financial system so that a permanent mechanism remains in place after its conclusion. Project structuring and evaluation (support to banks), technical studies and other related costs are also considered in this envelope.
- 2.12 The program is designed to optimize the use of funding available in terms of leverage and sustainability. It seeks to capitalize on the IDB's experience in Mexico (see [ME-L1148](#), [ME-G1005](#)), as well as in the work initiated in 2011 in Colombia in terms of renewable energies regulation and geothermal resource identification and exploration and development strategies ([CO-X1009](#)).
- 2.13 The program is aligned with the report on the Ninth Capital Increase (GCI-9) (AB-2764) lending program priority target of "lending to support climate change initiatives, renewable energy and environmental sustainability". It will contribute to the regional goal of: (i) institutions for competitiveness and social welfare by increasing the percent of firms using Banks to finance investments; and (ii) protecting the environment, responding to climate change and promoting renewable energy by reducing CO₂ emissions per US\$1 GDP. The program is also consistent with the Country Strategy with Colombia 2012-2014 (GN-2648-1) on its priority sector of Access to financial services, specifically with its objective of Increasing the availability and variety of financial services.

III. TECHNICAL ISSUES AND SECTOR KNOWLEDGE

- 3.1 The Executing Agency for the program will be *Banco de Comercio Exterior de Colombia S.A. (Bancóldex)*. Bancóldex is a well reputed national credit institution with ample experience in finance structuring and fiduciary

¹¹ Even when a first well is not successful, the information gathered from this process provides a basis for understanding the reason for failure, thus improving the probability of success on subsequent wells.

¹² At this stage it is early to determine the actual beneficiaries of the contingent recovery grant, but it is expected that the resources would be sufficient to, at least, lead to the discovery of the resource and, hence, promote the first geothermal plant in the country and develop the financial and technical capabilities to further encourage geothermal exploration and development.

¹³ Since there is little information available for actuarial calculations at the initial exploration drilling stage, recently developed risk insurance schemes for geothermal wells are being implemented only for later drilling stages, after the resource has been discovered and confirmed. In order to bring the insurance market to earlier stages of geothermal exploration, the program will study the possibility to cover part of the insurance premium.

management. This will permit: (i) to enhance the management synergies between the lending guarantee facility and the credit provided either by Bancóldex or the financial intermediaries; (ii) the use of financial techniques in structuring the pricing of the lending facility, as well as the insurance instrument; and (iii) to improve financial risk analysis of geothermal projects in Bancóldex and the financial intermediaries involved. The project will be structured based on a strong coordination with the energy authorities, especially the *Unidad de Planeación Minero Energética* (UPME) and the Ministry of Energy.

- 3.2 The program will apply the standard procedures established by the IDB for monitoring and evaluation of investment operations, but will also be consistent with reporting obligations to the CTF. CTF contingent recovery grant resources shall be administered through a special account. This account will receive any income from the investment of its funds as well as the reimbursements from sub projects and the fees charged for their use. Any remaining grant funds after 10 years shall be returned by Bancóldex to the CTF.

IV. SAFEGUARDS AND FIDUCIARY SCREENING

- 4.1 Geothermal projects deliver long term GHG emission reductions and are considered environmentally friendly projects as they entail cleaner energy production. However, some geothermal projects (including initial drilling) can be considered high-risk and can have adverse environmental or social impacts that can be significant and which need to be assessed and managed on a project by project basis. The IDB will define an Environmental and Social Management System (ESMS)¹⁴ that will enable the identification of potential impacts and risks and ensure that the beneficiaries of the program will implement environmental and social assessment, prevention, mitigation and management measures consistent with IDB safeguard policies. Bancóldex shows a strong institutional capacity in the management of environmental and social risks, with a full-fledged Environmental and Social Management System designed and implemented with the technical assistance of the IDB. Bancóldex is among the most advanced financial institutions in the Region in the management of Environmental and Social (E&S) risks for Tier 2 banking activities. However, during the project design and execution ESG will evaluate and confirm the institutional capacity of Bancóldex to manage the environmental and social risks of the projects and guarantee their compliance with IDB policies.

V. RESOURCES AND TIMETABLE

- 5.1 The Proposal for Operation Development is expected to be distributed for Quality and Risk Review (QRR) on August 3, 2015, approval of the Draft Grant Proposal by OPC is expected by October 16, 2015 and approval of the Grant Proposal by the Executive Board of Directors is expected by November 25, 2015, after endorsement by the CTF Trust Fund Committee. The administrative budget is estimated at US\$71,000, and the FTEs at 1.09, according to Annex V.

¹⁴ Following examples of previous experiences of similar projects (specifically, the [ME-L1148](#) currently in execution by *Nacional Financiera* (NAFIN), Mexican development bank).

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¹ The information contained in this Annex is confidential and will not be disclosed. This is in accordance with the "Deliberative Information" exception referred to in paragraph 4.1 (g) of the Access to Information Policy (GN-1831-28) at the Inter-American Development Bank.

SAFEGUARD POLICY FILTER REPORT

PROJECT DETAILS	
IDB Sector	FINANCIAL MARKETS-FINANCING FOR ENVIRONMENTAL SUSTAINABILITY
Type of Operation	Other Lending or Financing Instrument
Additional Operation Details	
Investment Checklist	Generic Checklist
Team Leader	Prats Cabrera, Joan Oriol (JOANP@iadb.org)
Project Title	Financing and Risk Transfer Program for Geothermal Power
Project Number	CO-G1007
Safeguard Screening Assessor(s)	Prats Cabrera, Joan Oriol (JOANP@iadb.org)
Assessment Date	2015-06-08

SAFEGUARD POLICY FILTER RESULTS		
Type of Operation	Investment Grants	
Safeguard Policy Items Identified (Yes)	The Bank will make available to the public the relevant Project documents.	(B.01) Access to Information Policy– OP-102
	The operation is in compliance with environmental, specific women’s rights, gender, and indigenous laws and regulations of the country where the operation is being implemented (including national obligations established under ratified Multilateral Environmental Agreements).	(B.02)
	The operation (including associated facilities) is screened and classified according to their potential environmental impacts.	(B.03)
	The Bank will monitor the executing agency/borrower’s compliance with all safeguard requirements stipulated in the loan agreement and project operating or credit regulations.	(B.07)
	Operation for which ex-ante impact classification may not be feasible. These loans are: Policy-based loans, Financial Intermediaries (FIs) or loans that are based on performance criteria, sector-based approaches, or conditional credit lines for investment projects.	(B.13)
	Suitable safeguard provisions for procurement of goods and services in Bank financed projects may be incorporated into project-specific loan agreements, operating regulations and bidding documents, as appropriate, to ensure environmentally responsible procurement.	(B.17)

Potential Safeguard Policy Items(?)	No potential issues identified	
Recommended Action:	Operation has triggered 1 or more Policy Directives; please refer to appropriate Directive(s), including B13, for guidance. No project classification required. Submit Report and PP (or equivalent) to ESR.	
Additional Comments:		

ASSESSOR DETAILS	
Name of person who completed screening:	Prats Cabrera, Joan Oriol (JOANP@iadb.org)
Title:	
Date:	2015-06-08

COMMENTS
No Comments

ENVIRONMENTAL & SOCIAL STRATEGY (ESS)

Project Name:	Financing and Risk Transfer Program for Geothermal Power
Project Number:	CO-G1007
Project Team:	Joan Prats, IFD/CMF, Team leader; Jose Ramón Gómez, ENE/CCO, Alternate team leader; Claudio Alatorre, INE/CCS; Enrique Rodríguez Flores, ENE/CPE; Jose Juan Gomes, Ramón Guzmán, Isabel Haro, Isabelle Braly-Cartillier, Pablo Carrión, Gloria Lugo and Cecilia Bernedo, IFD/CMF; Alvaro Concha, CMF/CCO; Escarlata Baza, LEG/SGO; Colin McKee, VPS/ESG; Mónica Rojas, CAN/CCO; Miguel Angel Orellana, Claudia Cárdenas García and Gabriele del Monte, FMP/CCO.
Borrower and Executing Agency:	<i>Banco de Comercio Exterior de Colombia S.A.</i> (Bancóldex)
Financial Plan:	IDB (CTF Grant): US\$9.53 million
Safeguards:	Policies triggered: B.13 Classification: Not required

I. INTRODUCTION

- 1.1 The objective of the program is to scale up investment in geothermal power generation projects by making available a financial mechanism tailored to meet the specific needs of a project's earliest development stages. This is expected to trigger power production from geothermal sources and, thus, contribute to the diversification of the energy matrix and the reduction of GHG emissions in Colombia. This will be delivered through two components:
- 1.2 **Component I. Risk mitigation for geothermal projects in the early stages of exploration and test drilling.** Contingent recovery grant funds¹ from the CTF, managed by Bancóldex, will be used to guarantee the credit provided by financial intermediaries (including Bancóldex) for the drilling at the initial stage where the aforementioned risks inhibit financing and investment. So, in case of unsuccessful drilling at the initial stage, the credit component of the funding incurred by the developer for drilling will be guaranteed by the contingent recovery grant fund. By providing resource risk coverage to loans granted by financial intermediaries to projects in early drilling stages,² this component aims to contribute to overcoming geothermal reservoir risks and enabling projects to advance towards subsequent phases of development.³ The intended beneficiaries of the facilitated loans will be developers of geothermal power

¹ The term contingent recovery grant obeys to the fact that the CTF will recover the funds of the grant facility if at the end of the executing period (10 years), there are funds remaining.

² Early stage refers to first exploration wells drilled, after significant knowledge of the geothermal resource has been attained. Developer must present due diligence of surface studies and have them certified by an independent consultant in order to be eligible.

³ Even when a first well is not successful, the information gathered from this process provides a basis for understanding the reason for failure, thus improving the probability of success on subsequent wells.

generation projects⁴. Where needed, grants may be used to partially cover insurance and insured loans premiums and rates.⁵ The rules to access the grant funds will be developed in the Proposal for Operation Development (POD). These rules will specify the technical, regulatory and financial access criteria of the facility so as to optimize the use of the funds and guarantee compliance with the Bank policies, especially the social and environmental standards of the Bank.

- 1.3 **Component II. Implementation and technical assistance activities.** CTF resources will finance independent third party expertise to provide advice on the technical validation of eligibility of projects and to carry out the required studies, as well as verifying success and failures on drillings. If needed resources could also be used to provide technical cooperation to the authorities in order to support their efforts in updating the required regulation. These resources will help guarantee a sound and efficient program, while also ensuring local capacity building of their financial system so that a permanent mechanism remains in place after its conclusion. Project structuring and evaluation (support to banks), technical studies and other related costs are also considered in this envelope.
- 1.4 The program is designed to optimize the use of funding available in terms of leverage and sustainability. It seeks to capitalize on the IDB's experience in Mexico (see [ME-L1148](#), [ME-G1005](#)), as well as in the work initiated in 2011 in Colombia in terms of renewable energies regulation and geothermal resource identification and exploration and development strategies ([CO-X1009](#)).

II. COMPLIANCE

- 2.1 According to Directive B.13 of the Environment and Safeguards Compliance Policy (document GN-2208-20 and OP-703), this program does not require classification.

III. ENVIRONMENTAL AND SOCIAL IMPACTS

- 3.1 Geothermal projects deliver long-term GHG emission reductions and are considered environmentally friendly projects as they entail cleaner energy production. However, some geothermal projects and some phases in the project cycle (including initial drilling) can be considered high-risk and can have adverse environmental or social impacts that can be significant and which need to be assessed and managed on a project by project basis.

⁴ At this stage it is early to determine the actual beneficiaries of the recovery grant facility, but it is expected that the resources would be sufficient to, at least, lead to the discovery of the resource and, hence, promote the first geothermal plant in the country and develop the financial and technical capabilities to further encourage geothermal exploration and development.

⁵ Since there is little information available for actuarial calculations at the initial exploration drilling stage, recently developed risk insurance schemes for geothermal wells are being implemented only for later drilling stages, after the resource has been discovered and confirmed. In order to bring the insurance market to earlier stages of geothermal exploration, the program will study the possibility to cover part of the insurance premium.

- 3.2 Environmental issues that may occur during geothermal power generation projects – specifically in the drilling phases, include the following⁶:
- Effluents
 - Air emissions
 - Solid waste
 - Well blowouts and pipeline failures
 - Water consumption and extraction
- 3.3 Main potential social issues are significant socio-cultural impacts related to land acquisition, land use, indigenous peoples, and cultural heritage.

IV. ENVIRONMENTAL AND SOCIAL RISKS MANAGEMENT AND STRATEGY FOR THE E&S DUE DILIGENCE

- 4.1 Bancóldex will execute the program as part of its current organizational structure. The operational rules governing the program and the eligibility criteria of individual projects will be established in the Operating Regulations document agreed between the IDB and Bancóldex, in accordance with the internal rules and policies of both counterparts, and laws and regulations in Colombia.
- 4.2 Bancóldex shows a strong institutional capacity in the management of environmental and social risks, with a full-fledged Environmental and Social Management System designed and implemented with the technical assistance of the IDB (CO-T1198). Bancóldex is among the most advanced Financial Institutions in the region in the management of E&S risks for Tier 2 banking activities.
- 4.3 The program Operation Rules will include an environmental and social risks management system which will include : (i) Colombian applicable law and regulations, standards, IDB environmental and social policies and safeguards and good practices applicable to the Program, including General guidelines on environmental, health and safety of the IFC; (ii) the classification criteria based on risk and environmental impact of the specific operation; (iii) the process, roles and responsibilities for the evaluation, approval, management and socio-environmental monitoring of projects; and (iv) the specific requirements and procedures applicable by category of risk and environmental and social impact assigned.

⁶ <http://www.ifc.org/wps/wcm/connect/329e1c80488557dabe1cfe6a6515bb18/Final%2B-%2BGeothermal%2BPower%2BGeneration.pdf?MOD=AJPERES&id=1323161975166>

INDEX OF SECTOR STUDIES

TEMA	DESCRIPCIÓN	FECHA	REFERENCIAS E HIPERVÍNCULOS
Country strategy	Country strategy with Colombia 2012-2014. Revised version.	2012	http://idbdocs.iadb.org/wsdocs/getDocument.aspx?DOCNUM=36640969
Techncial support	Cost-Benefit analysis of the Program.	2015	Under preparation.
Report	Banco Interamericano de Desarrollo (BID). Convenio ISAGEN – BID/JC. Colombia. Marzolf, Natacha C. Emprendimiento de la energía geotérmica en Colombia.	July 2014	http://publications.iadb.org/handle/11319/6558?locale-attribute=es
Report	Geothermal Energy Association (GEA) Reports. The Manageable Risks of Conventional Hydrothermal Geothermal Power Systems	February 2014	http://geo-energy.org/reports/Geothermal%20Risks_Publication_2_4_2014.pdf
Report	Geothermal Energy Association (GEA) Reports. 2014 Annual U.S. & Global Geothermal Power Production Report.	April 2014	http://geo-energy.org/events/2014%20Annual%20US%20%20Global%20Geothermal%20Power%20Production%20Report%20Final.pdf
Report	Improvement of Perception of the Geothermal Energy as a Potential Source of Electrical Energy in Colombia, Country Update. Claudia Alfaro Dg. 53 No. 34 – 53. Servicio Geológico Colombiano. Bogotá, Colombia. Proceedings World Geothermal Congress 2015. Melbourne, Australia, 19-25 April 2015	April 2015	http://www.geothermal-energy.org/publications_and_services/latin_america_gateway.html?no_cache=1&cid=1073&did=835&sechash=69d52af7

Presentation	GEOTERMIA EN COLOMBIA, Mayo 2014. Isagen.	May 2014	http://www.geothermal-energy.org/publications_and_services/latin_america_gateway.html?no_cache=1&cid=1073&did=834&sechash=3ce5d725
Study	International Finance Corporation (IFC). "Success of Geothermal Wells: A global study." Washington DC: World Bank Group.	2013	http://www.ifc.org/wps/wcm/connect/topics_ext_content/ifc_external_corporate_site/ifc+sustainability/publications/publications_gpn_geothermal-wells

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