Cover Page for CTF Project/Program Approval Request			
1. **Country/Region**	Chile	2. **CIF Project ID#**	(CIF AU will assign ID.)
3. **Project/Program Title**	Chile Geothermal Risk Mitigation Program		
4. **Terms and Amount Requested in million USD equivalent**	**Private sector** *IP:* Loan/guarantee: 27.7 Grant: 1.048 Fee (for implementation of TC / KM activities): 0.052 Fee (for implementation of investment operations): 1.2 Total IP: 30 *DPSP:* Loan/guarantee: 20 Total DPSP: 20 **Total IP and DPSP: 50**		
5. **Implementing MDB(s)**	Inter-American Development Bank		
6. **National Implementing Agency**	Not applicable		
7. **MDB Focal Point**	calatorre@iadb.org		

8. Brief Description of Project/Program (including objectives and expected outcomes)

1. For the last decades Chile has been one of the leading countries in Latin America in terms of economic development and growth, achieving the third highest rate of GDP growth per capita in the region in 2012. This high growth has been coupled with higher energy demand, with a 90% increase in the last decade. Projected energy demand growth until 2020 is 5.5%-6.5% per year, with an additional 7-8 GW of installed capacity required by then. Hydropower expansion could meet an important percentage of the expected demand, but some important projects have been put on hold because of environmental concerns. Development of coal plants can also face opposition when the plants are located in the vicinity of population centers, given the local pollution impact. Natural gas currently accounts for approximately 25% of the national installed generation capacity and its sizable contribution is expected to continue or increase in the coming years, but all natural gas is imported and is more expensive in terms of production costs than both coal and large hydro.
2. Given that Chile is a net importer of energy resources and dependent on fossil fuels, whose costs have been continuously rising in recent years, the GoC has been promoting the development of non-conventional renewable energy (NCRE) to diversify its energy sources in a sustainable way, contributing to a diversified, clean and safe energy matrix. The GoC recently approved legislation to increase the percentage of NCRE to 20% of all new contracts by 2025. Chile also encourages clean energy through total exemption of transmission charges to renewable projects up to 9MW, and partial exemption for projects between 9MW and 20MW.
3. Geothermal energy could be an alternative source of renewable, base-load energy to produce a relatively stable supply of electricity. Located in the Pacific Ring of Fire, Chile is one of the countries with the highest potential for geothermal energy development in Latin America.

Although geothermal developers have been increasingly arriving to Chile since 2008, the market remains untapped. While the Ministry of Energy has granted 79 exploration concessions and 7 exploitation concessions, none of these projects have installed generation capacity yet.

4. The high risk (resource, market/price, among other) and cost of developing geothermal power capacity in Chile pose barriers to raise risk capital and effectively advance exploration and complete project development. Besides the well-known risk/reward imbalance and barrier posed by geothermal resource risk during the exploratory stages, other cost and risk barriers are also important in Chile: a) higher capital costs: among other reasons, the lack of local availability of adequate rigs requires sourcing rental equipment from abroad, thereby doubling or tripling drilling costs; b) market/price risk: merchant project risk given the difficulty in securing PPAs in early stages of development and/or for an adequate duration; c) time to commissioning: project development lead times of geothermal (9-13 years) are longer than other renewable projects such as solar and wind, making it more difficult to obtain a PPA with unregulated clients such as mining companies; d) sites in remote locations: most of geothermal resources are far away from the grid and other essential services, making it challenging to connect to the grid and increasing the investment costs for developers; in addition, prevailing extreme weather conditions in some geothermal sites only allow for 3-4 months of work per year, increasing development time and cost.
5. These risks create a shortage of funding or inadequate funding conditions for geothermal development in Chile. CTF concessional finance has the potential to tackle some of these cost and risk barriers to enable and catalyze the development of the first few projects, providing a strong demonstration effect of the viability of this industry in Chile. The proposed MiRiG program aims to combine CTF resources under the Chile Revised Investment Plan (IP) and the Dedicated Private Sector Programs (DPSPs) envelopes to support investment needs of projects that have already completed some exploratory drilling but require -before they can access commercial debt financing- concessional risk mitigation support to advance with additional drilling and plant construction.
6. The MiRiG program intends to support up to three geothermal projects in Chile that have the potential to become the first in the country (and at this point in South America), demonstrating the viability of this technology in Chile and leveraging DFI and commercial financing. The program expects to directly enable a minimum of 100-150MW of installed capacity. CTF resources will be used in structuring financial solutions that will mitigate the effects of resource and other project development and operation risks, and incentivize project developers to make the significant additional investments still necessary to allow production drilling campaigns and plant construction to go forward. The proposed structuring solutions include senior and subordinated long term project loans, short term bridge loans (convertible to grant), and guarantees.
7. IDB is also submitting the "Geothermal Financing and Risk Transfer Facility" proposal for Mexico, and is planning to submit a geothermal proposal for Colombia. The simultaneous execution of these geothermal risk mitigation programs will offer opportunities for the exchange of experiences between the different stakeholders.

Justification of combined request for IP and DPSP resources

8. Resources are being requested from both sources for a couple of reasons, and with careful

consideration of additionality as well as minimum size to allow for demonstration. Firstly, given the high costs and risks associated to geothermal development in Chile (as detailed in point 4 above) the USD 30M available through the IP (per its revision, as approved on October 9, 2013) represents a very limited amount to confidently expect -given the high costs and financing needs of the prospective projects - sufficient demonstration. It would likely be just enough to support one project; if that project failed (a possibility that cannot be discarded given the high resource risk associated to the exploration stage of geothermal development), the whole program would not achieve its objective. A larger envelope that can support at least two projects would allow greater risk diversification and significantly enhance chances of having at least one successful project providing the intended demonstration. Secondly, the geothermal DPSP program approved by the CTF TFC was defined to exclusively support resource risk mitigation. As explained in the body of the proposal hereby presented, there are other risk and cost barriers hindering geothermal development in Chile, addressing which may be as crucial as mitigating resource risk, particularly for projects relatively more advanced in their development. The IP resources -not restricted in their use to resource risk mitigation- complementary allow such additional flexibility to customize CTF support to the individual risks and needs of each project. For these reasons -size of the envelope to enhance chances of program achieving intended demonstration and the need for flexibility in terms of risk and cost barriers that need to be addressed-, a combined envelope of USD 50M (USD 30M from IP; USD 20M from DPSP) is hereby requested.

9. Consistency with CTF Investment Criteria

See V. Fit with CTF Investment Criteria pp. 14-18

(1) Potential GHG Emissions Savings: see p. 14
(2) Cost-effectiveness: see p. 14
(3) Demonstration Potential at Scale: see p. 15
(4) Development Impact: see p. 16
(5) Implementation Potential: see p. 16
(6) Additional Costs and Risk Premium: see p. 17
(7) Financial Sustainability: see p. 17
(8) Effective Utilization of Concessional Finance: see p. 18
(9) Mitigation of Market Distortions: see p. 18
(10) Risks: see p. 18

10. Stakeholder Engagement

In addition to the engagement through the Ministry of Energy, the IDB team has been working for the last eighteen months in the identification of a pipeline of projects and discussion of possible structures to cater to the needs of developers. In the framework of the preparation of the Program, a firm was hired by IDB to support the preparation of the project and conducted interviews with developers as part of a demand assessment and modeling of potential financing solutions.

During the preparation of the Revised Investment Plan in July 2013, meetings with relevant stakeholders from civil society and private developers were held.

11. **Gender Considerations**

The IDB will include gender considerations in its social and environmental safeguards due diligence process. Gender aspects will be taken into account in the framework of consultations to be undertaken, as well as in the development of best practice manuals for the industry and for the Ministry of Energy, and in the materials generated in the knowledge management component of the Program.

12. **Co-financing Indicators and Targets (consistent with results framework)**

Core Indicators	**Targets**
New capacity installed by the project	At least 100MW
GHG tons abated by the Project	At least 8.7 $MtCO_2e$ [a]
Financial leverage	At least 1:10 [b]
Development Indicator(s):	
Annual reductions in fossil fuel imports	At least USD 16 Million [a]

[a] Assuming drilling is successful for at least 1 or 2 projects, enabling at least 100MW of installed capacity
[b] For projects with successful drilling which thus proceed to plant construction

13. **Co-financing**

	Please specify as appropriate	Amount (in million USD)
• CTF		50
• MDB		Up to 140-205[c]
• Private Sector	Sponsor (equity)	220-330
• Others	Other financing (other DFIs, commercial banks, ECAs)	140-240
Total		550-825

[c] This range represents the maximum that IDB can finance, 25% of total project costs for projects in Chile. IDB financing may however be more limited, closer to the $50M CTF investment amount, depending on the stage of development of the project/s supported and how CTF funding is structured. Given the critical role that CTF concessional funding will play on this, this cannot be determined until CTF funding is endorsed and in depth assessment of projects is completed.

14. **Expected Date of MDB Approval (first project)**

Q2 2015

Chile Geothermal Risk Mitigation Program (MiRiG)

IDB Private Sector CTF Proposal
for Submission to the CTF Trust-Fund Committee

TABLE OF CONTENTS

EXECUTIVE SUMMARY

1. For the last decades Chile has been one of the leading countries in Latin America in terms of economic development and growth, achieving the third highest rate of GDP growth per capita in the region in 2012. This high growth has been coupled with higher energy demand, with a 90% increase in the last decade. Chile is the world's largest copper exporter, and the energy-intensive nature of that industry creates substantial challenges in meeting power demand. In 2010, the copper industry consumed 32% of the total power generated in the country that year.

2. Projected energy demand growth until 2020 is 5.5%-6.5% per year, with an additional 7-8 GW of installed capacity required by then. Hydropower expansion could meet an important percentage of the expected demand, but some important projects have been put on hold because of environmental concerns. Development of coal plants can also face opposition when the plants are located in the vicinity of population centers, given the local pollution impact. Natural gas currently accounts for approximately 25% of the national installed generation capacity and its sizable contribution is expected to continue or increase in the coming years, but all natural gas is imported and is more expensive in terms of production costs than both coal and large hydro.

3. Given that Chile is a net importer of energy resources and dependent on fossil fuels, whose costs have been continuously rising in recent years, the GoC has been promoting the development of non-conventional renewable energy (NCRE) to diversify its energy sources in a sustainable way, contributing to a diversified, clean and safe energy matrix. The GoC recently approved legislation to increase the percentage of NCRE to 20% of all new contracts by 2025. Chile also encourages clean energy through total exemption of transmission charges to renewable projects up to 9MW, and partial exemption for projects between 9MW and 20MW.

4. Geothermal energy could be an alternative source of renewable, base-load energy to produce a relatively stable supply of electricity. Located in the Pacific Ring of Fire, Chile is one of the countries with the highest potential for geothermal energy development in Latin America. Although geothermal developers have been increasingly arriving to Chile since 2005, the market remains untapped. While the Ministry of Energy has granted 79 exploration concessions and 7 exploitation concessions, none of these projects have installed generation capacity yet.

5. The high risk (resource, market/price, among other) and cost of developing geothermal power capacity in Chile pose barriers to raise risk capital and effectively advance exploration and complete project development. Besides the well-known risk/reward imbalance and barrier posed by geothermal resource risk during the exploratory stages, other cost and risk barriers are also important in Chile: a) higher capital costs: among other reasons, the lack of local availability of adequate rigs requires sourcing rental equipment from abroad, thereby doubling or tripling drilling costs; b) market/price risk: merchant project risk given the difficulty in securing PPAs in early stages of development and/or for an adequate duration; c) time to commissioning: project development lead times of geothermal (5-13 years) are longer than other renewable projects such as solar and wind, making it more difficult to obtain a PPA with unregulated clients such as mining companies; d) sites in remote locations: most of geothermal resources are far away from the grid and other essential services, making it challenging to connect to the grid and increasing the investment costs for developers; in addition, prevailing extreme weather conditions in some geothermal sites only allow for 3-4 months of work per year[1], increasing development time and cost.

6. These risks create a shortage of funding or inadequate funding conditions for geothermal development in Chile. CTF concessional finance has the potential to tackle some of these cost and risk barriers to enable and catalyze the development of the first few projects, providing a strong demosntration

[1] This is for the initial exploration phase (surface studies and preliminary test drilling) in some projects in Chile. Once a project step into a deep exploratory drilling phase it has to be organized for full time work, and this implies additional costs for "winterized" drilling equipment, winter logistics and access maintenance.

effect of the viability of this industry in Chile. The proposed MiRiG program aims to combine resources from the IP and DPSP to support investment needs of projects that have already completed some exploratory drilling but require -before they can access commercial debt financing- concessional risk mitigation support to advance with additional drilling and plant construction.

7. The MiRiG program intends to support up to three geothermal projects in Chile that have the potential to become the first in the country (and at this point in South America), demonstrating the viability of this technology in Chile and leveraging DFI and commercial financing. The program expects to directly enable a minimum of 100-150MW of installed capacity. CTF resources will be used in structuring financial solutions that will mitigate the effects of resource and other project development and operation risks, and incentivize project developers to make the significant additional investments still necessary to allow production drilling campaigns and plant construction to go forward. The proposed structuring solutions may include senior and subordinated long term project loans, short term bridge loans, and guarantees.

LIST OF ABBREVIATIONS

CO_2	carbon dioxide
CO_2e	carbon dioxide equivalent
CSP	concentrated solar power
CTF	Clean Technology Fund
DFI	development finance institution
DPSP	Dedicated Private Sector Programs (CTF)
ECA	export credit agency
EDC	Energy Development Corporation (Philippines)
GDP	gross domestic product
GHG	greenhouse gases
GoC	Government of Chile
GW	gigawatt
IDB	Inter-American Development Bank
IP	Investment Plan
KfW	*Kreditanstalt für Wiederaufbau* (German development bank)
LCOE	levelized cost of energy
MiRiG	*Programa de Mitigación de Riesgos de Geotermia* (Geothermal Risk Mitigation Program)
MRP	Mighty River Power
MW	megawatt
MWh	megawatt hour
NCRE	non-conventional renewable energy
PPA	power purchase agreement
PV	photo-voltaic
RE	renewable energy
RPS	renewable portfolio standard
SIC	*Sistema Interconectado Central* (Central Interconnected System)
SING	*Sistema Integrado del Norte Grande* (Northern Interconnected System)
Tcal	teracalories
TFC	Trust-Fund Committee
USD	United States Dollars

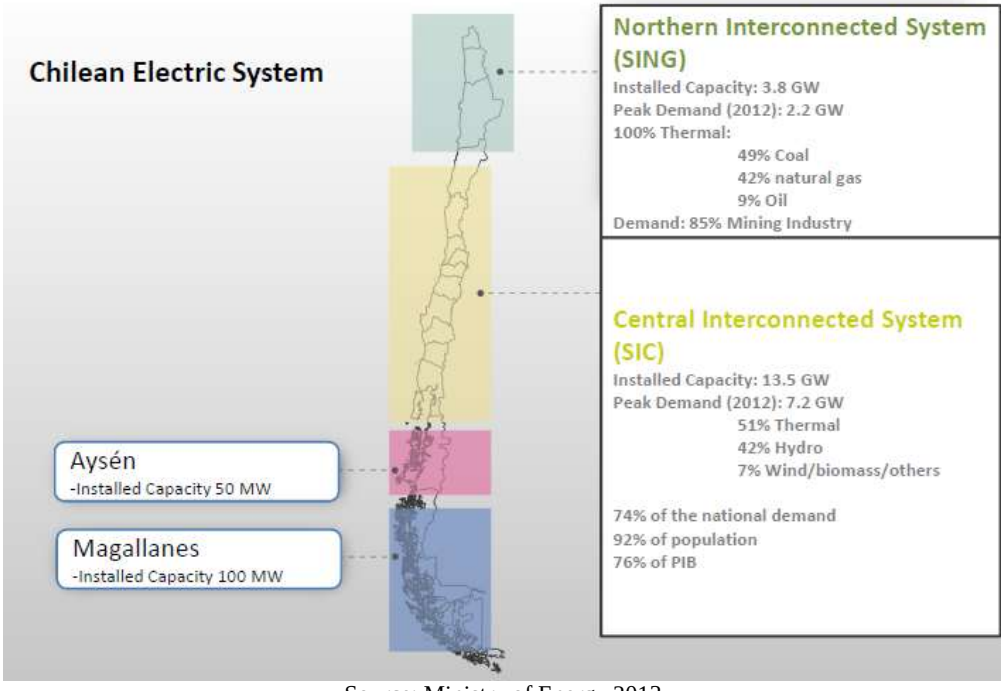
I. COUNTRY AND SECTOR CONTEXT

8. For the last few decades, Chile has been one of the leading countries in Latin America in terms of economic development and growth, and its economic fundamentals are expected to continue driving growth in the period from 2014-2018. Forecasts of Chile's GDP annual growth rate for the period (4.7 - 5% annually) are almost twice the OECD average (2-2.3%)[2]. However, Chile will be exposed to global developments, in particular to changes in commodity prices. Minerals account for more than 50% of Chile's total exports and fuel purchases account for more than 40% of its imports. The mining and energy sectors are expected to expand in terms of capacity. The agricultural sector, which is the second-largest source of Chilean exports, will continue to grow, supported by its large network of free trade agreements. The construction sector will be boosted by investment in commercial and retail projects.

9. In 2012, Chile had the third highest rate of GDP growth per capita in Latin-America.[3] Its economic growth has been coupled with higher energy demand. In fact, during the last decade, its energy consumption increased by 90% from 257,841 Tcal in 2002 to 488,944 Tcal in 2012.[4] Oil and electricity were the main energy sources. The transportation sector had the highest share in oil consumption, and the industry and mining sector had the highest share in electricity consumption.

10. Chile today has an installed power generation capacity of 17.6 GW, of which approximately 74% corresponds to the Central Interconnected System (SIC) and 25% to the Norte Grande Interconnected System (SING). The remaining 1% corresponds to the intermediate systems of Aysen and Magallanes (see Figure 1). Mining operations are geographically located in the northern part of the country, serviced mostly by the SING system.

Figure 1. Chilean Electric System



Source: Ministry of Energy 2013

[2] Economist Intelligence Unit, Country Report, October 2013

[3] World DataBank

[4] http://bit.ly/BalanceEnergia, National Energy Balance 2012

11. In 2012, Chile generated a total of 66TWh of electricity. Large hydro is the country's largest electricity source, accounting for a third of power generated. In addition, 8% was produced from other renewable energy technologies (small hydro, biomass, wind and solar). The rest of the electricity is generated from imported fossil fuels. Keeping pace with rising energy demand is a challenge for the country. Chile is the world's largest copper exporter, and the energy-intensive nature of that industry creates substantial challenges in meeting power demand. In 2010, copper industry consumed 19TWh, which represents 32% of the total power generated in the country that year. Electricity consumption in Chile is projected to grow at an annual rate of 5.5%-6.5% until 2020.[5] As a result, Chile relies heavily on imported electricity generated from fossil sources.

12. These projections indicate that, by 2020, Chile will need an additional 7-8 GW of installed capacity. Hydropower expansion could meet an important percentage of the expected demand, but one important project[6] has been put on hold because of environmental concerns. Development of coal plants can also face opposition when the plants are located in the vicinity of population centers, given the local pollution impact. Natural gas currently accounts for approximately 25% of the national installed generation capacity and its sizable contribution is expected to continue or increase in the coming years, but all natural gas is imported and is more expensive in terms of production costs than both coal and large hydro.

13. Given that Chile is a net importer of energy resources and dependent on fossil fuels, whose costs have been continuously rising in recent years, the GoC has been promoting the development of non-conventional renewable energy (NCRE) to diversify its energy sources in a sustainable way, contributing to a diversified, clean and safe energy matrix. Since the 2004 natural gas crisis, the GoC has actively fostered diversification of energy sources. The GoC recently approved legislation to increase the percentage of NCRE to 20% of all new contracts by 2025, which demonstrates the ambitious path being followed by the GoC and further supports the clear goal to increase the share of RE in the current energy matrix.[7] Chile also encourages clean energy through total exemption of transmission charges to renewable projects up to 9MW, and partial exemption for projects between 9MW and 20MW.

II. TECHNOLOGY CHOICE – WHY GEOTHERMAL?

14. The production of electricity from geothermal resources is a mature, proven generation technology for which Chile has enormous potential. Geothermal energy could be an alternative source of renewable and low-carbon energy to produce a relatively stable supply of electricity. It does not depend on weather conditions, and can provide a supply of relatively low-cost baseload power, thereby complementing other sources whose supply is intermittent. A recent publication by the Renewable Energy Platform[8] (2013) envisions geothermal energy as the key renewable energy in terms of penetration in the SIC System.

15. Chile is located in the Pacific Ring of Fire, a belt of volcanoes and earthquake epicenters, where a high potential for geothermal energy development is estimated. Chile is one of the countries with the highest potential for geothermal energy development in Latin America, with up to 16 GW that can be produced domestically, according to studies undertaken by the University of Chile and quoted in a recent

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5 http://bit.ly/PAEE20, p.9, 2013

6 The HydroAysen project proposed to build five mega-dams, for a combined capacity of 2,750 MW, and across the Baker and Pascua rivers in the Aysén Region, connecting the dams with a 2,000 mile transmission line which would intersect national parks and land held by various indigenous communities.

7 For contracts signed after July 1, 2013, this law contemplates a progressive growth of the contribution of NCRE of 1% yearly to reach 12% by 2020, 1.5% yearly from 2021 to 2024 to reach 18%, and 2% by 2025, in order to reach the 20% share of NCRE by 2025. This means that over the next decade the role of all NCRE sources will become increasingly important, as will the need to incorporate appropriate technical standards and the adequacy of a distribution matrix that facilitates the injection of distributed generation.

8 Report "Energy Scenarios in Chile" (2013) (http://bit.ly/Chile_Escenarios)

publication by the Center for Renewable Energy (CER) in 2012.[9] More conservative estimations from the National Petroleum Company (Empresa Nacional de Petroleos, ENAP, 2009) consider the potential for electricity generation to be closer to 3,300 MW in the country. The growing economy and electricity demand, jointly with potential geothermal prices below market prices, suggest an opportunity for geothermal development. Although geothermal developers have been increasingly arriving to Chile since 2005, the market remains untapped. To date, the Ministry of Energy has granted 79 exploration concessions and 7 exploitation concessions, but none of these projects have installed generation capacity yet. The private sector requires additional support to effectively develop this clean source of energy. Thus, policy solutions are necessary to unlock the market before the private sector interest wanes.

16. The goals set by the GoC in terms of NCRE promotion (20% NCRE by 2025) send a clear signal to the market and have the potential to provide financial incentives (premiums) for renewable generation (including geothermal, which can particularly benefit given its high capacity factor as a baseload technology).

17. In addition, the Chilean government set a new regulation, Decree No. 114-2012,[10] for geothermal concessions to streamline project initiation. This regulation came into effect on March 8th, 2013, and aims to reduce market risks and expedite the regulatory processes. With the publication of the new regulation of geothermal energy, the Ministry of Energy made a significant regulatory change to encourage the development of this non-conventional renewable energy technology. The new regulatory body eliminates one of the main barriers of the geothermal industry, which was the lack of legal certainty in obtaining geothermal exploitation concessions. The main change in the new regulation is that it gives to the holder of the exploration concession the exclusive right to obtain the exploitation concession. This means that exploration concessionaires may work on developing high-cost investments with the certainty that in the future they will be entitled to obtain the exploitation concession. Additionally, the new regulation eliminates a number of requirements to apply for a concession of geothermal energy exploration, expediting the application process.

18. Despite these recent changes, given the high risk (resource, market/price, among other) and cost of developing geothermal power capacity in Chile, private developers still face barriers to raise risk capital and effectively advance exploration and complete project development. Beyond the most crucial resource risk, other cost and risk barriers are also important in Chile:

- **High capital costs:** activities encompassing exploration and production drilling can represent up to 60% of the total investment to be financed, a particularly severe issue in Chile for many reasons. Firstly, the lack of local availability of adequate rigs requires sourcing rental equipment from abroad, significantly increasing drilling costs. Secondly, the remote location of the geothermal sites, with most of them far away from the grid and other essential services, make it challenging to connect to the grid and increasing the investment costs for developers. Costly transmission and access road infrastructure require tens of millions of dollars of additional investment. Moreover, harsh geographic and weather conditions in some of the fields (high altitude, low temperature) make access to them difficult and costly for much of the year, allowing only 3-4 months of work per year in some cases (this is for the initial exploration phase, i.e. surface studies and preliminary test drilling; once a project steps into a deep exploratory drilling phase it has to be organized for full time work, and this

[9] http://bit.ly/CER_GEOTHERMAL, p. 2

[10] http://bit.ly/Geothermal-Regulation

implies additional costs for "winterized" drilling equipment, winter logistics and access maintenance).[11]

- **Market/price risk:** Merchant project risk given the difficulty in securing PPAs in early stages of development and/or for an adequate duration (PPAs normally available in Chile are for no longer than 7-10 years; geothermal power production assets are normally amortized over 20+ years).
- **Time to commissioning:** Project development lead times of geothermal (5-13 years) are longer than other renewable projects such as solar and wind, making it more difficult to obtain a PPA with unregulated clients such as mining companies, or to have access to commercial financing.
- **Local capacity:** Limited supply of value chain players and technical expertise given the lack of a domestic oil and gas sector. The gas and oil sectors share similar activities with geothermal such as drilling. Additionally, the mining sector in Chile already utilizes much of the human resources by offering attractive labor conditions to those with technical expertise, such as geologists.
- **Knowledge.** Insufficient knowledge on how to assess the feasibility of projects by investors, which increases risk perception.

19. All this creates a shortage of funding or inadequate funding conditions and acts as a deterrent of private investment in the sector. As a result, CTF concessional finance has the potential to tackle some of these cost and risk barriers to enable and catalyze the development of the first few projects, providing a strong demonstration effect of the viability of this industry in Chile.

III. PROPOSED PROGRAM

A. General Description

20. The Revised Investment Plan (IP)[12] for the Clean Technology Fund (CTF),[13] endorsed by the CTF Trust-Fund Committee (TFC) on 9 October 2013 includes a Geothermal Risk Mitigation Program (MiRiG). Furthermore, on 29 October 2013 the CTF TFC endorsed the creation of the Dedicated Private Sector Programs (DPSP), a new window within the CTF, independent ot the national IPs. The DPSP includes a Program specifically focused on the mitigation of geothermal drilling risks, with an allocation of USD 115 million. This program targets the countries that already have a CTF IP, including Chile.

21. The proposed IDB/CTF MiRiG program aims to combine resources from the IP and DPSP to support investment needs of projects that have already completed some exploratory drilling but require concessional risk mitigation support to advance with additional drilling and plant construction, and before they can access commercial debt financing. In parallel, the World Bank will execute a capacity building component to strengthen domestic capacity, also funded by CTF IP resources.

22. The projects that the IDB MiRiG program intends to support have the potential of becoming the first geothermal projects in Chile (and at this point in South America), demonstrating the viability of this

[11] One important risk component in early stages of exploration – and particularly for geothermal prospects located in Central-South Chile – is the access road, due to long distances through strongly dissected terrains. A road complying with minimum requirements for safe access of drilling rigs and materials could in cases have costs in the USD 15-25 million range, and successive high maintenance costs to guarantee all-year operations. Besides the financial risk, the construction of those roads, and eventually the commitment to develop a project in those harsh conditions, is also matter of a very complex internal decision for the geothermal companies.

[12] See http://bit.ly/CtfChIPR

[13] The CTF aims to provide 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 GHG emission reductions. Investments for the promotion of: i) renewable energy, ii) sustainable transport, and iii) energy efficiency, are eligible under the CTF. As of 2012, contributors had pledged US$5.2 billion for the CTF (CIF 2012 Annual Report). See http://bit.ly/infoCTF.

technology in Chile and leveraging DFI and commercial financing on a non-recourse basis. Access to adequate debt financing –with debt leverage making many of these projects financially viable– poses however a significant challenge, as the level of risk entailed in these projects is still beyond what commercial banks and even DFIs can normally bear. Besides other country- or project-specific risks such as price/market risk (given the difficulty at this point securing PPAs for this technology) or interconnection risk (where transmission infrastructure or interconnection arrangements are still not in place), projects at the targeted stage also face a significant level of resource risk given that most production and reinjection drilling is still to be undertaken.

23. CTF resources will thus be used in structuring financial solutions that will mitigate the effects of these risks to project developers and financiers, and incentivize project developers to make the significant additional investments still necessary to allow production drilling campaigns and plant construction to go forward. Such structuring solutions could include senior and subordinated long term project loans, short term bridge loans, and guarantees. When needed, CTF loans may be disbursed earlier than IDB or other senior lenders' capital, if perceived resource risk levels are still too high for such lenders.

24. Focusing on the projects that already have exploitation concessions and some exploratory drilling conducted, IDB is already in discussions with the developers of prospective projects in both the SIC and SING as candidates for the application of CTF resources. Due to resource uncertainty, it is not possible to specifically define each project's size until a certain level of production drilling has been completed; however, based on available information, it is believed that the three projects in Chile with most advanced exploration have the capacity to support approximately 200 MW of installed capacity. Assuming a cost of USD 5-6 million per MW, the all-inclusive cost to bring these projects on-line is estimated to be USD 1-1.2 billion[14].

25. There is limited number of projects in Chile that have already conducted some level of resource confirmation from the drilling of slim holes and/or production-sized wells. Of these, even fewer are characterized by significant investment having already been made in basic site infrastructure and civil works as well as a sponsor with meaningful financial capacity and track record. In these cases, the project developers are considering –subject to further commercial and technical assessment– the launching of a coordinated production drilling campaign, with such coordination allowing for economies of scale in the rental of rigs to be temporarily imported from abroad (as these type of rigs are not available in Chile).

26. While further analysis and engagement with companies will be required (only possible once the present CTF program is endorsed), CTF support is deemed to be necessary to enable and catalyze investments in these projects for further drilling and construction, to mitigate resource risk and market/price risk (vis-à-vis the difficulty obtaining PPAs with adequate tenor and pricing), among other.

[14] These estimates are provided to share a sense of the estimated capacity and investment associated with the most advanced projects, but such figures do not represent the program targets, as projects to be supported are still to be defined.

Figure 2. Location of most advanced geothermal projects

27. Assuming USD 50 million in CTF resources are invested in up to three projects, in support of 100-150MW at a cost of USD 5-6 million per MW[15], the estimated total investment would be USD 550-825 million[16]. Supervision will be conducted during the life of the loans following standard IDB procedures.

B. Program Financing Plan

Source of financing	Funding (millions of USD)
Sponsor (equity)	220-330
CTF Program (loans and/or guarantees)	50
IDB financing (loans)	Up to 140-205 [a]
Other financing (other DFIs, commercial banks, ECAs)	140-240
Aggregate amount of investments	***550-825***

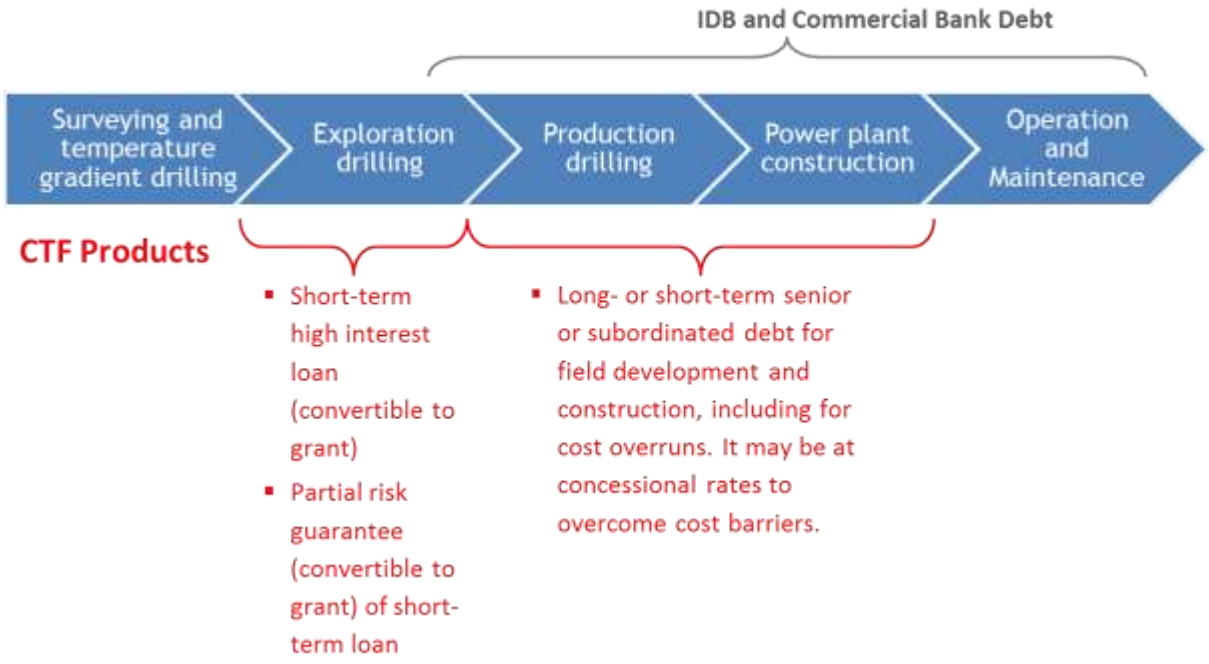
[a/] This range represents the maximum that IDB can finance, 25% of total project costs for projects in Chile. IDB financing may however be more limited, closer to the $50M CTF investment amount, depending on the stage of development of the project/s supported and how CTF funding is structured. Given the critical role that CTF concessional funding will play on this, this cannot be determined until CTF funding is endorsed and in depth assessment of projects is completed.

[15] Expected range based on estimates from Ministry of Energy and geothermal developers in Chile.
[16] Taking average estimate of investment cost at USD5.5M /MW

C. Financial Instruments

28. Over the next three years, the Program expects to provide CTF concessional investment support to up to three projects facing the common development and financing barriers described above. Financing will be provided to private sector borrowers along with additional financing from IDB, other DFIs, export credit agencies, and/or commercial lenders. CTF funds will be structured to mitigate resource and drilling risk, mainly, but also other risks during the project development and operation with potential to hinder effective financing of projects. The proposed financial instruments may include long-term, senior or subordinated project finance loans, corporate loans to pay for drilling or other project development activities, short-term loans provided during the drilling period and rolled over or taken out by long-term debt as the geothermal resource is proven, and guarantees. Any short-term loans and guarantees structured to provide support during exploration will be convertible to grant in case of drilling failure, and IDB will aim to the extent possible to prioritize support to projects where sponsors can offer corporate guarantees for non resource-related risks, to ensure additional risk sharing with sponsors. Pricing is expected to be commensurate with the level of risk entailed by the instruments (i.e. high risk instruments will result in risk premiums charged through interest rates and fees), although some level price concessionality –which will be determined on a case-by-case basis following the principle of minimum concessionality- is expected to be required. Adequate financing structures will be determined on a case-by-case basis. The structures proposed below are those IDB considers to be most relevant to finance prospective projects, given current knowledge. Determination of the most appropriate structures will be based on detailed, project-by-project assessments following approval of this Program, and as additional data is available during project due diligence. Figure 3 below shows the stage in which each of these instruments would be utilized. The final terms and conditions will be determined during negotiation, but are expected to be within the proposed ranges indicated below. CTF investment criteria and principles, such as of minimum concessionality, additionality, cost-effectiveness, and avoidance of market distortions, will be observed in all cases.

Figure 3. Proposed instruments by stage of geothermal project development



29. Any CTF support (as loans or guarantees) during the exploration drilling stage will face high risk. This is necessary and unavoidable if CTF resources are to be used to effectively address the risk/reward

imbalance and market failure that prevents –in the absence of other public funding or sufficient incentives, or sufficient equity available to fully bare these risks– the further and more rapid development of the geothermal industry in Chile. IDB will however implement a series of measures to mitigate such risk, including:

- Requirement of equity co-investment by developers. CTF will not support the full cost of the development (through loans or guarantees) but only a portion of it. This would ensure sufficient risk-sharing with sponsors and alignment of incentives to prevent moral hazard.
- Support for projects which have already conducted (with sponsor's equity) some initial drilling. Such initial drilling provides a better basis and knowledge of the resource (to better assess the risk), thus reducing the chances of failure, while also providing more evidence of the commitment from developers.
- As mentioned before, for short-term loans and guarantees structured to provide support during exploration IDB will aim to obtain as much as possible corporate guarantees for non resource-related risks, to ensure additional risk sharing with sponsors.
- Robust technical evaluation of prospective projects by independent geothermal and technical advisors.

30. On this last point, IDB will contract the services of world-class independent geothermal and technical advisors, to assist in project evaluation, analysis of drilling plans, determination –when appropriate- of success and failure criteria, among other functions, to ensure additional mitigation of the risk to the CTF.

31. Finally, CTF funding may also be considered to subsidize the cost of a geothermal exploration insurance premium (premium cost buy-down), if such product became available in Chile during the life of the program (currently not in place).[17] Specific criteria and terms would be developed at such point, and additional CTF funding may be sought then to ensure adequate concessional support to enable this product to achieve sufficient critical mass for its operation.

D. Technical Assistance & Knowledge Management

32. To ensure successful program implementation, CTF resources will be needed to support the following technical assistance and knowledge management activities.[18]

a) ***Development and implementation of social & environmental best practices:*** In order to address the issues raised by Chilean society in past years regarding the social and environmental impacts of power generation projects (hydro, coal, and in a couple of cases also geothermal), a component focused on these aspects in envisioned. This would include but not be limited to: (i) educational campaign and awareness raising on the benefits and risks associated to geothermal development, including web materials and workshops; (ii) addressing any needs on environmental regulation related to geothermal development; (iii) development of a best practices handbook for the different stakeholders (Ministry of Energy, developers); (iv) establishment of a consultation protocol and implementation of it in the projects.

[17] While this product is not available in Chile (or more broadly in Latin America) as this program is prepared, IDB is working with Munich Re and the Government of Mexico to develop and pilot such a product in Mexico. As the product is developed, IDB will help explore its applicability in Chile.

[18] Activities will be coordinated with the TA program to be implemented by the IBRD, which in principle could consider and encompass (a) the preparation of a geothermal master plan, (b) monitoring and evaluation of geothermal concessions; (c) training and capacity building and (d) support from a global advisory panel on geothermal.

b) Independent geothermal advisory services: This will entail the contracting of independent geothermal advisors to assist in –among other- determining the eligibility of the projects, defining success and failure criteria for drilling campaigns (as required by specific projects, for the cases where guarantees or insurance may be implemented), and advising on resource and project development risks. The activities would include: (i) defining the technical documentation required to conduct due diligence; (ii) technically evaluating geothermal projects, in terms of available resource information, reservoir modeling, and other aspects contributing to technical and financial feasibility of the proposed project ; (iii) analyzing drilling programs indicating whether (a) the procedures for drilling and safety systems are implemented to achieve the correct safety requirements and environmental protection, (b) the specific objectives, the minimum expectations and expected outcomes are consistent with the proposed preliminary geothermal model.

Geothermal expertise will also need to be transferred and shared in order to maintain the sustainability of the program in the long term and ensure the demonstration effect of the Program. This could be done through training and development of an evaluation protocol for the Ministry of Energy or the designated institution (e.g. CORFO).

Expert consultant services may also be contracted to explore solutions to mitigate other project development and operational risks, such price/market risks when no PPAs are available.

c) Knowledge Management. In order to be able to catalyze investment and share lessons learned from the design and implementation of the MIRIG, a series of activities are envisioned, such as: (i) knowledge exchange with countries in the Region (such as Mexico); (ii) training and development of materials for government agencies, developers, other financial institutions on aspects such as regulation, risk management, simulation software; (iii) development of materials for the dissemination of lessons learned.

IV. PROGRAM'S STRATEGY FOR ACHIEVING MARKET TRANSFORMATION

33. The Program aims to have a transformational role in the Chilean geothermal sector by catalyzing and enabling early successes of private sector projects that will in turn contribute to further market uptake. The demonstration effect of the projects included under this Program will include:

a. demonstrating and bringing confidence about the viability of the geothermal technology and sector in Chile, showing that:
   i) the technology can deliver cost-competitive and reliable base-load power,
   ii) projects can be completed within time and budget,
   iii) contractual and financial arrangements can be developed to provide reliable revenue streams;
b. demonstrating different financing arrangements for private sector projects, that are effective to overcome the high resource risk and other risk barriers for project development and financing.

34. These demonstration efforts will improve capacity in the sector (engineering, geothermal financing, equipment supply, etc.) and prove the technical and economic viability of geothermal technology in Chile. These demonstration effects will increase the confidence of off-takers to enter PPAs for subsequent projects, as well as of financial institutions to finance them. Effective demonstration of the viability of geothermal as a base-load source of power will prove the availability of alternative paths and options to large hydro and coal, currently facing significant hurdles for further development given environmental and social concerns.

35. Through this program CTF and IDB will leverage the capabilities and resources of the private sector, as outlined in the investment plan. This program will support projects where private developers have invested a significant amount of seed finance to fund the early stages of exploration (including drilling) and resource confirmation, taking a significant level of risk. The program will capitalize the geothermal project development expertise of the seasoned international geothermal developers behind the prospect

projects, such as Enel (Italy), Mighty River Power (New Zealand) and EDC (Philippines), as well as the knowledge of the local market and business environment of their local public and private partners.

36. The Program adequately fits the country's existing regulatory environment and government policies. As explained in previous sections, recent regulations have given clear signals and incentives in support of further renewable energy supply (increase of renewable portfolio standard to 20% by 2025) and of the streamlining of the process for obtaining geothermal concessions. Moreover, the strong private sector orientation of the power sector in Chile makes this program appropriate for the business context.

37. IDB will leverage its experience in financing private and public sector geothermal projects across Latin America (Nicaragua, Costa Rica, Mexico, Colombia, El Salvador and Bolivia, among others) to support developers in these initial projects. Moreover, it will seek synergies with other geothermal programs it is currently developing in the region, for the purpose of knowledge. Besides the close exchange that IDB will facilitate with the CTF Mexico geothermal program, IDB, as a member of the KfW-led Geothermal Development Facility for Latin America (under development), will also help facilitate access for Chile as a beneficiary country. Most importantly, IDB will leverage its knowledge and profound engagement in the Chilean power sector, where it currently has a diverse portfolio of renewable energy projects, including solar PV and CSP, wind and marine energy, as well as of energy efficiency projects. IDB's resident energy specialist and infrastructure investment officers, in permanent contact with local geothermal developers, will be a key enabler to the delivery of the Program.

38. IDB will capitalize all these conducive conditions, capabilities and resources to use CTF funds in the most targeted and effective manner with minimum concessionality to address the key barriers that are preventing progress of private sector investment in the geothermal sector and thus catalyze its development and the availability of geothermal installed capacity.

V. FIT WITH INVESTMENT CRITERIA

A. Potential GHG Emissions Savings

39. The technology is commercially available, and has high mitigation potential, given its low emission factor and its high capacity factor[19]. The USD 48M of CTF investment support for development of 100MW of capacity, with a plant operational life (and minimum expected resource availability) of 30 years, will result in GHG emissions savings of between 8.7 and 18.0 $MtCO_2e$[20]. The wide range is due to the difference in the emission factors of the two main grids (with SIC at 0.391 $MtCO_2e$/MWh and SING at 0.806 $MtCO_2e$/MWh) and the uncertainty at this point of which projects will be finally supported by the Program (current prospective projects are located in both of them).

B. Cost-Effectiveness

40. Given the direct GHG mitigation potential mentioned above, the cost effectiveness of CTF investments would range between 0.18 and 0.38 tCO_2e/USD (for projects in the SIC and SING, respectively). This corresponds to abatement costs of 5.5 and 2.6 USD/tCO_2e of CTF resources. Assuming an estimated 1:10 financial leverage of CTF resources (ie. CTF providing ~9% of the total investment resources needed), total abatement cost (considering total project costs) would range between 29 and 60 UDS/tCO_2e.

[19] A capacity factor of 85% -which is considered conservative, given that factors of more than 90% can normally be achieved- was used to estimate GHG emission reductions.

[20] This assumes that drilling is successful in at least 1 or 2 of the supported projects, enabling at least 100MW of installed capacity. This assumption is maintained for all other GHG abatement and cost-effectiveness estimates in this and the following sections.

41. Given the demonstrational purpose of CTF investments, cost effectiveness could be considered higher if we take into account the indirect mitigation potential resulting from successful demonstration. Assuming only 5% of the 16GW potential (ie. 800MW) that some estimates present is developed over the next couple of decades, successful demonstration of this program would contribute to pave the way for GHG savings of 70 to 145 $MtCO_2e$, with cost effectiveness of CTF investment further enhanced to 0.3-0.7 USD/tCO_2e.

42. Geothermal project development costs in Chile are expected to reduce over the years as the first few projects provide demonstration and investment and drilling start to increase, further developing local capacity and contributing to reduction of future cost. Some opportunities for cost reductions would be:

- ***Reduction of drilling failure rates:*** as more drilling is completed in these first few projects, the geothermal fields are better understood and drilling success rate should increase (at the very least for project expansions in the same fields, given that some of them plan to take a phased approach).
- ***Cost reduction through equipment rental coordination:*** one of the main costs in the project development stage is the cost of drilling rigs (for production-size wells). This is particularly high in Chile given the absence of adequate equipment in country, as a consequence of the absence of an oil and gas industry utilizing similar machinery. Rigs then need to be temporarily sourced from abroad during drilling campaigns. This –along with other factors, such as geographic and weather conditions- significantly increase drilling costs, from averages of USD 2-4 million per well globally to about USD 8-10M+ in Chile. Some of the prospect projects to be supported by this program are looking to coordinate the timing of their upcoming drilling campaigns to share the cost of bringing the equipment from abroad. If successful, this could serve as demonstration on cost efficiency opportunities for future projects (more importantly, further cost efficiencies may be found if a growing volume of drilling allows for the development of local drilling businesses and service providers).
- ***Reduced cost based on development of local capabilities:*** as the first few projects increase confidence of future development of the sector, the prospects of increasing local content of the supply chain are favored. This includes equipment as well as intellectual expertise (geothermal engineering, resource assessment, financial structuring, etc.). Local sourcing should result in reduced costs and increased co-benefits (employment, trade balance, etc.).
- ***Reduced financing cost based on reduced risk perception:*** successful performance of this Program may increase the interest of other financing institutions, as risk perception is reduced and financing structures mitigating resource and other relevant risks are demonstrated. Broader access to debt financing (increasing the debt/equity ratio of projects) could have a significant impact in reducing geothermal development cost, enhancing the economic and financial viability of this base-load technology and incentivizing sponsors to accelerate investment and development.

C. Demonstration Potential at Scale

43. As introduced in the previous point, while this Program is expected to support directly at least 100 MW of geothermal power generation capacity, the demonstration effect is expected to help catalyze further geothermal investment and development. With an estimated potential of up to 16 GW of geothermal energy in Chile according to some estimates, achievement of a 5% fraction of this –or about 800 MW- in the next decades (with four countries having already achieved installed capacities over 1 GW in the last few decades) seem to be an achievable aspiration. Timing for this would be uncertain, as well as specific conditions such as marginal emissions factors that would allow for adequate estimation of GHG savings potential. Assuming emission factors are in the next few years in the same range as current ones, an additional 800 MW of geothermal power capacity would result in 70 to 145 $MtCO_2e$.

44. The prospect for replication is not only supported by the vast potential that has been estimated along the lengthy geography of the Andes Mountains in Chile, but also the presence of seasoned international geothermal developers, operating in multiple sites. The number of geothermal concessions (79 for

exploration, and already 7 for exploitation) is also an indication of the level of interest this technology has raised as a result of the quick growth of power demand and environmental and/or social challenges being faced by other more traditional base-load technologies used in Chile (large hydro and coal).

D. Development Impact

45. This Program has a significant number of potential development co-benefits. Some of them (e.g. energy security, improvement of trade balance, employment) are certain, but will become significant as the demonstration effect of the Program impacts in a scale larger than that of the directly supported investments. Other potential co-benefits (e.g. access to modern energy services though rural electrification, reduced air pollution) are uncertain at this stage, as they depend on the specific location of the plants, but their existence would be assessed as specific investments are defined and confirmed (and as part of IDB's development effectiveness assessment of private sector investments). Expected co-benefits are:

- ***Energy security:*** About 76% of Chile energy supply is based on fossil fuels, of which approximately 91% is imported, given the absence of significant oil, gas or coal production in Chile (National Energy Balance 2012[21]). Chile has already experienced the vulnerability of its economy to price or supply shocks of these fuels. Beyond the vulnerability to fossil fuel price changes, Chile experienced a shocking shortage of supply of gas when Argentina's supply capacity started experiencing challenges since 2004. In addition, higher power supply costs result in reduced competitiveness of Chilean industry (and particularly in energy intensive, commodity producing sectors –like mining- where cost increases cannot always be proportionally transferred to prices). Energy security concerns are heightened by the fact that two base-load technologies (large hydro and coal) have been facing significant environmental and social barriers for further development.
- ***Trade balance:*** fossil fuel imports represent 23% of total imports in Chile (IEA, 2010). Any reductions on fossil fuel needs resulting from scale-up of geothermal power production would directly improve the trade balance position.
- ***Employment:*** lower cost power and the resulting increased competitiveness of local industry (as explained in the point above) has the potential to protect and promote employment, as Chilean products become more competitive internationally and export volumes can be maintained or increased.
- ***Rural electrification:*** as transmission lines are built to connect remote geothermal fields with demand centers, there's the potential of making access to the grid viable for remote populations currently not connected. Access to affordable, modern energy through connection to the grid would result in significant development co-benefits.
- ***Reduction in air pollution:*** in case any of the prospect projects was to substitute an existing or envisioned coal plant in the vicinity of population center, reduced local air pollution could prove a significant co-benefit. As specific investments have not been confirmed at this point, this cannot be assessed.

E. Implementation Potential

46. The implementation potential of the Program is good, given a number of favorable conditions outlined in previous paragraphs. From the policy and regulatory angle, recent legislation and regulations incentivizing renewable generation and streamlining the concession processes facilitate further geothermal investment and development.

47. In addition, and for a sector that requires the expertise and investment of international developers, Chile has a very positively regarded regulatory environment for private sector investment, across the economy in general but also in the power sector in particular (as it was the first country in the world to

[21] http://www.minenergia.cl/documentos/balance-energetico.html

move to a private, unbundled power sector model which has been sustained since the 1980s). The GoC has strongly supported the development of the private sector since the eighties, when a series of economic reforms were made to open the Chilean economy to the world through liberal policies, such as privatization of social security, free trade agreements, and low government intervention. As a result, Chile consistently ranks very high (normally at the top among Latin American countries) in investment climate rankings (such as the *Doing Business* ranking).

48. These enabling conditions for private businesses in the power sector, along with high power prices and high renewable resource potential (solar, wind, geothermal), have attracted to Chile some of the top international utilities and renewable energy developers, including geothermal developers like ENEL Green Power, Mighty River Powers, Energy Development Corporation, and Origin, who are bringing key expertise and investment resources necessary for the development of the sector. Companies like these have been responsible for a significant amount of exploratory drilling that has already taken place (although still insufficient to access commercial project financing).

49. Finally, the vicinity of some of these fields to mining exploitations and the energy intensive nature of these activities (which require stable power on a constant basis) present a potential market of off-takers, whose interest may be enhanced following the demonstration effect of the first few projects.

F. Additional Costs & Risk Premium

50. Geothermal resource and other geothermal development risks are perceived as significant by lenders during the exploratory and production drilling stages, significantly limiting debt financing to a) corporate lending backed by a strong balance sheet, or b) concessional financing by public sector development banks or bi/multilateral donors.

51. When project debt financing is not available, and sponsors need to finance this stage with equity, the cost of capital is often times prohibitive (especially in a market like Chile, where no PPAs may be available to ensure an adequate return commensurate with LCOE). CTF resources would provide the missing project debt financing (or in cases maybe even concessional corporate debt) or project guarantees to support further drilling; this financing is not available from other lenders and is critically needed to a) allow sponsors to achieve a certain measure of risk-sharing, and reduce the amount of additional capital at risk required before commercial debt is available, and b) leverage sponsors equity and enhance the economics of projects, in order to achieve a competitive LCOE. Depending on each specific project and the relevant financing structure, CTF would provide price and/or risk concessionality (subordination, security, tenor) to achieve this objective.

G. Financial Sustainability

52. As the project supports the take-off of the sector through demonstration of the first few projects, the following factors will contribute to future cost reductions, replicability and sustainability of geothermal power development:

- reduced project development cost if local content (technical and financial expertise; supply of equipment and drilling/construction services supply) is further developed, incentivized by the evidence of a growing sector.
- increased likelihood of securing PPAs as technology and development costs are demonstrated; this could contribute to more secure, improved returns, and a reduction or risk perception for project sponsors and financiers.
- successful financing schemes are demonstrated, reducing financing risk perception and cost.
- success of project further gains government and public support to encourage further improvement of enabling environment and public support through incentives.
- recently increased renewable energy targets expected to progressively increase the premium compensation for renewable energy projects

- reduced perception of multiple project development and operation risks (resource, technology, financing, environmental and social, among other) should increase access to debt financing reducing project development cost and LCOE.

H. Effective Utilization of Concessional Finance

53. As explained in previous sections, investment in geothermal is limited by:

- For developers, the large amounts of equity required to be put at high levels of risk, given (as outlined in paragraph 18): a) the higher cost of geothermal development in Chile (need to source drilling rigs from abroad, geographic and weather factors requiring more expensive mobilization and transmission and longer development times), and b) high risks: not only resource risk, but also -among other- price/market risk given the difficulties securing adequate PPAs.
- For lenders, the high risk perceived in geothermal given difficult development conditions and lack of previous demonstration in the Chilean context.

54. Concessional finance is therefore needed to help overcome the increased cost and risks faced by developers. While GoC has developed incentives for renewables and improved regulation to further promote geothermal development, this support is insufficient as there is no direct financial support available to reduce geothermal development cost or share its risk. Given Chile's unbundled and privatized power market the government's ability to directly intervene to support its development is limited. In other countries with liberalized power markets, exploration and development grants and high risk loan guarantees have been successfully utilized to spur the industries development. The financial structures hereby proposed aim to provide similar support, reducing capital at risk for incremental equity investments by developers, while also reducing cost of capital by leveraging their investment.

55. As this proposal is prepared there are no other known similar concessional investment resources readily available to support geothermal development in Chile, but the KfW-led Geothermal Development Facility for Latin America under development is expected in the future to provide additional concessional resources to support exploration.

I. Mitigation of Market Distortions

56. The market will not be distorted since there isn't currently any offer of project debt financing for geothermal projects in Chile during the drilling stages. Private sector will be crowded in as drilling is advanced and resource is sufficiently confirmed to allow financing of the construction of the plant and other support infrastructure.

J. Risks

57. The main risks for the Program are the following:

58. **Lack of demonstration given drilling failure:** given the risky nature of geothermal development (and the use of CTF resources to mitigate some of the entailed risks) failure of individual projects is possible, in which case the intended demonstration effect may not be achieved. This risk is mitigated by:

- selection of projects where significant sponsor equity has already been invested in exploration drilling and pre-feasibility studies provide a certain level of confidence on the viability of the development (making sponsors willing to continue to invest their own equity).
- the Program aims to support more than one project, diversifying the risk to increase the likelihood that at least one project will successfully complete sufficient drilling and resource confirmation to advance to plant construction and commissioning, providing the intended demonstration of the viability of geothermal power development.

59. **Financing risk:** Sponsor equity and CTF support would not be sufficient to fully finance prospect projects. Additional debt financing will be needed to support field development, and plant and other

infrastructure construction. Besides residual resource risk, other risks such as the difficulty obtaining a PPAs and the volatility of spot price may pose a challenge securing commercial financing even when production drilling is advanced/completed and resource risk reduced. To mitigate this risk CTF will provide risk and price concessionality, to help reduce LCOE and increase DSCR for senior lenders, thus reducing perceived project risk and crowding such lenders in to secure needed financing.

60. **Public support given environmental/social potential impacts:** the Chilean civil society has demonstrated over the years its ability to effectively oppose developments with perceived undesired environmental or social impacts. Some large hydro and coal plants developments –and in a couple of cases some early geothermal projects- have been discontinued or delayed on that basis. Given the normally smaller footprint of geothermal projects, as well as their positive GHG externalities, similar levels of opposition are in principle not expected in development of these projects, as long as environmental and social regulations are abided by, best practices observed, and lessons from previous experiences (development of El Tatio) are capitalized in further developments. This said, the little experience so far developing these projects in Chile (with no project having yet completed the full project cycle to effectively deliver power) presents certain level of risk that unexpected social or environmental concerns may arise. To mitigate this risk, TA support on environmental, social and operational management of the project, to ensure compliance with national regulation and international best practices, is planned as part of the IDB/WB CTF geothermal program in Chile. Initial consultation with civil society organizations during the investment plan revision process did not present concerns perceived to pose a significant challenge for geothermal development.

K. Performance Indicators

Key Performance Indicators	**Target**
# of projects with sufficient drilling/steam confirmed to initiate plant construction	At least 1 [b]
Capacity of plants constructed/to be constructed enabled by the project	At least 100MW [b]
Energy expected to be generated based on projects supported	At least 744,600 MWh/year [b]
GHG tons abated	At least 8.7 $MtCO_2e$ [b]
Financial leverage	At least 1:10 [c]

Additional Development Indicators	**Target**
Annual reduction in fossil fuel imports (and dependency)	~USD 16 Million [b]
Jobs created (direct and indirect)	5410 [b]
Access to energy (new connections to the grid)	Any such benefit cannot be assessed until the specific investee projects are defined

[b] Assuming drilling is successful for at least 1 or 2 projects, enabling at least 100MW of installed capacity
[c] For projects with successful drilling which thus proceed to plant construction