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PROJECT PAPER

FOR

A PROPOSED CLEAN TECHNOLOGY FUND (CTF) GRANT

IN THE AMOUNT OF US$1.78 MILLION

TO THE

AGENCIA DE COOPERACION
INTERNACIONAL DE CHILE

FOR A

TECHNICAL ASSISTANCE FOR SUSTAINABLE GEOTHERMAL DEVELOPMENT PROJECT

August 31, 2016

CURRENCY EQUIVALENTS

(Exchange Rate Effective as of June 23, 2016)

Currency Unit: US Dollar
US$ 1.00 = Ch$ 673.8
Ch$ 1.00 = US$ 0.00149

FISCAL YEAR
January 1 – December 31

ABBREVIATIONS AND ACRONYMS

AGCI	Agencia de Cooperación Internacional de Chile
CPS	Country Partnership Strategy
CIF	Climate Investment Funds
CTF	Clean Technology Fund
DREGU	Division for Renewable Energy's Geothermal Unit
ECLAC	Economic Commission for Latin America and the Caribbean
EIA	Environmental Impact Assessment
ESMAP	Energy Sector Management Assistance Program
FM	Financial Management
GDF	Latin America Geothermal Development Facility
GDP	Gross Domestic Product
GGDP	Global Geothermal Development Plan
GHG	Greenhouse Gas
GoC	Government of Chile
GW	Gigawatts
IDB	Inter-American Development Bank
IFR	Interim Financial Report
IP	Investment Plan
KfW	German Development Bank
LCoE	Levelised Cost of Energy
LNG	Liquefied Natural Gas
MiRiG	Geothermal Risk Mitigation Program
MoE	Ministry of Energy
MW	Megawatts
MWh	Megawatt hours
NCRE	Non-conventional Renewable Energy
OECD	Organization for Economic Cooperation and Development
PMR	Partnership for Market Readiness Climate Change Mitigation in Chile Project
PPA	Power Purchase Agreement
RETs	Renewable Energy Technologies
SE4ALL	Sustainable Energy for All
SEPA	Procurement Plans Execution System
SIC	Sistema Interconectado Central
SING	Sistema Interconectado del Norte Grande
ToR	Terms of Reference
TSP	Total Suspended Particulates

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CHILE
TECHNICAL ASSISTANCE FOR SUSTAINABLE GEOTHERMAL DEVELOPMENT PROJECT

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Chile

TECHNICAL ASSISTANCE FOR SUSTAINABLE GEOTHERMAL DEVELOPMENT PROJECT

Small Grant Project Paper

LCR

GEEDR

Basic Information			
Date:	August 31, 2016	Sectors:	Other Renewable Energy (100%)
Country Director:	Alberto Rodriguez	Themes:	Climate Change (50%) Infrastructure services for private sector development (50%)
Practice Manager:	Antonio Barbalho	EA Category:	B
Project ID:	P152820		
Instrument:	Investment Project Financing		
Team Leader(s):	Migara Jayawardena, Mariano González		

Recipient: Agencia de Cooperación Internacional de Chile – Ministerio de Relaciones Exteriores (AGCI)			
Executing Agency: Ministerio de Energía			
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Project Implementation Period:	Start Date: October 1, 2016	End Date:	June 30, 2020
Expected Effectiveness Date:	November 29, 2016		
Expected Closing Date:	June 30, 2020		

Project Financing Data (US$ million)		
[Loan]	[X] Grant	[ ] Other
[Credit]	[ ] Guarantee	

For Loans/Credits/Others

Total Project Cost :	2.33M	Total Bank Financing :	1.78M
		Financing Gap :	0

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Financing Source	Amount(US$ million)
BORROWER/RECIPIENT	0.55
Clean Technology Fund – Government Executed	1.78
Total	2.33

Expected Disbursements (in US$ million)

Fiscal Year	2017	2018	2019	2020					
Annual	0.143	0.650	0.625	0.364					
Cumulative	0.143	0.792	1.417	1.780					

Project Development Objective(s)

The development objective of the Technical Assistance for Sustainable Geothermal Development Project is to assist the Government of Chile in resolving specific barriers to improve the geothermal energy market conditions. By addressing key legal, social and market barriers, this technical assistance will contribute to the development of commercializable geothermal resources.

Components

Component Name	Cost (US$ million)
Component 1: Improve policy framework and strengthen management capabilities to help mobilize investments in geothermal energy	1,330,000
Component 2: Enhancing market conditions for promoting sustainable development of the geothermal energy sector	450,000

Systematic Operations Risk – Rating Tool (SORT)

Risk Category	Rating
1. Political and Governance	L
2. Macroeconomic	M
3. Sector Strategies and Policies	S
4. Technical Design of Project or Program	M
5. Institutional Capacity for Implementation and Sustainability	M
6. Fiduciary	M
7. Environment and Social	M
8. Stakeholders	S
OVERALL	**M**

Compliance

Policy

Does the project depart from the CPS/CPF in content or in other significant respects?	Yes [ ] No [X]
Does the project require any exceptions from Bank policies?	Yes [ ] No [X]
Have these been approved by Bank management?	Yes [ ] No [ ]
Is approval for any policy exception sought from the Board?	Yes [ ] No [X]
Does the project meet the Regional criteria for readiness for implementation?	Yes [X] No [ ]

Safeguard Policies Triggered by the Project	Yes	No
Environmental Assessment OP/BP 4.01	X	
Natural Habitats OP/BP 4.04	X	
Forests OP/BP 4.36	X	
Pest Management OP 4.09		X
Physical Cultural Resources OP/BP 4.11	X	
Indigenous Peoples OP/BP 4.10	X	
Involuntary Resettlement OP/BP 4.12	X	
Safety of Dams OP/BP 4.37		X
Projects on International Waters OP/BP 7.50		X
Projects in Disputed Areas OP/BP 7.60		X

Team Composition

Bank Staff

Name	Title	Specialization	Unit	UPI
Migara Jayawardena	Senior Energy Specialist	Task Team Leader	GEEDR	170640
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Non Bank Staff

Name	Title	Office Phone	City
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Subir Sanyal	Geothermal Specialist Consultant		
John Armstong	Energy Policy Specialist Consultant		
Manlio Covielo	Chief, Natural Resources & Energy Unit, ECLAC UN –Peer Reviewer		
Jim Lawless	Geothermal Resource Specialist Consultant – Peer Reviewer		

Locations

Country	First Administrative Division	Location	Planned	Actual	Comments
Chile					Countrywide impact as a result of sector reforms

I. STRATEGIC CONTEXT

A. Country Context

1. **Chile is one of the most stable economies in Latin America with steady growth rates mainly driven by commodities export.** With almost 18 million inhabitants, and US$240 billion gross domestic product (GDP) in 2015,[1] the country averaged annual growth rates of 3.5 percent during the past twenty years. Per capita income over the same period has almost doubled in real terms. Employment and income growth significantly reduced poverty rates, although earnings and labor productivity have been distributed unevenly. Chile's economy is characterized as being open and heavily dependent on natural resources and foreign trade, with the mining sector accounting for 60 percent of the country's total exports. Services and the energy-intensive industrial sector (including value added in the mining sector) account for 60 percent and 37 percent of the GDP, respectively, with agriculture making up the rest. GDP growth forecasts for Chile for 2014-18 are around four percent per year, almost twice the OECD average (2 to 2.3 percent).[2]

B. Sectoral and Institutional Context

2. **The energy sector is a key determinant of economic growth in Chile.** Electricity demand in Chile, increasing at around seven percent per annum, has doubled every ten years and outpaced economic growth. This reflects the relative energy intensity driving economic growth, especially in the industrial and service sectors. In order to sustain growth, address poverty, and expand prosperity throughout the country, it will be essential to ensure the availability of reliable and low cost electricity to fuel the productive sectors of the economy. The Government of Chile (GoC) estimates that electricity demand will continue to grow at 6 to 7 percent[3] per year through 2020, which will require an additional eight gigawatts (GW) of power generation capacity and associated infrastructure.

3. **Chile's power system is primarily comprised of two major electricity networks, which are shaped by the country's unique geographical characteristics.** The total installed power generation capacity in the country is 17.7 GW, in four separate non-interconnected networks that stretch through its 4,300 kilometer long and 175 kilometer wide geographic area: *Sistema Interconectado del Norte Grande* (SING), *Sistema Interconectado Central* (SIC), *Magallanes*, and *Aysen*. Nearly all of the installed capacity is concentrated in the two large networks of SIC and SING, with only 150 megawatts (MW) of installed capacity in the other two systems. The largest system is SIC, covering the central and central-southern portion of Chile. SIC's installed capacity of 13.8 GW supplies electricity to 90 percent of the population, including the Santiago metropolitan area, the largest load center in the country. SING, covering 25 percent of the country's geographical area, is located in the northern part of Chile and has an installed capacity of 3.7 GW. While SING supplies only about 6 percent of the population, the concentration of the mining industry in the region drives over 90 percent of the system's electricity demand. The terrain and the extended length of the power systems in Chile create considerable challenges. These

[1] The World Bank.
[2] Economist Intelligence Unit, *Country Report Chile* (London: Economist Intelligence Unit, October 2013).
[3] Government of Chile, *National Energy Strategy (2012-2030)* (Santiago: Government of Chile, February 2012).

challenges include high costs and accessibility issues for extension of the transmission network, including the potential inter-connection of the SIC and SING that could produce synergies.

4. **Electricity in Chile is predominantly produced from thermal and hydro resources.** In 2013, thermoelectric installed capacity (coal, natural gas and diesel) accounted for 62 percent of the total power generation mix in Chile. Hydropower accounted for 34 percent, biomass made up 2.2 percent, wind was 1.7 percent and solar power was just 0.1 percent of the total installed capacity in the country (see Annex 5, Figure V.1).

5. **Chile has had some difficulties in reliably operating existing power plants as well as in strategically expanding new power generation capacity.** Extreme weather, resulting in the severe drought of 2010 in Chile and multiple years of below average rainfall, reduced availability of the large scale hydropower plants. In addition, new hydropower capacity development has faced opposition due to civil society concerns such as the potential for flooding, impact on wildlife, and effects on small population groups. Chile's energy supply vulnerabilities were evident between 2004 and 2008 when there were a series of disruptions in the significant amount of natural gas supplies being imported from Argentina. This led to severe constraints and adversely impacted the production of electricity. The natural gas shortage was later alleviated through diversification of supply sources and the construction of two liquefied natural gas (LNG) terminals for domestic storage and regasification. Even with these remedies, reducing excessive reliance on imported fuel supplies through the development of alternate indigenous power generation options continues to be an imperative in order to strengthen the energy security of the country.

6. **Chile manages the energy sector primarily through a *laissez faire* approach with policies that promote private sector-led investments and prices determined primarily through market-based principles.** In 1982, Chile became one of the first countries to implement comprehensive electricity sector deregulation. As a result, generation, transmission, and distribution services were unbundled and are now in private hands. Generation is structured as a competitive market with independent power producers, while transmission remains a natural monopoly and distribution is arranged through distribution companies that are regulated as monopolies to sell electricity within their concession areas. Given the structure of the sector, electricity prices are mostly determined through market forces, thus, electricity prices have fluctuated, reflecting various factors, including volatility in fossil fuel prices, availability of hydro, and disruption of gas supplies from Argentina. Figure V.2 in Annex 5 illustrates this volatility, with average spot prices for power ranging from less than US$25/MWh to over US$300/MWh. Since the uncertainty in prices undermines business competitiveness and creates hardship for people, the GoC has made reducing power sector prices and stabilizing price volatility a primary objective for the energy sector.[4]

7. **Chile is also determined to develop the energy sector in a sustainable manner limiting global greenhouse gas (GHG) emissions.** Chile's greenhouse gas emissions, expected to double by 2025, are primarily from the energy sector. The CO_2 emissions per capita have increased from 3.6 metric tons in 2000 to 4.6 metric tons in 2011, substantially higher than the average for other Central and South American countries.[5] The SING system has particularly high carbon intensity

[4] *National Energy Strategy (2012-2030).*
[5] United States Energy Information Administration.

due to the substantial utilization of coal for power generation. Redirecting the emissions trajectory is important for the GoC since, as an OECD country, Chile may face commitments to reduce emissions as a part of future global agreements on climate change. Thus, GoC wants to reduce its dependency on fossil-based electricity. In its Nationally Determined Contribution (NDC) for the 2015 Climate Agreement in Paris, Chile made a voluntary commitment to reducing its CO2 emissions per GDP unit by 30% below their 2007 levels by 2030. On October 1, 2014, Chile implemented a modest yet important carbon tax of US$5/ton of CO_2 emissions from power plants that are larger than 50 MW, sending a clear signal to the market to shift toward cleaner sources of energy. The GoC also secured international assistance of US$220 million[6] through the Climate Investment Funds (CIF) to promote renewable energy development in the country.

8. **If developed prudently and in compliance with safeguards requirements, expanding renewable energy as a part of a better-diversified generation mix will also have considerable local environmental benefits**. Expanding renewable energy will reduce pollutants that are common bi-products of fossil-based power generation, such as sulfur dioxide (SO_2), nitrogen oxide (NOx), and total suspended particulates (TSP). However, as with all power generation technologies, there is a need for incorporating prudent measures that mitigate any negative environmental, social, and safety issues that may arise during construction and operation. In Chile, there has been considerable civil society opposition to hydropower development due to concerns such as the potential for flooding, impact on wildlife, and effects on small population groups. Similar issues may arise from the development of other technologies as well. If Chile is to scale-up the utilization of renewable energy, these concerns will need to be carefully and conscientiously addressed in a manner consistent with local and international standards.

9. **Chile's latest Energy Agenda[7] and long-term strategy seek to boost the utilization of renewable energy as one key solution for addressing the challenges facing the sector.** In March 2014, the GoC established an Energy Agenda addressing some of the key issues facing the sector. Consistent with its long-term National Energy Strategy 2012-2030, the agenda's strategic objectives include: boost the utilization of non-conventional renewable energy (NCRE), reduce the marginal cost of electricity, and improve energy efficiency to reduce consumption. The unique geography of the country has endowed Chile with an abundance of hydro, wind, solar, and geothermal resources that, if further developed, can diversify and optimize the country's power generation mix. Recognizing this need and opportunity, the GoC has established a NCRE target that currently aims for a 20 percent share by 2025.[8] To meet this goal, between 3,500 and 4,000 MW of estimated additional NCRE generation capacity will need to be installed in the next 10 years.[9] While Chile has met similar targets previously, some NCRE technologies will face greater hurdles in scaling-up than others.

10. **Chile's abundant geothermal potential provides a good renewable energy option to further diversify the country's power generation mix, reduce price volatility, and improve energy security.** The mountainous eastern backbone of Chile is the Andes Range, comprised of almost 3,000 active and dormant volcanoes. There are good indications that the entire northern

[6] Including Clean Technology Funds allocated to Chile through the Global Geothermal Development Plan.
[7] Government of Chile, *Agenda de Energía. Un Desafío País, Progreso para Todos*. (Energy Agenda. A National Challenge, Progress for All) (Santiago: Government of Chile, May 2014).
[8] Law 20.698, commonly referred to as the 20/25 Law.
[9] Center for Economic Load Dispatch.

and central parts of the Andes have significant geothermal energy potential, with studies indicating it could be in excess of 3 GW.[10] Geothermal energy stands out among renewable energy systems for a number of beneficial reasons especially relevant for Chile. They include:

- Unlike other renewable energy alternatives, such as wind and solar power, geothermal is a non-intermittent source[11] that can provide reliable base-load power on a 24/7 basis.
- Geothermal energy is a clean source of energy emitting a fraction of the GHG emissions (CO_2) compared with other baseload options such as coal; and does not emit local pollutants such as nitrous oxides (NOx) and sulphur dioxides (SO_2), and total suspended particulates (TSP).
- As an indigenous and non-tradable resource, geothermal will enhance energy security in Chile.
- Once developed, geothermal energy can provide stable prices and serve as a natural hedge against the volatility of commodity-driven electricity prices.
- Geothermal energy offers the potential for direct applications such as heat for households (district heating) and agricultural and industrial applications.

11. **The GoC has made a concerted effort to develop Chile's nascent geothermal energy industry.** In 2000, the GoC promulgated the Geothermal Concessions Law (Law Number 19.657), with the objective of issuing geothermal development concessions to mobilize investment in the sector. Many developers, including a number that were internationally reputable, hurried to enter the Chilean market and over 100 geothermal concessions were issued, with many developers securing multiple concessions. Despite what appeared to be a promising start, only a few investments were mobilized towards the riskier earlier stage exploration drilling and resource confirmation efforts – a requirement for advancing green field projects. A number of issues stymied exploration investments, including the limited time afforded for test drilling under the terms of the concession, uncertainty regarding follow-on development, excessive concessioning (given the globally modest number of qualified geothermal developers), lack of exit clauses for those not meeting development objectives, and inadequate capacity within GoC to monitor and oversee the concession regime. Offtake and commercial issues related to the overall power sector integration of geothermal energy as well as environmental concerns have also created uncertainty for developers. The GoC issued a revised regulation in 2013 to ease some of the administrative constraints in applying the law and this has led to a few developers making some progress. Despite these efforts, presently there are no geothermal power plants in operation in Chile.

12. **In addition to enhancing the policy and regulatory framework, there are key barriers to sustainably developing geothermal as a viable base-load generation option.** There is a need to rationalize the scale and pace of geothermal energy that can be realistically developed for the Chilean market and for commensurate revisions to the policy and regulatory framework. These reforms would need to resolve impasses related to concessions and ensure that capacity exists within GoC for adequate oversight and pro-active management of concession areas throughout the development process. However, reforms to the policy and regulatory framework alone will not address other important barriers impeding the progressive development of geothermal. There are also barriers related to the technology and the specific conditions of the Chilean energy market, in particular:

[10] With some estimates suggesting the potential may be as much as 16 GW.
[11] The other presently available renewable technology is hydropower with storage.

(a) *Geothermal resource risks.* Uncertainty surrounding the availability of a commercially exploitable resource in greenfield projects is a major barrier inherent to early stage geothermal development. The risk is perceived by many developers to be greater in the Chilean market, since the sector is nascent and widespread drilling results and information are not available. Therefore, investors are often reluctant to mobilize the US$30 million or more in risk capital required for exploration drilling and geothermal resource confirmation.

(b) *Integration of geothermal in the power market.* There is a need to rationalize the scale and timeframe for geothermal expansion in Chile and to ensure that the country's power markets can adequately integrate geothermal into the existing systems. At present, power purchase agreements (PPAs) in Chile typically extend from 7 to 10 years whereas geothermal projects are often amortized over 20 to 30 years. This mismatch hampers developers' ability to raise financing for projects. In addition, many geothermal fields are in remote locations requiring the extension of transmission lines to evacuate power, which can be costly and difficult to coordinate.

(c) *Environmental and social considerations.* Chile's policy framework for environmental and social safeguards is broadly aligned with international standards. However, there is a need to ensure broad awareness among developers and local communities as to how these policies apply to geothermal development. While most civil society opposition is directed at hydropower development, events, such as a well blowout at the El Tatio geothermal field, can negatively alter perceptions about geothermal development. Strong stakeholder engagement and consultation (including with affected indigenous populations), raising awareness about social and environmental regulations, requirements, and international best practices among developers are essential for sustainable scale-up of development in the sector.

(d) *Long-term competitiveness of geothermal.* Based on the few drilled fields, there is evidence that initial investments in geothermal can be costly on a financial basis. This is primarily due to the rugged terrain, limited duration of drilling due to weather conditions, and the remote location of many sites. There may be existing industries in the country that can suitably provide services to the geothermal sector at lower costs. Combining other purposes such as direct use of geothermal for heating can also enhance the overall viability of geothermal projects by taking advantage of co-benefits from the technology. Long-term, addressing some of these issues and opportunities will help transform a nascent market into a more robust one and provide a more sustainable environment for investing in geothermal energy in Chile.

13. **The GoC is intensifying efforts to address challenges to advance geothermal and is seeking international assistance.** The GoC recognizes the importance of developing geothermal to meet both the country's NCRE targets and its long-term development needs. Since most renewables are intermittent, supplying stable base load power is key and the GoC's Energy Agenda already includes reforms specific to promoting geothermal development. These include: (a) the preparation of a new geothermal law; (b) design of risk mitigation schemes to mobilize investments in exploration drilling; and (c) launch of a program to promote the utilization of low and medium enthalpy geothermal for direct uses such as heating. Chile's initial geothermal targets

are modest to moderate, ranging from 200 MW[12] to 800 MW[13] by 2025. This reflects the infant state of the industry and resulting uncertainty of how the sector will develop and evolve in Chile.

14. **A catalytic effort to kick-start the sector could lead to a more robust outcome over time, exploiting the country's significant geothermal potential.** In order to successfully implement the proposed GoC reform agenda for geothermal and address key barriers to sector development, the GoC has sought international assistance from its development partners. The GoC secured US$53 million from the Clean Technology Fund (CTF), channeled through the World Bank and the Inter-American Development Bank (IDB), to advance geothermal development in the country. Of the CTF funds, US$50 million is allocated through IDB to facilitate financing for several geothermal projects where field exploration (drilling) is sufficiently advanced.[14] Under a US$1.22 million Bank executed trust fund (BETF) financed by CTF and a US$500,000 BETF financed by the Energy Sector Management Assistance Program (ESMAP), the World Bank will provide additional support to GoC through advisory services (see Annex 3). They will respond to GoC's request to the World Bank to share its global experience in the geothermal sector and best practice examples, to serve as analytical input, and inform the GoC's reforms and capacity building. The GoC also secured an additional US$1.78 million from the CTF to institute reforms and strengthen its capacity in the geothermal sector in order to implement accepted industry practices and meet international standards. The proposed technical assistance is expected to have an immediate impact by: (a) strengthening the existing architecture for facilitating financing from IDB and other sources for exploratory activities to develop commercializable steam fields; and (b) reducing or eliminating barriers to progressively enhance market conditions to support long-term sustainable development of geothermal.

C. Higher Level Objectives to which the Project Contributes

15. **The Technical Assistance for Sustainable Geothermal Development Project in Chile is fully consistent with the World Bank's twin goals and the Country Partnership Strategy (CPS).** The Bank's first twin goal is to end extreme poverty. The CPS (FY11-16), consistent with this goal, aims to support Chile's vision for eradicating extreme poverty and achieving high-income, developed status by 2018. A major strategic component of this vision is the promotion of sustainable investments in infrastructure for sectors such as energy. The GoC's strategy calls for improving the business climate to attract private sector investments, including in renewable energy projects. Additionally, the strategy calls for supporting options that make a positive contribution to climate change. The steps taken by the GoC, including issuance of the Energy Agenda, confirm that geothermal development is a national priority consistent with its long-term development objectives. The reallocation of US$33 million[15] within its CTF Investment Plan (IP) and the requests for international assistance to support geothermal development are both confirmation of GoC's commitment to reforming the sector. The proposed project and its associated activities will

[12] Energy Agenda.
[13] IDB Geothermal Risk Mitigation Program.
[14] The IDB project is distinctly separate from this TA project, and the achievement of the TA project's PDO is not dependent on the success of the IDB project. The benefits and achievement of the objectives of the proposed TA project extend beyond the IDB funded geothermal projects and support the development of the sector in order to promote investment in geothermal resources across the country.
[15] Since augmented in July 2015 by another US$ 20 million, for a total of US$ 53 million in CTF funds toward geothermal development.

contribute to the promotion of private investments in the geothermal energy sector and the achievement of Chile's development goals.

16. **The proposed project is also consistent with higher-level global development objectives.** It supports the Sustainable Energy for All (SE4ALL) initiative led by the United Nations, which, among other things, aims to double the share of renewable energy in the global mix. In addition, the World Bank through its Energy Sector Management Assistance Program (ESMAP) is spearheading the Global Geothermal Development Plan (GGDP), which aims to mobilize and channel investments through development partners into high risk drilling activities to advance and unlock the potential of geothermal green fields. Finally, the World Bank is coordinating with KfW Group (KfW) and other development partners to establish the Latin America Geothermal Development Facility (GDF), which is designed to channel funds toward geothermal exploration and development. If Chile can reform the sector and transition to a vibrant and sustainable market for geothermal development, the country is expected to be a key market for the GDF.

17. **The ultimate objective of the Project is to mobilize investments in the geothermal energy sector in Chile by addressing some of the key barriers described in paragraph 12**. This is in line with the Bank's second twin goal of promoting shared prosperity by improving the living standards of the bottom 40 percent of the population, and with the IDB and the CTF objectives. The project is part of and contributes to the common endeavor to enhance the investment environment for the country's geothermal sector. Utilization of Chile's indigenous renewable resources will: (a) contribute to meeting the country's growing energy demand; (b) attenuate Chile's energy supply vulnerabilities by enhancing energy security; (c) promote environmentally sustainable development by reducing local pollution; (d) mitigate global GHG emissions and help the country to meet its goal in this regard; (e) help stabilize and reduce long-term electricity prices, which will contribute toward further boosting the country's economic competitiveness and ease burdens on residential consumers; and (f) promote investments in remote rural areas, where poverty is more concentrated.

II. PROJECT DEVELOPMENT OBJECTIVES

A. PDO

18. The development objective of the Technical Assistance for Sustainable Geothermal Development Project is to assist the Government of Chile in resolving specific barriers to improve the geothermal energy market conditions. By addressing key legal, social and market barriers, this technical assistance will contribute to the development of commercializable geothermal resources.

Project Beneficiaries

19. Primarily, energy consumers in Chile stand to benefit from long-term development of geothermal resources, which will contribute to lower and more stable energy prices. These benefits will accrue to business, industrial, and residential consumers. In addition, those living in project areas, including those who are of indigenous origin, will also benefit from industrial services, employment and better connectivity, and other co-benefits associated with sector development. Greater utilization of clean energy in Chile will also have largely positive environmental impacts

that will lead to local and global benefits in terms of reduced pollution and GHGs.

PDO Level Results Indicators

20. The successful achievement of the development objective of the proposed project will be evaluated through the following indicators:

- Strengthened legal and policy framework through the preparation/revision of laws and/or policies;
- Establishment of a framework for mobilizing risk capital toward geothermal exploration;
- Facilitate greater exploration of geothermal resources through the drilling of wells.

III. PROJECT DESCRIPTION

A. Project Components

21. The proposed project forms a complementary part of a package of initiatives undertaken by the GoC with the assistance of development partners through CTF support. As previously noted, the CTF approved Chile's revised Investment Plan, allocating US$53 million[16] to advance geothermal development in Chile and begin to exploit geothermal's large potential. The private sector arm of the IDB expects to channel US$50 million, combined with its own financing, to support at least two geothermal projects with advanced exploration through slim hole or full diameter drilling, to resource confirmation. For such efforts to succeed, it will be important to bolster existing market conditions so developers can make immediate investments confidently in early stage geothermal development. In order to achieve the long-term progressive and sustainable development of the sector, the investment climate necessary to support the multiple stages in the full development of geothermal operations—from surface reconnaissance through to operating power plants—will be strengthened as a result of the project.

22. To kick-start Chile's geothermal program while attempting to catalyze investments, key reforms in the policy framework and in concession management are vital. These reforms would help smooth the way for geothermal field development beyond the initial risky stage of resource confirmation. For this, the GoC has requested the World Bank's global experience and advisory support (with CTF and ESMAP funding as described in paragraph 14) to assist the GoC make key reforms to improve market conditions and to facilitate greater immediate and long-term investments in the sector. To draw upon the World Bank's advisory services to carry out the suggested reforms, the GoC is being provided a grant of US$1.78 million from CTF. The GoC is also providing an in-kind contribution of US$550,000 that includes staff time, office space and other related costs.

23. The activities in the proposed project will be carried out under two components. A more detailed description of the project components and activities are included in Annex 2. The GoC, through MOE, will be responsible for design and implementation of the policy, regulatory and

[16] The initial reallocation of funds for geothermal development was US$33 million in November 2013, but this amount was later augmented with an additional US$20 million from the CTF private sector window as a part of the GGDP for a total allocation of US$53 million.

institutional reforms implemented through the proposed project with the support of the government executed grant. The GoC/MoE will be responsible for legal, regulatory and incentive framework design, stakeholder engagement and coordination of the industry, and the implementation of all reforms funded through the support of the government executed grant. The GoC, through AGCI, will also be responsible for all fiduciary aspects including procurement, financial management, and monitoring and evaluation of the government executed grant.

24. **Component 1:** Improve policy framework and strengthen management capabilities to help mobilize investments in geothermal energy **(total US$1,680,000; of which US$1,330,000 CTF;GoC in-kind US$350,000).** This component will assist the GoC in addressing potential legal, regulatory and administrative burdens undermining market confidence hampering the geothermal sector. The component's goal will be to dismantle key constraints preventing mobilization of investments for the substantial number of geothermal concessions in place.

(a) *Enhance legal and regulatory framework for geothermal development*. This subcomponent consists of the revision of the legal and regulatory framework for geothermal development, through, *inter alia*: (i) drafting of the necessary regulations; (ii) carrying out stakeholder consultations; and (iii) evaluation of the impact of the reforms to adjust the framework for optimal performance. The GoC will undertake revisions to the appropriate legal and regulatory instruments, namely the present Law on Geothermal Energy Concessions (No. 19.657), its implementing regulations, and other related policies and regulations impacting geothermal development, to create incentives and provide greater certainty for sector investments. Modifications also will be sought in related policy frameworks that are identified as being critical to the sector's successful development.

(b) *Review geothermal concession management framework*. This subcomponent entails review of the legal and regulatory framework for geothermal energy concessions, and developing recommendations on reform including, *inter alia*: (i) a review of the GoC's internal concession management system to optimize operations; (ii) identification of steps to strengthen the monitoring of awarded concessions to ensure compliance with investment and related agreements; and (iii) evaluation of exploitation concession bids, management of award process, and oversight of concessionaire's obligations. A significant number of geothermal concessions remain in place with limited or no investments made in exploration. To address this bottleneck, the geothermal concession process—will be reviewed and necessary reforms identified. Subsequent support will be provided to the GoC to implement key revisions to the concession management framework.

(c) *Capacity building and institutional strengthening.* This subcomponent will include capacity building and institutional strengthening activities within the Ministry of Energy (MoE), including, *inter alia*: (i) the provision of on-the-ground advisory support to the MOE to boost its existing capacity on the geothermal sector; (ii) the provision of support for the coordination of all activities related to the Project; (iii) the identification of: (A) key evolving sector needs; and (B) just-in-time support and additional training and capacity building needs; and (iv) the facilitation of the means to address the needs mentioned under (iii) herein.

(d) *Stakeholder engagement to address social and environmental considerations of geothermal development.* Under this subcomponent, the GoC, through MoE, will carry out

activities to promote stakeholder engagement to address social and environmental considerations of geothermal development, such as: (i) consultations; and (ii) awareness building activities including exchanges with other geothermal development countries and the incorporation of feedback arising from said activities into the reforms implemented through the Project. A stakeholder engagement strategy, informed by a social assessment, will be developed to improve engagement with affected communities and to increase knowledge and awareness of scientific, social and environmental aspects of geothermal development among stakeholders, including indigenous peoples. Activities will include, among others, developing communication materials and guidance notes, facilitating knowledge exchange, and strengthening consultation processes by facilitating stakeholders' access to independent expertise.

25. **Component 2:** Enhancing market conditions for promoting sustainable development of the geothermal energy sector **(total US$650,000; of which US$450,000 CTF; GoC in-kind US$200,000).** In order to scale-up and sustain long-term development of geothermal, it will be important to mobilize risk capital beyond the support of CTF, to expand the overall market size of the sector to achieve economies of scale, and to better integrate geothermal into the overall power sector in Chile. Component 2 undertakes several key associated reform activities, which include:

(a) *Geothermal resource risk mitigation framework to help mobilize investments in exploration and production drilling.* Through the project, the GoC will design and prepare a geothermal resource risk mitigation framework based on successful international experience and energy markets; including, *inter alia*, its (i) selection; (ii) consultation; (iii) refining; (iv) implementation; and (v) the carrying out of a revision of the legal and regulatory framework to support the geothermal risk mitigation options that will be implemented in Chile.

With the GoC, the IDB has developed the Geothermal Risk Mitigation Program, or MiRiG (see box 1, Annex 5), which will initiate support to at least two specific geothermal projects in addressing their technical, financial, and commercial viability. The proposed technical assistance will complement MiRiG support by addressing some of the key shortcomings developers face. In turn, the experience of MiRiG will create a feedback loop and inform the design of the risk mitigation framework.

(b) *Integration of geothermal power in the broader power market in Chile.* Under this subcomponent, the GoC will design and develop an incentive framework for better integration of geothermal power in Chile's broader power market, including, *inter alia*, the rationalization of Chile's geothermal expansion plans through the harmonization of its overall development goals with the existing power market conditions, including the undertaking of the necessary reforms and the implementation of adequate incentives.

There is a need to rationalize the scale and timeframe for geothermal expansion in Chile and to ensure that the country's power markets can adequately integrate geothermal into their respective systems. This is essential in order to provide sufficient incentives for geothermal developers to invest in the multiple stages of upstream and downstream development. The GoC will design and develop market incentives for expanding geothermal utilization, with a particular emphasis on the two large power markets in Chile, the markets' bidding and PPA conditions and potential non-rewarded externalities of geothermal. The proposed project will support the GoC in implementing

selected reforms and incentives within the broader power market in order to promote geothermal development.

(c) *Design of a strategy to enhance geothermal competitiveness in the long term by exploring synergies with alternate uses and related domestic sectors.* This subcomponent will include, *inter alia*: (i) the identification of the sectors best positioned in Chile to develop low and medium enthalpy resources in an economic fashion; and (ii) the design of the most appropriate schemes to promote the use of said resources and their implementation.

Based on the few fields where there has been drilling, there is evidence that initial investments in geothermal can be costly on a financial basis. This is especially the case with drilling, particularly due to the rugged terrain, limited duration of drilling due to weather conditions that restrict drilling time, and the remote location of many sites. There may be existing industries in Chile that can suitably provide services at lower costs, if they are sufficiently developed to support geothermal development. Combining other purposes, such as direct use of low and medium enthalpy geothermal, the overall viability of geothermal projects may be enhanced by taking advantage of co-benefits of the technology. This subcomponent will implement approaches and incentives to promote the uses of low and medium enthalpy geothermal in order to expand geothermal markets and to capture the benefits of cost reductions and greater economies of scale. Such efforts will contribute to transforming the current nascent geothermal sector into a robust one over time.

B. Project Financing

Instrument

26. The overall project will be funded by the US$1.78 million CTF grant, with a GoC in-kind contribution of US$550,000. The MoE will execute the grant, with AGCI's support to reform its geothermal program. The World Bank will also provide complementary direct advisory support, through additional CTF and ESMAP trust funds (further detailed in Annex 3).

Project Cost and Financing

27. The following table provides a breakdown of costs per project component:

Project Components	Project Costs (US$ million)	Funding Sources(US$ M)	
		CTF Grant	GoC*
1. Improve policy framework and strengthen management capabilities for mobilizing investments in geothermal.	**1.68**	1.33	0.35
2. Enhance market conditions for promoting sustainable development of the geothermal energy sector.	**0.65**	0.45	0.20
Total Project Costs	**2.33**	**1.78**	**0.55**

*GoC contribution will be in-kind.

IV. IMPLEMENTATION

A. Institutional and Implementation Arrangements

28. The GoC has requested the World Bank to provide advisory activities in which the GoC is seeking the World Bank's global sector experience, especially during the early part of the proposed

project, in which globally informed best-practice solutions will be identified. The GoC will directly execute the follow-on activities and activities that focus on preparation and implementation of policy, as well as sector oversight initiatives. Many of these activities will begin during the second year of project implementation.

29. Within GoC, the MoE will be the lead implementation agency regarding technical matters, overall oversight of the project, and day-to-day supervision, while the recipient of the funds and the bearer of fiduciary responsibilities will be the Agencia de Cooperación Internacional de Chile (AGCI) within the Ministry of Foreign Relations (Annex 4 - Figure IV.1). AGCI and the MoE are expected to sign a subsidiary agreement outlining their respective obligations and arrangements for the proposed project before effectiveness. Further details regarding the implementation arrangements and fiduciary responsibilities, including specific tasks related to the MoE, AGCI, are included in Annex 4.

30. The World Bank will be responsible for providing advisory activities and implementation support for the project. The World Bank will establish the necessary Bank executed trust funds and will transfer the client-executed CTF funds to the GoC on the basis of a grant agreement. To achieve the objectives of the proposed project, The World Bank will also carry out project implementation support missions at least once each year to evaluate the overall implementation of the proposed project and will liaise with CTF on behalf of GoC as it relates to the proposed project.

B. Results Monitoring and Evaluation

31. The MoE focal point is responsible for day-to-day supervision of the implementation of the project tasks and will be responsible for the overall collection of data and reporting on the project's progress. The World Bank team will provide technical support to the MoE during project implementation. AGCI will be responsible for the overall monitoring and evaluation for the project in coordination with and input from MoE.

32. Project monitoring and evaluation will include the following: (i) *Project results framework.* PDO and intermediate results indicators reflected in Annex 1; (ii) *Completion report*. Implementing agencies are required to prepare a completion report to ensure that objectives outlined in the grant agreement are met and that there is a plan for their sustainable continuation; and (iii) Financial statements. Implementing agencies are required to prepare financial statements that reflect the operations, resources, and expenditures related to the activities detailed in the grant agreement. Periodic, independent auditing of financial statements will be included in the grant agreement.

V. KEY RISKS AND EXPLNATION

A. Overall Risk Rating and Explanation

33. The Overall Risk Rating of the Project is Moderate. The development of market conditions to facilitate investments in a nascent sector will always include a certain degree of risk. This is the case for geothermal development in Chile. However, the proposed project attempts to directly address some of these risks, while the complementary activities carried out by IDB through CTF

also play an important role. As such, the overall risks of the project, including the key ones highlighted below, are manageable.

(a) *Cost and risks of geothermal.* The inherent resource risks are a barrier with all geothermal developments, and the nascent state of the market in Chile exacerbates this uncertainty. The CTF supported work, through IDB's investment support, and the preparation of a risk mitigation framework is directly designed to address this key constraint. There is also some concern that the financial cost of geothermal in Chile could be high, eroding its competitiveness with other technologies. This is substantiated by initial evidence that suggests drilling costs in Chile are considerably higher than in other countries, due to terrain, challenges to mobilizing rigs, and accessibility of remote locations. Some of these risks would be reduced as the market progressively develops. The proposed project also looks to enhance the long-term competitiveness of the sector by exploring compatible domestic industries and by promoting projects that utilize geothermal beyond power generation. Finally, the GoC has begun to internalize some of the environmental externalities that can cause alternate technologies to be more competitive on a financial basis, including through the carbon tax, which will lead to environmentally friendlier options such as geothermal being more competitive.

(b) *Adequacy of policy and regulatory framework to mobilize investments in the sector.* The previous policy measures undertaken by the GoC managed to attract many developers, yet the investments that followed for sector development, were limited and not widespread. The same risk could be present in the next round of reforms, given that there is a need to resolve some impasses with existing concessions. Through the project, the upcoming reforms by the GoC will benefit from the World Bank's global experience and other international expertise. The proposed project is also designed to help the GoC ensure the policy and regulatory frameworks will promote upstream development of geothermal, and better integrate the sector into the electricity market, providing a long-term incentive for developers to enter the market and invest. Chile's already attractive overall investment climate is also a key feature that will continue to appeal to investors.

(c) *Environmental considerations and social acceptance (stakeholder perspective).* Geothermal development could also run into civil society opposition, based on environmental and social concerns, similar to that which the hydropower sector faces in Chile. Under the current law, concessions were granted to developers without prior consultations with indigenous peoples, and without a full understanding of the environmental and social concerns of the local population. The recent well blow-out at the *El Tatio* geothermal field that stopped development at the site is likely to contribute to potential concerns. To mitigate this risk, the proposed project includes activities to improve early engagement with communities and raise awareness of the potential social and environmental risks and mitigation measures. This will enable local communities' concerns to be identified and addressed, for broad community support.

(d) *Unanticipated reform requirements.* While the proposed project has a clear set of activities that is commensurate with its overall objective, reforms of this nature are almost certain to present unanticipated challenges that will require adjustments in order to keep the reforms on track. This is particularly the case due to the nascent state of the sector in Chile, with many developers that are new entrants to the domestic geothermal market. In anticipation, the project is designed to be flexible and responsive to emerging needs in order to maintain focus on the overall development

goal of the country.

34. While a reform of this nature will always be challenging to implement in a sustainable manner, the actual design of the proposed technical assistance is straightforward to implement, selective in areas of focus, and can be adapted to meet evolving needs.

VI. APPRAISAL SUMMARY

35. The proposed project is designed to provide technical assistance to the GoC to address barriers so that market conditions for developing geothermal resources in Chile will improve. Since the implications and the impacts of addressing the identified barriers are indirect and far-reaching, a typical cost-benefit analysis is not an appropriate approach to evaluate the proposed project, as impacts are difficult to measure at a practical level. However, the World Bank, with the assistance of specialists who have experience in geothermal, financial markets, familiarity with the development circumstances in Chile, and understanding of environmental and social safeguards, has carried out due diligence on the project design, confirmed that the identified barriers are appropriate, and indicated that the overall activities proposed as reforms are consistent with industry practices and meet international standards. The proposed project includes sufficient flexibility to meet evolving needs and circumstances in the sector, and can dynamically respond to address most challenges that cannot be anticipated at present but that may arise during implementation.

36. **Social and environmental safeguards**. The proposed project will entail direct technical advisory support to the MoE, analytical and diagnostic studies, capacity building and institutional strengthening as well as information, engagement and consultation activities with key stakeholders. The project support will not include any physical investment or the implementation of any geothermal program on the ground. While the project is conceived as technical assistance and direct advisory support, key policy and regulatory reforms and changes in the geothermal sector will be recommended for implementation in the future that will have downstream impact on social and environmental management issues relating to the geothermal resource exploration and power generation. Operational Policies 4.01 Environmental Assessment, 4.04 Natural Habitats, 4.36 Forests, 4.11 Physical Cultural Resources, 4.10 Indigenous Peoples and 4.12 Involuntary Resettlement were triggered to identify the types of downstream impacts that can be expected, to ensure that the technical assistance is consistent with the Bank's environmental and social safeguards policies, and to integrate environmental and social objectives in the TA process. The application of these safeguard policies does not mean that every instrument set out in these policies is required as a pre-requisite. Social and environmental issues will be addressed through the following measures: (i) a social assessment will be prepared as an early output of the TA project to ensure that potential downstream positive and adverse impacts on indigenous peoples are evaluated and to ensure that technical advice provided under this project is consistent with the principles of Operational Policy (OP) 4.10; (ii) World Bank Environment and Social Specialists will review terms of reference (ToRs) for all studies prepared as part of the proposed project to ensure that environmental and social concerns related to the study are adequately addressed; and (iii) stakeholder engagement and participation to address social and environmental considerations has been included as component 1(d) to promote transparency and incorporate feedback throughout the proposed project.

37. Downstream geothermal activities are regulated by existing country guidelines, including but not limited to the *Guía para la Evaluación de Impacto Ambiental de Centrales Geotérmicas de Generación de Energía Eléctrica*, prepared in 2012, which serves as a guideline for Environmental Impact Assessment (EIA) for geothermal energy generation, and is generally consistent with the World Bank Group Environment, Health and Safety Guidelines on Geothermal Power, which will be used as a basis for evaluation. Environmental evaluation of the majority of infrastructure projects is managed by the *Servicio de Evaluación Ambiental*, an agency based within the Ministerio de Medio Ambiente. The procedure followed in determining the requirement for a full EIA is largely in line with OP 4.01, with the one exception that project alternatives are not explicitly considered within the scope of the EIA. However, given that the development of geothermal energy is entirely linked to the existence of the resource in a specific location, the project alternative would be not to proceed with development.

38. **Financial management.** On the basis of the review performed, it is concluded that financial management arrangements are acceptable to the Bank, subject to: (a) submission of the final format for project financial statements; and (b) submission of the financial management chapter in the project's Operational Manual. Both actions need to be completed before the grant agreement is signed. In addition, within two months after the grant agreement takes effect, the grantee will have to designate a financial management counterpart for the project and sign an inter-institutional agreement between the MoE and the AGCI.

39. **Procurement.** Government contracts in Chile are conducted transparently and efficiently primarily due to the existence of a modern and transparent electronic procurement system (the Public Market of ChileCompra). AGCI is currently implementing parallel operations financed by the Bank and will have benefited from those experiences. Implementation support by the Bank related to procurement will include: (a) providing procurement training to members of AGCI, when required; (b) reviewing procurement documents and providing timely feedback to the procurement units/specialists; (c) providing detailed guidance on the Bank's procurement guidelines; (d) monitoring of procurement progress against the procurement plan; and (e) carrying out procurement ex-post reviews.

40. **World Bank Grievance Redress.** Communities and individuals who believe that they are adversely affected by a World Bank (WB) supported project may submit complaints to existing project-level grievance redress mechanisms or the WB's Grievance Redress Service (GRS). The GRS ensures that complaints received are promptly reviewed in order to address project-related concerns. Project affected communities and individuals may submit their complaint to the WB's independent Inspection Panel which determines whether harm occurred, or could occur, as a result of WB non-compliance with its policies and procedures. Complaints may be submitted at any time after concerns have been brought directly to the World Bank's attention, and Bank Management has been given an opportunity to respond. For information on how to submit complaints to the World Bank's corporate Grievance Redress Service (GRS), please visit http://www.worldbank.org/GRS. For information on how to submit complaints to the World Bank Inspection Panel, please visit www.inspectionpanel.org.

Annex 1: Results Framework and Monitoring

Chile: Technical Assistance for Sustainable Geothermal Development Project

Project Development Objective (PDO): The development objective of the Technical Assistance for Sustainable Geothermal Development project is to assist the Government of Chile in resolving specific barriers in order to improve the geothermal energy market conditions. By addressing key legal, social and market barriers, this technical assistance will contribute to the development of commercializable geothermal resources.

PDO Level Results Indicators*	Core	Unit of Measure	Baseline	Cumulative Target Values**				Frequency	Data Source/ Methodology	Responsibility for Data Collection	Description (indicator definition, etc.)
				YR 1	YR 2	YR3	YR 4				
Indicator One: Greater exploration of geothermal resources through the drilling of wells	☐	Number of commercial wells drilled	7			9-10	11-13	Yearly	MoE/Geothermal Developers	MoE	New geothermal wells that are drilled by developers indicating improved market conditions for investment in sector
Indicator Two: Submission for Legislative approval of law and/or revised policies necessary for providing greater regulatory clarity to investors	☐	Yes/No	No new law/policy issued	Draft prepared	Submitted for Legislative approval			Yearly	MoE	MoE	Indicates strengthened policy and regulatory framework necessary for developers to proceed with field development
Indicator Three: A framework designed to mobilize risk capital toward geothermal exploration	☐	Yes/No	No mechanism for geothermal risk mitigation	Draft framework prepared	Framework issued	Framework under implementation		Yearly	MoE	MoE	Architecture in place to catalyze risk capital toward mitigation of risks associated with early stage geothermal development
INTERMEDIATE RESULTS											
Intermediate Result (Component 1): Improve policy framework and strengthen management capabilities for mobilizing investments in geothermal											
Indicator One: Review and recommendation report for geothermal concession framework	☐	Yes/No	No	Completed				Yearly	MoE/Bank	MoE	Review to determine existing bottlenecks in concession framework, in order to inform reforms to policy and regulatory framework
Indicator Stakeholder awareness consultations held	☐	Number	0	1	2			Yearly	MoE	MoE	Consultations carried out to better inform affected people regarding geothermal development including environmental and social aspects

Intermediate Result (Component 2): Enhance market conditions for promoting sustainable development of the sector											
Indicator Study on integration of geothermal in electricity market completed	☐	Yes/No		Draft prepared	Study completed			Yearly	MoE	MoE	Study to evaluate bottlenecks in power market that specifically impact geothermal development, in order to identify solutions to address barriers
Indicator Two: Recommendation made for risk mitigation solutions based on global solutions tailored for Chile	☐	Yes/No		Draft prepared	Completed			Yearly	MoE	MoE	Design of risk mitigation framework to facilitate sustained mobilization of funding especially toward early stage geothermal development
*Indicator Three***:** Study on alternate uses of geothermal in Chile	☐	Yes/No		Report drafted	Report finalized			Yearly	MoE	MoE	Identify alternate uses for geothermal energy in Chile

Annex 2: Detailed Project Description

Chile: Technical Assistance for Sustainable Geothermal Development Project

1. The sections in this Annex provide a detailed description of the proposed project's components and major activities. It is important to note that, while specific activities can be discrete, there are interconnections amongst activities, which, when brought together, are expected to significantly enhance the market conditions to better facilitate investments in the expansion of the geothermal sector in Chile. It is also worth noting that, while the key barriers that are identified have been confirmed, a reform of this nature especially in a nascent industry will require flexibility in design as the specific needs and solutions are certain to evolve as the sector and the proposed project progresses.

2. **Component 1-** Improve policy framework and strengthen management capabilities to help mobilize investments in geothermal energy**.** This component will assist the Government of Chile (GoC) in addressing potential legal, regulatory and institutional challenges that are hampering the development of the geothermal sector. The assistance will be provided through the following four key activities:

3. *C1.1. Enhance legal and regulatory framework for geothermal development:* The current Law on Geothermal Energy Concessions was passed in December 1999 and was developed primarily around the legal framework for the mining and extractive industry. While there is an extractive nature to geothermal, it requires a distinctly different policy framework for successful development. This is partly reflected by the fact that: (i) investments have been mobilized in only a very limited number of fields over the past fifteen years; (ii) there is no installed geothermal generation capacity to date in Chile; and (iii) scant efforts to develop alternate uses including low and medium enthalpy resources. Therefore, a review and reform of the legal and policy framework is critical to provide greater certainty for investors towards advancing geothermal development, and thus is a key item in the GoC's Energy Agenda.

4. An important element of the reform will be to first, and foremost, rationalize the scale and timeframe for expanding the geothermal sector in Chile and develop consensus around these objectives so that any modifications to the legal and policy framework is commensurate with these policy priorities and goals. This vitally important consensus building will be informed by several other activities, such as the *integration of geothermal in the power market study*, as well as global and regional experiences that may be applicable in the context of Chile. The activity will also include the design of reforms to the present Law on Geothermal Energy Concessions (No. 19,657), its implementing regulations, and other related policies that impact the development of the geothermal sector necessary to address identified shortcomings consistent with GoC's overall geothermal development objectives. Depending on the legal reforms sought, the GoC would then carry out additional intergovernmental and broader stakeholder discussions to obtain feedback, as well as generate consensus around the proposed changes. The GoC will then proceed to drafting the new legal framework including any new/revised laws with the support of the proposed project. There will be a final round of discussions and consultations that will be supported through the proposed project prior to the revised legal framework being submitted to Parliament for final approval. On the basis of the approved legal framework, the GoC will then develop the regulatory

framework and secondary instruments such as permits, licenses, warrants, etc., whose design and implementation the proposed project will support.

5. While the proposed review will include various associated legal and regulatory requirements in other sectors that impact geothermal development, a particular area of focus will be the environmental and social obligations for geothermal developers. It is common for inconsistencies to arise between laws across sectors, or some obligations to not be adequately incorporated in nascent sectors such as geothermal. Existing guidelines in Chile for EIA for geothermal energy generation (including the Guía para la Evaluación de Impacto Ambiental de Centrales Geotérmicas de Generación de Energía Eléctrica, prepared in 2012) is generally consistent with international standards and the World Bank Group Environment, Health and Safety Guidelines on Geothermal Power. Nevertheless, a gap analysis will be carried out by the World Bank (see Annex 3), which will form the basis for follow-on reforms that is expected to be supported by this project. This work will complement and benefit from the related activity on stakeholder engagement and awareness raising.

6. The revised legal and regulatory framework will create greater legal certainty for developers as well as the GoC, improve market conditions, and enhance investor confidence in the geothermal sector in Chile. An improved concession regime will reduce costly delays and the high transaction costs faced by qualified developers, and provide the legal basis for the GoC for managing the concessions to ensure progress towards its development goals. The reform of associated sectors that impact geothermal, in particular to ensure good-practice when addressing environmental and social considerations, as well as to eliminate cross-sectorial inconsistencies, will facilitate overall development of the sector and enable developers to invest with confidence in geothermal.

7. *C1.2. Review geothermal concession management framework*: The GoC had at one time issued over one hundred concessions to various developers, which has now been whittled down to 31 active ones. Many of them saw little or no investment mobilized, while development rights were relinquished by developers in other sites. While the responsibility for overseeing the concessions rests with MoE, it has had limited capacity to monitor and manage developers' obligations, taking corrective actions as necessary to maintain progress towards its goals. Therefore, in order to scale-up investments across a wide array of existing and potential new concessions, it has become vital to review and reform the geothermal framework and the capacity necessary to manage it in the context of the legal reform to the concession law described in the previous activity.

8. This activity will design and help implement necessary reforms to the existing management framework for granting and overseeing the geothermal concession system and revised legal framework, so that investments can me mobilized towards developing commercializable geothermal resources in Chile. It will entail the potential reform by the GoC of: *(i) the eligibility criteria*, to ensure fairness and effectiveness in the process for granting concessions (i.e. concessions will be awarded to the most qualified applicant, through a transparent and standardized process); *(ii) the existing process to evaluate concession applications/bids*, with special focus on the technical capacity, the understanding of the geothermal developmental process, and the financial capability perspectives; *(iii) the milestones for exploitation concession,*

to address the GoC's well-placed concern that the concessionaires make the best use of the geothermal resources, including the proposal of regulatory enforcement tools to compel the concessionaires to meet certain milestones in order to retain its concession rights; *(iv) the available governance tools to enforce policy*, like fees, taxes, regulations and bonds, examining the possibility of enforcing fees for the use of geothermal resource land or security in the form of bonds or letters of credit to ensure that the concessionaire is motivated to perform in a timely fashion without dampening investment motivation; *(v) the grants of concessions*, the rights these concessions grants and what it must do to maintain them throughout the period of any concession, as well as the requirement for the holders of concessions to obtain secondary permits from various governmental agencies at the local, provincial, and national levels; *(vi) the governmental monitoring process of concessions* in its two-fold purpose of creating an environment conducive to renewable resource project development, as well as a police role in ensuring that concessionaires are complying with the spirit and the letter of regulations, recommending substantive improvements, if appropriate; *(vii) the internal monitoring procedures,* ensuring that there is adequate personnel capacity in the government to digest and regulate the information flow between the concessionaire and the government; *(viii) the online-based information system,* with a threefold approach: a developmental outreach function that informs prospective investors of opportunities, an educational function that informs the general public as to the scientific nature of geothermal resources, as well as the policy, regulatory, financial, environmental, and economic issues that underlie the governmental policy of developing the country's geothermal resources, and to facilitate the exchange of information between the public and the governmental sectors.

9. *C1.3. Capacity building and institutional strengthening:* The MoE, which is mandated with overseeing the development of the geothermal sector in Chile, relies on its Renewable Energy Directorate to manage the sector. A dedicated Geothermal Unit has been established, but operates with limited capacity and geothermal development experience given the nascent state of the sector in the country. The MoE has made considerable efforts to bolster its capacity, including training and participating in international initiatives, such as the GGDP. The mobilization of CTF funds is another effort through which the MoE proposes to strengthen its capacity in key areas related to geothermal development so that it can benefit from international experience and apply industry standards to the development of the sector in Chile. This strengthened capacity will be vital, especially during the upcoming years where the GoC is making a concerted effort to reform the sector and advance development. The support provided by the proposed project will be as follows: (a) a Geothermal Technical Advisor with in-depth knowledge of the sector and international experience to help guide the MoE's reform program, liaise with developers and related industry groups, assist with the management of the concession framework, provide quality control for the technical and analytical work carried out under the proposed project, help coordinate activities with various stakeholders, and provide project implementation support as necessary; (b) deployment of specialists to provide specific expertise related to particular areas of reform that will include a spectrum of subject areas, such as technical (including geothermal resources, drilling expertise, power engineering), economic (including policy and regulatory), financial (including deal structuring and project finance), and environmental and social areas (including gender and indigenous peoples); and (c) just-in-time assistance that will be deployed to provide expertise to the MoE on an ad-hoc basis to address evolving reform needs in a flexible manner. The deployment of specific specialists and just–in-time support will be provided through a combination of experts hired directly by the MoE and direct advisory support by the World Bank, given its global

experience with geothermal development. It is expected that the assistance provided by the World Bank will strengthen the MoE's capacity during the crucial years of implementing major reforms, and transfer knowledge for the longer-term sustainable management of the sector as it is scaled-up.

10. *C1.4. Stakeholder engagement to raise awareness regarding geothermal development taking into account environmental and social considerations:* An evolving legal and regulatory framework on indigenous communities' rights to consultations and benefit-sharing, as well as negative public perceptions of the environmental risks related to it, have been identified as contributing to slow progress in the sector. For geothermal energy to become a socially and environmentally sustainable source of energy in Chile, a better understanding of the social and cultural context, improved stakeholder engagement at national, regional and local levels, and a practical application of regulatory requirements will be required. This subcomponent focuses on two main areas.

11. The first focus-area is to develop a stakeholder engagement strategy, based on a participatory Social Assessment in which key issues, concerns and perceptions of all stakeholders, including affected indigenous communities, will be identified. The activity will include knowledge exchange with international geothermal development projects on community engagement and consultations, and will develop practical culturally appropriate consultation toolkits and/or guidance for different stakeholders in Chile. The activity will also develop awareness materials that address key social and environmental concerns from both a geo-scientific and engineering perspective and from the cultural and socio-economic context in which geothermal will be developed. It will develop a platform for systematized citizen feedback and monitoring of public perceptions.

12. The second focus-area is to build the capacity of the MoE and Indigenous Communities in particular on the consultation processes. This activity will include: (i) strengthening the MoE's capacity to support and accompany the consultation process from an early stage, (ii) facilitating indigenous communities to build their own capacity with independent experts on geothermal energy, consultation mechanisms and social and environmental impacts; and (iii) faciliting study tours for MoE and key stakeholders to international geothermal developments with best practice experience in the consultation and engagement of local communities.

13. All technical assistance activities, recommendations, and advice under Component 1 will be consistent with the objectives and requirements of all World Bank environmental and social safeguard policies – including OP 4.10 on Indigenous Peoples. The Bank will review ToRs for all studies prepared as part of the project, and will review the resulting documents, to ensure that all environmental and social concerns related to geothermal exploration in Chile are adequately addressed.

14. **Component 2 – Enhancing market conditions for promoting sustainable development of the geothermal energy sector.**

15. *C2.1. Geothermal resource risk mitigation framework to help mobilize investments in exploration and production drilling:* Risks to developing geothermal in Chile have become a major

barrier for advancing progress in the sector. These risks arise primarily due to the fact that it is a nascent market where there is no geothermal power generation capacity in operation, inherent uncertainty regarding the resource availability and its commerciality, significantly high drilling costs, and subsequent downstream off-take in the power market. If Chile is to develop geothermal as a long-term, viable renewable base load energy option, it will be vital to address these barriers, especially the ones which have demonstrated to be challenging for the private sector to handle, i.e. confirming the upstream geothermal resource availability and capacity. This will be particularly vital to advancing the large number of geothermal fields that have been concessioned, but have seen little or no investment in exploration and development activities.

16. The goal of this activity is to develop a geothermal resource risk mitigation framework, based on successful international experience that is customized for implementation under the specific circumstances in the Chilean geothermal and energy markets. The GoC will engage existing and potential investors in Chile to validate specific challenges facing those looking to mobilize investments, especially in exploration and production drilling. This activity would have the benefit from global work already carried out by the World Bank in resource risks mitigation, and will also create an opportunity for information exchange and close coordination with the IDB on its CTF funded geothermal development activities to mobilize investments. These lessons and insights will inform the design of a framework for risk mitigation for the Chilean geothermal sector. Once consensus is reached around the design, subsequent work will include the development of the implementation protocols and arrangements for the risk mitigation framework and securing funding commensurate with the established goals (including coordination with the multi-partner supported Geothermal Development Facility (GDF) for Latin America that is expected to be in operation at the time, and the global Green Climate Fund). The proposed project will also support the initial set-up and operation of the geothermal risk mitigation framework. When successfully implemented, the Risk Mitigation Framework will help systematically facilitate the mobilization of risk capital, especially into the exploration, as well as for production drilling of highly uncertain green field developments; whereby, unlocking the resource potential in these geothermal fields in Chile.

17. *C2.2. Integration of geothermal power in the broader power market in Chile through an adequate incentive framework:* There is a need to rationalize the scale and timeframe for geothermal expansion in Chile and ensure that the power markets in the country can adequately integrate geothermal into the respective systems. In general, competitive markets fail to reward positive externalities embedded in Renewable Energy Technologies (RETs) or address technology specific barriers to make RETs competitively comparable. Therefore, identifying and implementing appropriate incentives that will create an "even playing field" for geothermal to complete and even flourish will be important complement to the other reforms by the GoC, since most geothermal developers' financial incentives will be strongly linked to the power sector.

18. The preliminary focus of the activity will be for the MoE to identify, design, and implement an incentive framework that would enhance the overall "bankability" of geothermal developments in Chile, and create a more favorable environment for investments in the sector commensurate with the GoC's development goals. This activity would benefit from a detailed evaluation of the existing power market in Chile to be conducted by the Bank (see Annex 3 for details) with a view to integrate geothermal under various scenarios in the future.

19. *C2.3. Design of a strategy to enhance geothermal competitiveness in the long term by exploring synergies with domestic sectors and medium and low enthalpy uses:* Based on the performance of the drilling activities in the few fields that have been explored, there is evidence that geothermal development can face significant logistical challenges and high financial costs. The location of most geothermal projects in the high cordillera implies dealing with complex logistics in very remote sites, and rugged terrain and harsh climatic conditions often result in limited seasonal operational timeframes. In addition, most of the equipment and services required for geothermal drilling are at present unavailable domestically in Chile and need to be imported and adapted to specific local conditions, national regulations, and commercial requirements. Another factor that poses challenges for geothermal development is the relatively small size of the market. At present, even the limited funding that has flowed is primarily focused on power generation, and there is scant efforts to expand markets to other direct uses for geothermal, which can improve the economies of scale for drilling operations. Many existing developers have indicated that expanding the market to where they could do year round drilling at a larger scale would help reduce the overall cost of geothermal drilling operations. This would enhance the competitiveness of geothermal and enhance project viability.

20. The MoE will prepare a strategy for enhancing domestic content in geothermal development through existing industries and service providers in Chile that could contribute domestically to the geothermal sector, which would be implemented through a series of reforms. It would focus on key elements and actions needed to be articulated and stimulated to provoke the transformation/adaptation of domestic industrial capacity to support the geothermal industry. Promoting domestic industries to provide specific services and goods required by the geothermal sector could contribute to facilitating development and bringing down the cost of geothermal projects over the long-term. This benefit may be of special relevance at the early exploration phases, given the high impact of drilling on project costs when resource availability risk is still very high. The strategy may focus on elements that could promote the creation of a national drilling industry for geothermal purposes or associated industrial sectors, such as steel or turbine manufacturers, that could adapt their products to meet the specific needs of the geothermal industry. Once industry needs are identified (under an assessment lead by the World Bank, see Annex 3), the strategy may include technical necessities and commercial incentives that could be put in place to direct the industries towards contributing to the geothermal industry with domestic products. The proposed project will support the MoE implement the necessary reforms to create the market incentives for greater support to geothermal development by domestic industries and service providers.

21. The identification of suitable alternate applications of geothermal energy, including the use of low and medium enthalpy resources for direct uses, will be an important part of this effort. Both low-mid temperature resource uses and downstream developments of geothermal-electric projects will be analyzed. Besides the high temperature geothermal resources associated with recent volcanic areas in the high Andean Cordillera, Chile is also endowed with low-mid temperature geothermal resources, which are located in less remote and more populated regions than the high cordillera. These resources provide potentially interesting opportunities for residential and commercial space heating applications and use of geothermal heat in industrial processes. The component entails the design of a strategy that MoE could implement both the potential of these

resources and geolocation, and the size and location of the potential demand to develop previously identified areas that could be promoted. The ultimate goal of this strategy would be to broaden the geothermal market and industry, and enhance viability of, and synergies with, potential power projects, by promoting multiple uses of geothermal resources.

22. The breakdown of project components, costs, and source of funds is shown in the following table.

#	Components/Key Activities	GoC implemented		Total Cost
		CTF Grant	GoC In-kind	
Component 1- Improve policy framework and strengthen management capabilities to help mobilize investments in geothermal energy				
1.1	*Enhance legal and regulatory framework for geothermal development*	125,000	75,000	200,000
1.2	*Review geothermal concession management framework*	200,000	50,000	250,000
1.3	*Capacity building and institutional strengthening*	605,000	140,000	745,000
1.4	*Stakeholder engagement to raise awareness regarding geothermal development taking into account environmental and social considerations*	400,000	85,000	485,000
Sub-Total		*1,330,000*	*350,000*	*1,680,000*
Component 2 – Enhancing market conditions for promoting sustainable development of the geothermal energy sector				
2.1	*Geothermal resource risk mitigation framework to help mobilize investments in exploration and production drilling*	250,000	120,000	370,000
2.2	*Integration of geothermal power in the broader power market in Chile through an adequate incentive framework*	-	20,000	20,000
2.3	*Design of a strategy to enhance geothermal competitiveness in the long term by exploring synergies with domestic sectors and medium and low enthalpy uses*	200,000	60,000	260,000
Sub-Total		*450,000*	*200,000*	*650,000*
Total		**1,780,000**	**550,000**	**2,330,000**

Annex 3: Coordination with Bank Executed Trust Funds

1. The proposed project forms a complementary part of a package of initiatives being undertaken by the GoC with the assistance of development partners through CTF support. As previously noted, the CTF has approved Chile's revised Investment Plan, which allocated a total of US$53 million[17] in funding toward a concerted and catalytic effort to advance geothermal development in Chile and begin to exploit geothermal's large estimated potential. The private sector arm of the IDB expects to channel US$50 million, combined with its own financing, to support at least two geothermal projects that have advanced exploration through slim hole or full diameter drilling, for resource confirmation. For such efforts to succeed, it will be important to bolster existing market conditions so that developers can make immediate investments confidently in early stage geothermal development. The investment climate necessary to support the multiple stages of full geothermal development—from surface reconnaissance through to operating power plants—must be considered, with a view to achieving a long-term progressive and sustainable scale-up of the sector.

2. To kick-start Chile's geothermal program while attempting to catalyze investments, it is also vital that key reforms in the policy framework and in concession management are made. These reforms would help smooth the way for geothermal field development beyond the initial risky stage of resource confirmation. In order to achieve this, the GoC has requested that the World Bank use its global experience to assist the GoC to make key reforms to improve market conditions and to facilitate greater immediate and long-term investments in the sector so that geothermal can eventually become a key pillar in a diversified power generation mix in Chile. US$1.22 million of the US$3 million CTF funds has been allocated in the form of a World Bank executed trust fund to support these key policy, regulatory, institutional, and market reforms to promote sector development, through advisory services. Given the importance of this work, the GGDP, managed by ESMAP, has agreed to provide an additional US$500,000 in Bank executed trust fund support for the proposed project.

3. The World Bank will be responsible for deploying the funds from ESMAP and CTF; implementing the Bank-executed advisory activities; and provide implementation support for the GoC executed aspects of the proposed project. The World Bank will establish the necessary trust funds to channel the ESMAP and CTF funds; and transfer the client-executed CTF funds to the GoC on the basis of a grant agreement.

4. Through the proposed project, the World Bank, informed by international experience, will provide advisory services to the GoC in designing strategies and identifying specific solutions to address the key barriers that impede geothermal development in Chile, while strengthening GoC's capacity both to oversee and manage geothermal development and to implement the identified reforms. The activities are in line with the proposed project and will complement the two components summarized in the project description, with the intention of comprehensively addressing several key barriers.

[17] The initial reallocation of funds for geothermal development was US$33 million in November 2013, but this amount was later augmented with an additional US$20 million from the CTF private sector window as a part of the GGDP for a total allocation of US$53 million.

5. The rational for direct participation of the Bank in the operation is for the project to benefit from the Bank´s extensive experience in the geothermal sector, as the main Multilateral Development Bank (MDB) with global knowledge of this technology. This exposure of the Bank to different regulatory frameworks, technological issues and incentive frameworks is highly valued by the Government of Chile, which prompted the request for Bank´s direct technical assistance, in the form upstream advisory support through the Bank executed grants. The GoC will be responsible for design and implementation of the policy, regulatory and institutional reforms that will be implemented through the proposed project with the support of the government executed grant. Therefore, there is a clear distinction between the Bank Executed (BE) activities and the Government Executed (GE) activities within the Project. The Bank will contribute through its global position and convening capabilities to secure the services of external and internal international experts to deliver upstream technical advisory support that is not available in Chile and difficult for the Ministry of Energy to secure otherwise. To ensure country ownership, the BE activities, for all components, will be limited to providing: (1) High level, upstream advisory work to inform Ministry of Energy´s decisions; whereby (2) the Bank can leverage its relevant global experience. The Government of Chile will be responsible for decision making, legal, regulatory and incentive framework design, stakeholder engagement and coordination of the industry, and the implementation of all reforms funded through the support of the government executed grant. The GoC will also be responsible for all fiduciary aspects including procurement, financial management and monitoring and evaluation of the government executed grant. As such, the BE activities are upstream advisory to help inform the design and execution of the GE activities.

6. The following describes the Bank executed activities related to the project and how they complement those carried out by the GoC:

7. **Component 1-** Improve policy framework and strengthen management capabilities to help mobilize investments in geothermal energy

8. *C1.1 - Enhance legal and regulatory framework for geothermal development*: The Bank will conduct a comprehensive review of the present Law on Geothermal Energy Concessions (No. 19,657), its implementing regulations, and other related policies that impact the development of the geothermal sector. This would enable the identification of gaps and inconsistencies within the legal framework, given the GoC's overall geothermal development objectives leading to the design of the reforms necessary to address these shortcomings. Furthermore, the Bank will conduct a gap analysis, comparing domestic requirements with international standards, on the various associated legal and regulatory requirements in other sectors that impact geothermal development, with a particular area of focus being the environmental and social obligations for geothermal developers.The Bank will mobilize the necessary expertise to share various international practices, examples of other legal and regulatory framework worldwide, and technical issues. This will include disseminating lessons from developed and developing countries within the LCR region and globally, on their geothermal experience. This information will be used to understand from an overall policy standpoint, how and what mechanisms those countries used to be able to attract investments to the sector. This will also enable the review of Chile's existing regulatory framework compared with experience in other countries to identify short comings that could be included in a reform program.

9. The international experience and upstream advice will enable the GoC to utilize the GE trust fund to design and develop a set of reforms that will enhance the policy framework for geothermal, draft the necessary regulations, and carry out stakeholder consultations before enacting them in order to improve the overall investment climate for geothermal in the country. The GoC will also evaluate the impact of the reforms that may lead to the design of additional amendments to adjust the policy framework for optimal performance. These activities and associated decisions will be carried out by the GoC with the support of the GE trust fund.

10. *C1.2 - Review geothermal concession management framework*: Under this component, the Bank will evaluate the existing management framework for granting and overseeing the geothermal concession system, compare its suitability given the revised legal framework and identify shortcomings commensurate with GoC's goal. It will entail the evaluation of: (i) the eligibility criteria; (ii) the existing process to evaluate concession applications/bids; (iii) the milestones for exploitation concessions; (iv) the available governance tools to enforce policy; (v) the grant of concessions; (vi) the governmental monitoring process of concessions; (vii) the internal monitoring procedures; and (viii) the online-based information system. The Bank will mobilize expertise to share international practices for the evaluation and possible reform of the existing management framework for granting and overseeing the geothermal concession system. In particular, the Bank will share lessons on issuing and managing concessions, as is practiced in other countries –including policy enforcement– in the geothermal sector. The Bank specialists will compare accepted industry practices with the existing system presently under implementation in Chile, and identify shortcomings. It will help define appropriate eligibility criteria for concessions, information requirements from developers, potential criteria for evaluating bids, approaches to the multi-stage concessioning process, and activities that are typically allowed during these various stages. It will also include the facilitation of information exchange between officials from other geothermal development countries and their Chilean counterparts, including through learning visits.

11. The GoC will utilize this information and experience to undertake the necessary restructuring of its geothermal concessioning system, and improve its oversight and management of the process. This will include a review of its internal concession management system to optimize operations, steps to strengthen the monitoring of awarded concessions to ensure compliance with investment and related agreements, and carry out evaluation of exploitation concession requests. The design and implementation of these measures and the ongoing management of the concession framework will be supported through the GE trust fund.

12. *C1.3. Capacity building and institutional strengthening*: The Bank has convened a group of internal and external international experts specializing in various aspects of geothermal development. They specialize in areas such as geothermal resources, drilling, geothermal power, finance, and environmental and social safeguards. The Bank will mobilize these specialist to provide advisory support across the BE program including just-in-time support to help the GoC address evolving needs that arise over the course of the project. The Bank group will also organize specific training sessions to develop the capacity especially within the Ministry of Energy in Chile. This will also include the Bank utilizing its convening capacity to facilitate cross country exchanges where the Chileans could benefit from the experience of other geothermal developing countries.

13. Since the World Bank is administering the overall CTF Grant, an administrative fee (Multilateral Development Bank fee) of five percent of the US$3 million grant amount (US$140,000) will be applied to cover the administrative costs such as project supervision, procurement oversight, and compliance with safeguards, and is provided under the Bank Executed CTF TF.

14. The GoC will hire a geothermal technical advisor to provide on-the-ground advisory support to the Ministry of Energy, to boost its existing capacity on the geothermal sector. The technical advisor will be responsible for supporting the coordination of all activities related to the project, including identifying key evolving sector needs. S/he will also be responsible for identifying the just-in-time support and additional training and capacity building needs, and facilitate its acquisition in order to meet the project objectives.

15. *C1.4. Stakeholder engagement to raise awareness regarding geothermal development taking into account environmental and social considerations*: For the Bank, this component will review the MoE's recent experience with community engagement and consultations, and provide recommendations. The Bank will bring to bear its expertise and experience in geothermal development including environmental and social safeguards, which will help advise the GoC on the requirements for meeting international standards. The Bank will also help organize international knowledge exchanges so that Chilean stakeholders will have the opportunity to access experiences from other countries. This work will also enable the Bank to carry out high-level diagnostic studies, including identifying gaps between existing policy in Chile and international good practice. This will provide a basis for enhanced awareness in Chile regarding geothermal and also an opportunity to raise the standards in Chile for the application of environmental and social safeguards.

16. The GoC will carry out stakeholder engagement to raise awareness across the country regarding geothermal development especially given the nascent nature of the sector in Chile. The GoC will convene various stakeholders including potential project affected people so that they can participate in awareness building activities including exchanges with other geothermal development countries. The GoC will take the lead in communications and carrying out other awareness raising activities. The GoC will incorporate feedback arising from the consultation and awareness raising activities especially with regards to safeguards policies, into the reforms that will be implemented through the proposed project. These activities that will be led by the GoC will be supported through the GE trust fund.

17. **Component 2 –** <u>Enhancing market conditions for promoting sustainable development of the geothermal energy sector</u>

18. *C2.1. Geothermal resource risk mitigation framework to help mobilize investments in exploration and production drilling*: The Bank will review existing global experience, and support the GoC and actively participate in engaging existing and potential investors in Chile to identify specific challenges facing those looking to mobilize investments, especially in exploration and production drilling, so that the GoC may benefit from the World Bank´s global experience. The Bank will evaluate the various risk mitigation approaches that have been applied globally including

identifying the various conditions under which some have thrived and others have been less successful. This will include, in particular, mechanisms for addressing upstream resource risks, particularly during the exploration stage. With the assistance of international experts, the Bank will also review drilling practices in Chile and identify ways in which its overall costs can be reduced, as this poses additional risks for geothermal development. In addition, the Bank will provide the necessary international expertise to analyze and identify existing industries and service providers in Chile that could contribute domestically to the geothermal sector, which could enhance domestic participation in the industry that would also contribute to cost and risk reduction. Overall, the BE grant supported activities would identify a menu of possible options based on international experience that could be adapted to the Chilean context to mitigate geothermal risks that could lead to greater investments in the sector.

19. The GoC, as result of the Bank's advisory support, will select a set of options that are applicable in Chile in order to design a geothermal risk mitigation framework for the country. Once selected, the GoC will consult sector stakeholders and further refine the options as necessary, before developing these options so that they are ready for implementation. The GoC will also undertake any adjustments that will be necessary to adapt the legal and regulatory framework to support the geothermal risk mitigation options that will be implemented in Chile. These activities that will be led by the GoC will be supported through the GE trust fund. It is also important to note that the high level advisory support provided by the Bank will also help inform the support that is being provided by IDB to mitigate risks in several specific geothermal projects in Chile as a part of the overall CTF Investment Plan.

20. *C2.2. Integration of geothermal power in the broader power market in Chile through an adequate incentive framework*: The Bank will conduct an assessment that will be centered on the two larger non-interconnected networks, SING and SIC – which are envisaged to be the primary off-takers for much of the expected geothermal generation capacity. The evaluation will include: (i) an assessment on the supply side, including the economic levelised cost of energy (LCoE) of the existing capacity in the system, firm and variable capacity, and planned capacity additions; (ii) a medium to long-term demand analysis and forecast, including current and expected capacity gaps; (iii) analysis of maximum integration of RETs in the main networks, including a stress analysis in the most unfavorable conditions of the relevant seasons; (iv) dispatch restrictions and PPA conditions for RETs; (v) cost of spinning reserves/back-up capacity; (vi) base load capacity; (vii) system costs; and (viii) technical restrictions of the grid, considering frequency and voltage security standards and grid code. The evaluation will provide insights into the absorptive capacity for geothermal including its competitiveness in the power market under the current contracting regime in the absence of any equalizing factors. Once some business-as-usual scenarios are identified, the analysis will assess the various economic benefits including externalities that arise due to geothermal as well as other generation technologies that would otherwise not be internalized in investment incentives and decision-making. It will also take into account other parameters such as dispatchability, security of supply, diversification of the generation matrix, co-benefits, and reduction on oil and gas imports and impacts on the countries balance of payments. Taken together, it would provide insights into the integration of geothermal under fair competition in the Chilean power market, helping identify the financial and other constraints that limit the bankability of geothermal investments that deter expansion of the sector in Chile. The Bank, mobilizing globally

applied techniques for systems planning, will review the overall expansion plans in Chile for power generation and evaluate the scope and scale to which geothermal can be integrated into the existing power system. This will establish the competitiveness (including externalities) of geothermal compared with other technologies in the broader power market in Chile; and also help identify potential power system bottlenecks for integrating the technology in-line with the GoC goals.

21. The GoC, with the benefit of the Bank's advisory assistance, will rationalize its geothermal expansion plans by reconciling its overall development goals and the existing power market conditions. This would include undertaking necessary reforms and implementing adequate incentives that would facilitate the integration of the geothermal power supply in the broader power market and to compete with other power generation sources under fair conditions.

22. *C2.3. Design of a strategy to enhance geothermal competitiveness in the long term by exploring synergies with domestic sectors and medium and low enthalpy uses*: The Bank will identify suitable alternate applications of geothermal energy, including the use of low and medium enthalpy resources for direct uses. The analysis will include both low-mid temperature resource uses and downstream development of geothermal-electric projects. Both the potential of residential and commercial space heating applications and use of geothermal heat in industrial processes will be evaluated as well as an assessment of these resources and geolocation, and the size and location of the potential demand. This assessment will provide the basis for identifying potential development options and actions required to promote direct use of geothermal heat. The Bank will mobilize international experts to share different regulatory frameworks and incentive schemes deployed internationally to promote the use of low and medium enthalpy geothermal resources. The Bank will also inform about technical solutions available to tap into these resources in different sectors.

23. The GoC will decide which sectors are best positioned in Chile to develop low and medium enthalpy resources in an economic fashion and design the most appropriate schemes to promote the use of these resources, based on the advice provided by the Bank on international experiences, customized to the Chilean case. The decision making, support scheme design, and implementation will be carried out by the GoC with the GE trust fund.

Annex 4: Implementation Arrangements

Chile: Technical Assistance for Sustainable Geothermal Development Project

Institutional and Implementation Arrangements

1. Within the GoC, the lead implementation agency regarding technical matters, overall oversight of the project, as well as day-to-day supervision will be the Ministry of Energy (MoE), while the recipient of the funds along with fiduciary responsibilities will be with the Agencia de Cooperación Internacional de Chile (AGCI) within the Ministry of Foreign Relations. A Subsidiary Agreement will be signed between AGCI and the MoE outlining their respective obligations and arrangements for the proposed project before effectiveness. Both MoE and AGCI have prior experience working with the World Bank, and a similar arrangement is currently in place for implementing the grant funds for the ongoing Program for Market Readiness (PMR).

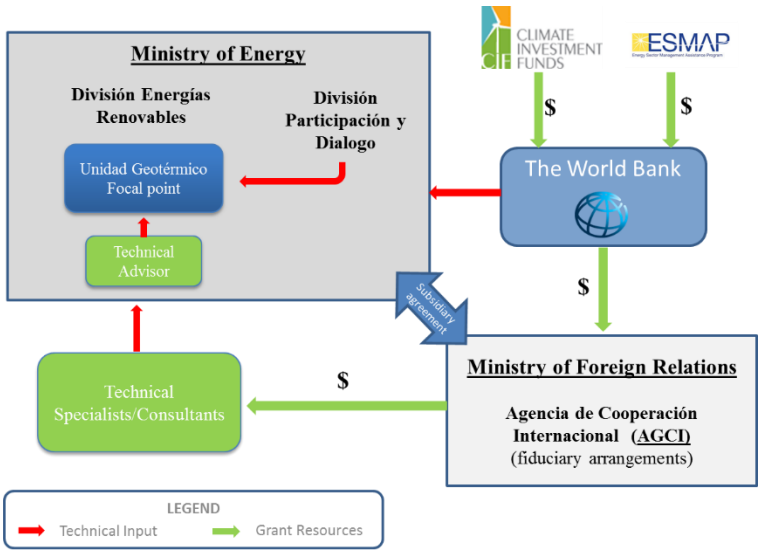


Figure IV.1 - Illustration of Institutional Roles

2. The specific institutional roles for implementing the project are as follows:

a. Ministry of Energy (MoE): Given its mandate and organizational structure, the MoE is well positioned to oversee the overall implementation of the technical activities included in the proposed project; and engage various stakeholders in consultations and implementation. Within the MoE, the proposed project will be implemented under the Directorate for Renewable Energy's Geothermal Unit. In addition to their specialized staff, the Geothermal Unit would secure the services of an experienced Technical Advisor, who will coordinate the mobilization of other specialists required to carry out specific tasks. The Geothermal Unit will also coordinate very closely with the MoE's Division for Participation and Dialog, who oversee the social aspects of the sector including the stakeholder consultation and engagement with indigenous peoples. The MoE's specific tasks and responsibilities will include: (i) identifying the specific scope of work necessary for carrying out specific project activities and selecting appropriate specialists (in

coordination with AGCI); (ii) preparing the project's budget, operational annual plan and procurement plan in coordination with AGCI; (iii) reviewing and approving products and services before authorizing payments; and (iv) monitoring of overall project implementation.

b. Ministry of Foreign Relations: As the recipient of the funds, the Agencia de Cooperación Internacional de Chile (AGCI), within the Ministry of Foreign Relations will carry out all fiduciary functions. AGCI will coordinate all of its activities related to the proposed project with the MoE. The specific responsibilities of AGCI include: (i) managing the Designated Account and a local currency account to process payments; (ii) processing and recording project transactions; (iii) managing procurement and contracting processes; (iv) preparing and submitting withdrawal application requests; (v) preparing annual and interim project financial statements; and (vi) coordinating audit reviews. Details of its main duties and responsibilities are specified in the Project Operational Manual.

Financial Management (FM) and Disbursements Arrangements.

3. The description of the FM and Disbursement arrangements for this project are based on the FM arrangements agreed with the GoC for the Market Instruments for Climate Change Mitigation in Chile (PMR) project, declared effective on September 5, 2014. Under these arrangements, project implementation will be under the MoE through the Directorate for Renewable Energy's Geothermal Unit (DREGU) as project executing unit and the Agencia Chilena de Cooperación Internacional para el Desarrollo (AGCI) as project financial administrator. Under these arrangements, the DREGU will be responsible for technical aspects of the project and for overall monitoring of the project. In particular, the DREGU will prepare terms of reference; approve contracting processes in accordance with the project's budget and procurement plan; and accept products/services. AGCI as responsible for fiduciary tasks, will carry out procurement processes; carry out payments; record project transactions; prepare and submit project financial information; and coordinate audits. These arrangements will be reflected in detailed inter-institutional agreement to be signed by both entities.

4. The AGCI is a well-established entity that has developed expertise implementing IDB financed projects and is currently implementing World Bank-financed projects.[18] Within AGCI, its Management and Finance Unit, led by the Chief of the Administration and Finance Department, will be responsible for project financial management. The project involves Bank-executed and Recipient-executed activities that are clearly defined and straightforward. As in other projects, grant proceeds and transactions will not be included in the national budget of the AGCI; however, project transactions will be processed and accounted for in the government's integrated financial management system (SIGFE) following the "Administración de Fondos" mechanism. In addition to this, a complementary information system, managed by AGCI for projects, will also be used to have detailed information on the project expenditures.[19]

[18] Market Instrument for Climate Change Mitigation in Chile TF17731; Chile FCPC Readiness Preparation Grant TF16024; GEF Sustainable Land Management TF 15104, all currently effective.

[19] The Accounting Manual of Chile establishes the accounting process to be followed by public administrators entities which do not include financing resources a part of their budgets.

5. On the basis of the review performed, the FM team concludes that the FM risk is Low and that the proposed financial management arrangements are acceptable to the Bank, subject to: (i) submission of the final format for project financial statements; and (ii) submission of the FM chapter in the project's operational manual; both, before the grant agreement is signed. Within two months after effectiveness, the project will have to designate the FM counterpart for the project and inform the Bank and sign the inter-institutional agreement between the MoE and the AGCI.

7. *Organization and staffing*. The AGCI has a well-established financial unit, responsible for accounting, treasury, reporting and auditing tasks under the project. A qualified and experienced FM professional will be assigned for day-to-day project implementation.

8. *Programming and Budgeting*. The DREGU, in coordination with the AGCI, will prepare the annual operation program (AOP) and procurement plan (approved by the Bank) to be used for monitoring purposes. As in other projects, under the AGCI financial administration, project transactions will not be incorporated under their entity's budget and project transaction will be only controlled and recorded following the "Administración de Fondos" mechanism.

9. *Accounting Policies and Information System.* Chile's regulatory FM framework[20] will apply to this project. Within such framework, project transactions will be accounted for in the government's integrated financial management system, SIGFE, and complemented by the accounting system for projects called "Multiproyectos" to record detailed project transactions by type of expenditure and component. Multiproyectos information will be used by the AGCI to prepare the financial reports and disbursement reports as described below.

10. *Processes and procedures.* The AGCI and the DREGU have to comply with local requirements related to internal controls and internal procedures. The AGCI will maintain auxiliary reports of payments made by contracts, and will maintain adequate segregation of duties to control, record project transactions and financial reporting. Roles and responsibilities of the DREGU and the AGCI during project implementation will be reflected in a subsidiary agreement to be signed between both entities.

11. *Financial Reporting*. As with the PMR project, AGCI will prepare project financial statements (including disbursement reports), based on SIGFE and Multipropositos information systems, using the cash basis. *Project-Interim financial reports (IFRs)* will be semi-annual, prepared in U.S. Dollars, submitted to the Bank not later than 45 days after the end of each calendar semester and will include: i) a statement of sources (incomes) and uses of funds (expenses), and cash balances; ii) statement of cumulative investments; iii) designated account reconciliation; and iv) explanatory notes to the financial statements. Annual financial statements for the project will be prepared for auditing purposes. The core content and format of the reports are being agreed with the AGCI and should be finalized before signing of the legal agreement.

[20] (i) the *Ley Orgánica de la Administración Financiera del Estado*, Decreto ley N° 1263 de 1975; (ii) Accounting procedures manual for the Public Sector (*Manual de Procedimientos Contables*) issued by the Supreme Audit Institution (CGR); (iii) the annual Law of the General Budget of the State; and (iv) the Ministry of Finance regulations and manuals.

12. Audit Arrangements. Annual audit reports for the project will be performed by the Contraloria General de Chile and submitted to the Bank within six months of the end of the Recipient's fiscal year. Audit requirements would include the following:

Audit Report	Due date
Project financial statements	June 30
Management Letter	June 30

13. Funds Flow and Disbursement Arrangements. Similarly to the PMR Project, the Bank will disburse grant proceeds using the disbursement methods of reimbursement, advance and direct payment. A new Designated Account (in U.S. Dollars) will be opened and maintained in the Banco Estado by the AGCI. Funds deposited into the Designated Account (DA) as advances, will follow the procedures described in the Disbursement Letter and the applicable Bank policies as referenced in the letter. The AGCI will also open a local currency bank account in pesos at Banco Estado, where funds withdrawn from the DA will be deposited and subsequently utilized exclusively to make payments under the project. Payments of eligible expenditures will be made by the AGCI subject to authorization from the DREGU. The DA has a ceiling, which is the maximum amount of grant proceeds that may be on deposit in a DA pending the provision to the Bank of supporting documentation evidencing the use of advance of funds. The ceiling of the DA for this project is US$200,000 which has considered the life of the project (four years) and an average of the planned project expenditures for six months. The initial advance to the DA could be requested for the total amount of the ceiling or the recipient may consider requesting partial advances to replenish the DA as long as these advances do not exceed the ceiling of the DA. Retroactive Financing is not envisaged for the project. Grant proceeds would be disbursed against the following expenditures categories:

Table of Grant Proceeds		
Category	**Amount of the Grant Allocated (in US dollars)**	**Percentage of Expenditures to be financed (inclusive of taxes)**
1. Consulting services, goods, training and operating costs under Part 1 and 2 of the Project.	1,780,000	100%
TOTAL AMOUNT	**1,780,000**	

Procurement

14. Procurement for the proposed Project would be carried out in accordance with the World Bank's *"Guidelines Procurement of Goods, Works and Non-Consulting Services under IBRD Loans and IDA Credits & Grants by World Bank Borrowers",* dated January 2011, revised July 2014, "*Guidelines Selection and Employment of Consultants under IBRD Loans and IDA Credits & Grants by World Bank Borrowers*", dated January 2011, revised July 2014; and the provisions

stipulated in the Grant Agreement. For each contract to be financed by the Grant, the different consultant selection methods, estimated costs, prior review requirements, and timeframe are agreed between the Borrower and the Bank in the Procurement Plan. The Procurement Plan will be updated at least annually or as required to reflect the actual project implementation needs and improvement in institutional capacity. The Borrower, through AGCI, has prepared a detailed and comprehensive procurement plan that includes all contracts for which bid invitations and invitations for proposals are to be issued in the first 18 months of Project implementation. The Procurement Plan will be available at the Procurement Plans Execution System (SEPA). Goods, works, and non-consulting services shall be procured under contracts awarded on the basis of International Competitive Bidding, National Competitive Bidding, Shopping, Direct Contracting and local procedures, such as Framework Agreements (for contracts up to US$350,000). Consultants' services shall be procured under contracts awarded on the basis of Quality and Cost-based Selection, Quality-Based Selection, Selection under a Fixed Budget, Least Cost Selection, Selection Based on the Consultants' Qualifications, Single Source Selection, Mercado Público of ChileCompra and, Procedures set forth in Section V of the Consultant Guidelines for the Selection of Individual Consultants, including Single Source Selection for Individual Consultants.

15. **Training:** Training would include expenditures incurred by the Borrower to finance logistics for workshops, meetings, and seminars, and reasonable transportation costs and per diem of trainees and trainers (if applicable), training registration fees, and rental of training facilities and equipment, and other costs directly related to training courses preparation and implementation (but excluding goods and non-consulting services).

16. **Operating Costs:** The project will finance expenses for project day-to-day administration, for the incremental expenses incurred on account of Grant activities implementation by AGCI and MoE, such as: document printing, consumables, travel costs and per diem for staff, for activities linked to the implementation of the Grant Activities. The operating costs would be procured under institutional arrangements.

17. Assessment of the agency's capacity to implement procurement:

a. **Country.** The risk associated with the Bank portfolio in Chile should be considered low. Government contracts in Chile are conducted transparently and efficiently thanks, as a result of a modern and transparent electronic procurement system (the Public Market of ChileCompra); although procurement processes, outside the use of this system could be lengthy at times, the robustness and capacity of institutions in charge of procurement make Chile one of the countries with the most reliable and transparent procurement system in the region.
b. **Agency**. In accordance with the implementation arrangements, AGCI will be responsible for the fiduciary activities of the Project, including procurement, financial management and disbursement. AGCI is adequately staffed and will maintain its capacity to conduct Procurement under this new operation. For procurement. AGCI counts on an Administrative and Financial Management Unit lead by the Chief of the Administration and Finance Department, which is supported by: (a) one person in charge of Procurement (Encargado de Adquisiciones), (b) Purchase Executives (Ejecutivos de Compras), (c) a person in charge of reception and storage of goods and supplies (Encargado de

Abastecimiento), and (d) Contract Administrators (Administradores de Contratos). AGCI would be beneficed for experience in parallel operations with similar implementation arrangements: Chile – Partnership for Market Readiness (PMR), financed by the World Bank, and Chile – First Biennial Update Report, financed by GEF, and the World Bank acting as the trustee of the funds. An assessment of the implementation agency's capacity to implement procurement actions for the Project was updated on April 2015. The capacity assessment looked into AGCI's: (a) organizational structure, (b) facilities and support capacity, (c) qualifications and experience of the staff that will work in procurement, (d) record-keeping and filing systems, (e) procurement planning and monitoring/control systems used, and (f) capacity to meet the Bank's procurement contract reporting requirements. It also reviewed the procurement arrangements proposed in the Procurement Plan.

18. Considering the country's and the agency's capacity to implement procurement, as outlined above, the overall project risk for procurement is **Moderate** (M).

19. The corrective mitigating measures proposed are:

Mitigating Measure	Stage
Configure SEPA as the system to expedite and monitor Procurement Plan	Before effectiveness
Hiring a skilled professional in procurement, if the load of work requires it	During implementation
Procurement post-reviews, and/or supervision missions carried out by the Bank	During implementation

Procurement Plan

General

Bank's approval date of the Procurement Plan: November 18, 2015

Date of General Procurement Notice: Estimated first quarter Fiscal Year 2017.

Period covered by this Procurement Plan: 18 months

20. The procurement plan will be updated in agreement with the Project team, at least annually or as required to reflect the actual project implementation needs. The Procurement Plan will be available and updated through the Procurement Plan Execution System (SEPA).

21. The Procurement Plan shall set forth those contracts which shall be subject to the Bank's Prior Review. All other contracts shall be subject to Post Review by the Bank, except for those contracts terminated by the recipient's agency for which the Borrower shall seek the Bank's no objection prior to the proposed termination.

a. Goods, Works and non-consulting services

Prior Review Threshold: Procurement Decisions subject to Prior Review by the Bank as stated in Appendix 1 to the Bank's "Guidelines: Procurement under IBRD Loans and IDA Credits".

b. Selection of Consultants

Prior Review Thresholds for Consulting Services: Procurement Decisions subject to Prior Review by the Bank as stated in Appendix 1 to the "Guidelines: Selection and Employment of Consultants under IBRD Loans and IDA Credits & Grants by World Bank Borrowers":

Thresholds for procurement methods and prior review (thousands of USD)			
Contract Category	**Contract Value (Thresholds) US $ thousands**	**Procurement Method**	**Contracts Subject to Prior Review**
Goods and Non-Consulting Services	>3,000	ICB	All
	100-3,000	NCB*	
	<100	Shopping / CCompra, FA	First
	Regardless of value	DC	All
Consulting Services			
Firms	>=300	QCBS, QBS, FBS, LCS	All
	<300	QCBS, QBS, FBS, LCS, CQS, CCompra	None
	Regardless of value	SSS	All
Individuals		3CVs	>=100 or First
		SSS	All
Note:	QCBS = Quality- and Cost Based Selection QBS = Quality-Based Selection FBS = Fixed Budget Selection LCS = Least-Cost Selection CQS = Consultants' Qualifications Selection SSS = Single-Source Selection FA = Framework Agreements CCompra: ChileCompra procedures		

* For contracts up to US$350,000 equivalent, Mercado Público portal of ChileCompra may be used for advertisement and processing, as alternative to NCB and Bank's shopping procedures, provided that the bidding documents are acceptable to the Bank.

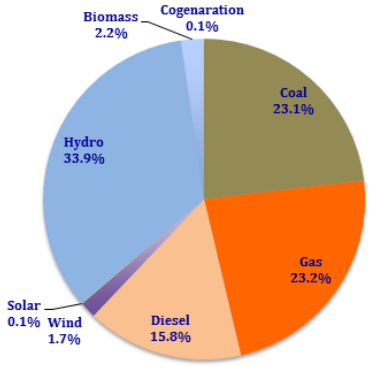
22. **Short list comprising entirely of national consultants:** Short list of consultants for services, estimated to cost less than US$500,000 equivalent per contract, may consist entirely of national consultants in accordance with the provisions of paragraph 2.7 of the Consultant Guidelines.

23. **Frequency of Procurement Supervision** In addition to the prior review supervision to be carried out by Bank offices, the capacity assessment of AGCI has recommended one full annual procurement supervision mission, including field visits, post-reviews of procurement actions.

Annex 5: Additional Sector Information

Chile: Technical Assistance for Sustainable Geothermal Development Project

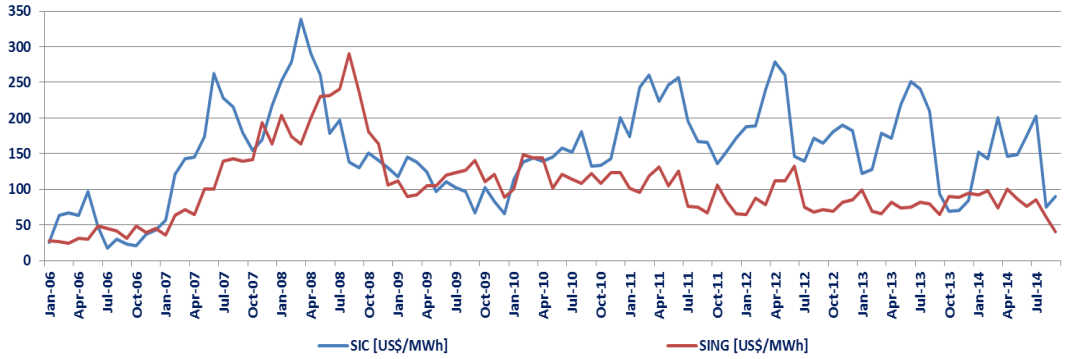
1. **Electricity in Chile is predominantly produced from thermal and hydro resources.** In 2013, thermoelectric installed capacity (coal, natural gas and diesel) accounted for 62 percent of the total power generation mix in Chile. Hydropower accounted for 34 percent, biomass made up 2.2 percent, wind was 1.7 percent and solar power was just 0.1 percent of the total installed capacity in the country**.** Figure V.1 below shows the country's capacity by source. With a few small exceptions, all the hydroelectric capacity is located in the SIC, representing 43 percent of that network's total installed capacity. The remainder of the installed capacity in the SIC is comprised of coal, natural gas and diesel, each with a share in excess of 15 percent. In the SING, where most of the energy–intensive mining industry is located, power generation is dominated by fossil fuels. Over half of the generation capacity in the system is based on coal, while natural gas makes up a significant 38 percent. Diesel provides 9 percent of the generation capacity in the SING.



Source: Ministry of Energy, Government of Chile

Figure V.1 Power Generation Capacity in Chile by Technology (2013)

2. **Marginal Price of Electricity in Chile.** Given the structure of the sector, electricity prices are mostly determined through market forces, thus, electricity prices have fluctuated, reflecting various factors, including volatility in fossil fuel prices, availability of hydro, and disruption of gas supplies from Argentina. Although electricity prices have moderated somewhat, in 2014 prices still ranged from US$90/MWh to about US$200/MWh.



Source: Ministry of Energy, Government of Chile

Figure V.2 Marginal Price of Electricity in SIC and SING

Box 1 - MiRiG Program

The Geothermal Risk Mitigation Program (MiRiG)

The Geothermal Risk Mitigation Program (MiRiG) is part of the CTF geothermal support to Chile to scale-up investments in geothermal development. Approved in April 2014, MiRiG was designed by the IDB in consultation with the Ministry of Energy of Chile to support geothermal projects during the high-risk drilling phase. MiRiG's objective is to stimulate additional investment in the sector, which will in turn eventually lead to the construction of Chile's first geothermal power plants. US$47.7 million in CTF resources, which can be structured as short-to-medium term loans or guarantees, is currently available to support geothermal projects, as is long-term project finance debt, depending on the particular risk and cost barriers of each project. MiRiG is expected to contribute to the development of approximately 100 to 150 MW of installed capacity. Following a preliminary review conducted by the IDB of the most advanced geothermal projects in Chile, four projects are presently being considered for support. Three projects were selected to participate in the first round of MiRiG funding, one of which the mandate letter has already been signed. The other two are expected to be signed by the end of 2016.

Annex 6: Clean Technology Fund

Chile: Technical Assistance for Sustainable Geothermal Development Project

Indicator	Units	I Short-Term Impact contributed to by CTF Intervention		II Scaled-up phase, with Increased Impact	
Installed geothermal capacity for power generation	MW	50 - 100*		250** - 800***	
Renewable Energy Generated Annually	GWh/Yr	373 - 745		1863 - 5,960	
Tons of GHG emissions reduced or avoided		**Low******	**High**	**Low**	**High**
- Annual	$KtCO_2e/Yr$	145	600	728	4,805
- Lifetime (Min. 30 years life)	$MtCO_2e$	4.4	18	21.9	144
Finance leverage through CTF funding	US$	50M + private sector			
CTF investment cost effectiveness	$US\$/tCO_2$	0.46	0.23		
Other Co-benefits					
▪ Enhanced energy security in the country due to utilization of an indigenous resource ▪ Expansion of domestic associated industries to support geothermal sector ▪ Local environmental benefits from lower pollution from thermal power generation ▪ More inclusive development due to better stakeholder engagement and awareness, including with indigenous peoples, at national, regional and local levels					

* Estimated installed capacity is consistent with IDB's MiRiGs program
** Estimated installed capacity by 2025 according to GoC 2014 Energy Plan
*** Potential based on estimate of 5% development of 16GW geothermal potential, consistent with the IDB's estimate
**** Low scenario: if all power plants are installed in SIC network; High scenario: if all are installed in SING network

I. INTRODUCTION

A. Country and Sector Context

1. **Chile is one of the most stable economies in Latin America with steady growth rates mainly driven by commodities export.** With almost 17 million inhabitants, and US$277 billion GDP in 2013[21], the country recorded an average annual growth rate of 3.5 % while per capita

[21] The World Bank

income over the past 20 years has almost doubled in real terms. The effects of steady growth on employment and income have significantly reduced poverty rates, although earnings and labor productivity have been distributed unevenly. Chile's economy is characterized as being open and heavily dependent on natural resources and foreign trade with the mining sector accounting for 60% of the country's total exports. The industrial sector (including value added in the mining sector), which is energy intensive, and services account for 37% and 60% of the GDP with agriculture making up the rest. Despite being a mature economy, GDP growth forecasts for Chile for 2014-18 are around 4% per year, almost twice the OECD average (2-2.3%).[22]

2. **To sustain economic growth and protect the gains in poverty reduction, the energy sector will need to keep pace.** Electricity demand in Chile has been out pacing economic growth, at around 7 percent per annum, doubling every 10 years. It reflects the energy intensity that is fueling economic growth. The GoC estimates[23] that an additional 8 GW of power generation capacity along with associated infrastructure improvements are needed to meet demand. This expansion will also need to be from a sufficiently diversified mix of generation options, including renewable energy, in order to optimize system reliability and efficiency as well as produce low and reliable prices while improving the local and global environment. Recognizing the need to diversify, the Government of Chile's (GoC's) Energy Agenda established a non-conventional renewable energy (NCRE) target of 20% or about 2,500-4,000 MW by 2025. Geothermal is envisaged as an important part of this target, especially for meeting base-load renewable energy needs.

3. **Chile's abundant geothermal potential provides a good renewable energy option to further diversify the country's power generation mix, reduce price volatility, and improve energy security.** There are good indications that the entire northern and central parts of the Andes have excellent geothermal energy potential. Studies indicate that the geothermal power generation potential in Chile can be in excess of 3 GW with some estimates suggesting that the potential may be as high as 16 GW[24]. Geothermal energy stands out among renewable energy systems for a number of beneficial reasons that address some of the key challenges facing the energy sector in Chile. In particular: i) unlike other renewable energy alternatives, such as wind and solar power, geothermal is a non-intermittent source[25] that can provide reliable base-load power on a 24/7 basis; ii) it is a clean source of energy emitting a fraction of the GHG emissions (CO_2) compared with other baseload options such as coal, and none of the local pollutants such as nitrous oxides (NOx) and Sulphur dioxides (SO_2), and total suspended particulates (TSP); iii) as an indigenous and non-tradable resource, it will enhance the energy security that has been of concern in Chile; iv) once developed, it can provide stable prices and serve as a natural hedge against the volatility of other commodity-driven electricity prices; and v) it offers the potential to provide for direct applications such as heat for households (district heating), and agricultural and industrial applications.

4. **While some renewable energy technologies have increased its utilization in Chile, others such as geothermal have faced greater hurdles in scaling-up.** While most renewable energies provide intermittent supply, hydropower with storage and geothermal are technologies

[22] Economist Intelligence Unit, Country Report, October 2013
[23] National Energy Strategy 2012-2030
[24] IDB Geothermal Risk Mitigation Program (MiRIG)
[25] The other presently available renewable technology is hydro with storage.

that are well suited for meeting base load needs. With most hydropower projects hampered by environmental concerns and many prime sites being already developed, geothermal has emerged as an important option. However, geothermal is a nascent industry in Chile with no operating power plant to date. Despite a large number of concessions being issued, very limited investments have been mobilized for developing many of these fields. There are a number of reasons for this outcome as many potential investments in geothermal are held back due to the upfront resource risks of developing green fields, clarity in the legal and regulatory framework for geothermal as well as power offtake, the relatively high costs of drilling and the modest scale of the current domestic market in the country, and more inclusive development considerations concerning environmental and social aspects of the technology. Therefore, if Chile is to develop geothermal as a viable alternate source of energy in a sustainable way, it will be important to address some of these specific key barriers, so that a nascent sector can progressively scale-up towards a transformational and impactful end.

B. Chile's CTF Investment Plan

5. The GoC's commitment to clean energy development for achieving energy and environmental goals is reflected in its energy agenda; and it is taking considerable action to tap global knowledge and experience through development partner support. In this regard, Chile secured the endorsement of the Clean Technology Fund (CTF) in May 2012 for its initial Investment Plan (IP) that included a CTF contribution of US$200 million. The CTF IP proposed projects in concentrated solar power, large scale photovoltaic, and efforts to promote self-supply of renewable energy and energy efficiency. While the CTF IP was being successfully implemented, it became evident that international experience and financial support would also be needed to address barriers and develop its nascent geothermal sector as, despite issuing a large number of concessions, progress has been stymied. When GoC was able to realize a savings in the CTF IP of US$33 million, it became timely to utilize the freed-up funding to support the geothermal sector. In September 2013, the GoC submitted and secured endorsement of a revised CTF IP, which included US$33 million in funds earmarked for geothermal development implemented through the Intern-American Development Bank (IDB) and the World Bank. Later, an additional US$20 million was secured from CTF for the same purpose through the effort by the Global Geothermal Development Plan (GGDP) that is led by the Energy Sector Management Assistance Program (ESMAP) at the World Bank. Of the total CTF allocation of US$53 million for geothermal, US$50 million is allocated through IDB to facilitate financing for several geothermal projects where field exploration (drilling) is sufficiently advanced and there could be a quick impact. The GoC is seeking the benefit of the World Bank's extensive global experience in supporting geothermal development, to help implement a complementary set of reforms in parallel that would progressively address the key barriers to sector development. CTF funds of US$3 million, US$1.78 million, executed by the GoC, and US$1.22 million, executed by the World Bank, (along with an additional US$500,000 from ESMAP through GGDP from non-CTF sources) are allocated towards technical assistance through the World Bank so that Chile could implement a set of reforms and strengthen its capacity in the geothermal sector that reflect accepted industry practices and meet international standards. The proposed technical assistance is expected to have an immediate impact by strengthening the existing architecture for facilitating financing from IDB and other sources for exploratory activities towards the development of commercializable steam fields; and also address barriers that will progressively enhance the market conditions for the sustainable development of geothermal in the longer-term. Taken

together, it is expected to be catalytic and will contribute to a transformational outcome.

C. Project Description

6. The proposed project forms a complementary part of a package of initiatives being undertaken by the GoC with the assistance of development partners through CTF support. As previously noted, the CTF has approved Chile's revised Investment Plan, which allocated a total of US$53 million[26] in funding towards a concerted and catalytic effort to advance geothermal development in Chile to begin to exploit its large estimated potential. The private sector arm of the IDB will be channeling US$50 million combined with its own financing to support at least two geothermal projects that are at various stages of resource confirmation. For this effort to succeed, it will be important to bolster existing market conditions so that developers can make immediate investments with confidence in early stage geothermal development. Therefore, if GoC is to achieve its geothermal development goals, then it is vital that some of the key barriers with regards to the policy framework and concession management are simultaneously addressed while attempting to catalyze investments in existing concessions; and a participatory approach is utilized to raise awareness about this nascent industry amongst the broader population as well we potentially impacted people as a result of future sector development. While these efforts will help kick-start the geothermal program, market conditions for sector development will need to be further and continuously enhanced in order to achieve a sustainable scale-up in the longer-term. Therefore, the activities in the proposed project will also help prepare the groundwork beyond the initial stage of riskier resource confirmation; and help support development over the multiple stages through which investments are necessary before an operational power plant is commissioned. It is with the intention of addressing the full project development cycle that the GoC has requested the World Bank to bring to bear its' global experience to assist the GoC undertake a number of key reforms.

7. The objective of the proposed project is to assist the Government of Chile (GoC) in resolving specific barriers to improve the geothermal energy market conditions. By addressing these key legal, social and market barriers, the proposed technical assistance will contribute to the development of commercializeable geothermal resources. CTF funding of US$3 million (US$1.78 million under GoC execution and US$1.22 million, under World Bank execution) has been allocated to support these key reforms to promote geothermal development. Given the importance of this work, the GGDP managed by ESMAP has agreed to provide an additional US$500,000 in Bank executed trust fund support for the proposed project. Overall, it will complement the US$50 million in CTF funding through IDB as well as the associated additional private financing; and beyond. At its conclusion, the aim is to determine the potential for commercializing geothermal development in Chile and contribute towards the progressive scale in order for the sector to become a key pillar in a diversified power generation mix in the country.

8. The proposed Technical Assistance for Sustainable Geothermal Development project will include a number of related activities designated under two project components. A detailed

[26] The initial reallocation of funds for geothermal development was US$33 million in November, 2013, but this amount was later augmented with an additional US$20 million from the CTF private sector window as a part of the GGDP; for a total allocation of US$53 million.

description of the project components and activities can be found in Annex 2. They are summarized below:

9. **Component 1- Improve policy framework and strengthen management capabilities to help mobilize investments in geothermal.**

a) Enhance legal and regulatory framework for geothermal development.
b) Review geothermal concession management framework:
c) Capacity building and institutional strengthening.
d) Stakeholder engagement to address social and environmental considerations of geothermal development.

10. **Component 2 – Enhance market conditions for promoting sustainable development of the sector**

a) Geothermal resource risk mitigation framework to help mobilize investments in exploration and production drilling.
b) Integration of geothermal power in the broader power market in Chile.
c) Design of a strategy to enhance geothermal competitiveness in the long term by exploring synergies with alternate uses and related domestic sectors.

Project Components	**Project Costs**	**Funding Sources (US$ millions)**			
		ESMAP	**CTF**		**GoC***
		WB executed		***GoC executed***	
1. Improve policy framework and strengthen management capabilities for mobilizing investments in geothermal.	**2.65**	0.20	0.72	1.38	0.35
2. Enhance market conditions for promoting sustainable development of the sector.	**1.40**	0.30	0.50	0.40	0.20
Total Project Costs	**4.05**	**0.50**	**1.22**	**1.78**	**0.55**

* GoC contribution is in-kind.

II. ASSESSMENT OF PROPOSED PROJECT WITH CTF CRITERIA

A. Potential for GHG Savings

11. ***Emissions Reduction Potential Contributed to by Intervention***: The combined installed capacity for Chile's two main power systems – the SIC and SING - in December 2013 was 17.6GW, and is expected to grow by 39% to about 24.4GW by 2025. In the Government of Chile's Energy Agenda for 2014, the country is committing to have 45% of the newly installed capacity come from renewable sources, so as to have 20% of the whole network come from renewable sources by 2025. Geothermal has a low emissions factor, and for calculation purposes a power

plant operating capacity factor of 85% was used to estimate the GHG emissions reduction[27]. The expected operational life of the power plants is 30 years. Given that the proposed project is entire technical assistance to remove specific barriers to geothermal development, and therefore, indirectly facilitate investments in the sector, it is estimated to contribute towards the expansion initially 50 MW or more; and then could unlock geothermal potential in the longer-term that could reach 800 MW or about five percent of the higher end estimates or geothermal potential in Chile of about 16 GW. For this range, the overall GHG savings is estimated to be from a low of 4.4 $MtCO_2e$ to 144.0 $MtCO_2e$ if the higher end of the potential target is achieved. The range is even greater than expected due to the differences in the SIC and SING grids (whereby SIC is much less reliant on fossil fuels), and thus affected by two main factors: (1) the uncertainty of the location of possible plants; and (2) the significant difference in emission factors (SIC at 0.391 $KgCO_2e/kWh$ and SING at 0.806 $KgtCO_2e/kWh$). In the Government's Energy Agenda, it estimates an installed capacity of 250 MW by 2025, which would give a range of GHG savings between 21.8 $MtCO_2e$ and 45 $MtCO_2e$.

12. ***Technology Development Status:*** Geothermal is a proven technology that is commercially available around the world for both power generation as well as other uses such as heating. The directional drilling techniques that are commonly utilized in geothermal are similar to that of on-shore oil and gas exploration, although the challenging terrain in many geothermal development areas in Chile could lead to further innovation and additional lessons learned that could benefit the overall industry. While the technology is at a nascent state in Chile, a number of internationally reputable firms specializing in geothermal have acquired geothermal concessions in Chile. They could contribute significantly to the development of the sector in Chile if some of the key obstacles they are facing can be addressed, as the proposed project aims to do. In doing so, there will likely be considerable knowledge transfer that will benefit the expansion and the sustainability of the domestic market.

B. Cost-Effectiveness

13. The cost-effectiveness of the CTF intervention of USD3 million has been estimated to be between 0.46 USD/tCO_2 and 0.23 USD/tCO_2 for an installed capacity of up to 100 MW. This estimate is based on an expected GHG avoidance in the range of 4.4 and 18 $MtCO_2e$ depending on the grid locations of these power plants. This significant CO_2 emissions reduction would be reached through the sustainable geothermal development, as a result of the implementation of the project. In the absence of this renewable power, generation would most likely be met from fossil fuel based generating plants, not only producing more GHG emissions, but also other local pollutants such as nitrous oxides (NOx) and Sulphur dioxides (SO2).

C. Demonstration Potential at Scale

14. ***Scope of the avoided GHG emissions through replication:*** The proposed project will have

[27] While a plant capacity factor of 0.85 is conservative in the case of most geothermal project that often operate at over 90 percent, the assumption in the analysis reflects the nascent state of the geothermal sector in Chile and it is also consistent with the assumptions made in the IDB estimates for the MiRiG project.

an immediate impact in particular through the reforms to the legal and policy framework, concession management system, and stakeholder engagement – all of which will help catalyze investments for primarily the expansion of existing concessions including the ones supported through CTF by IDB. This could lead to the reduction of anywhere from 145,000-600,000 tons of CO_2 per year depending on the grids where the power plants are located. This would be equivalent to 4.4-28 million tons on a life-time basis. However, if the reforms had long-term success and progressively improved the market conditions for geothermal development, then the related scale-up in investments help achieve the GoC's target in the Energy Agenda of 250 MW to even 800 MW or beyond. This would result in 728,000-4,805,000 tons of avoided CO_2 or 22-144 million tons of CO_2 over the lifetime of the project.

15. ***Transformational potential:*** The proposed project will have a transformational impact since it will be supporting a set of market enhancing reforms that will impact the investment climate underlying the entire geothermal sector. By doing so, it will *kick-start a nascent industry* and contribute to progressively transforming it towards a more mature, commercially viable and sustainable industry that will enhance the overall energy sector in Chile. It will support economic growth and help sustain the gains in poverty alleviation in the country.

16. *Develop new generation option for diversification of energy matrix:* The proposed project will contribute to establishing geothermal as a viable alternative in Chile's power generation mix with an additional renewable base-load option. At present, of the renewable energy technologies, only hydropower has the capability to provide non-intermittent, base-load supply, but has faced challenges to expand further. Developing geothermal as a reliable power generation source will provide greater flexibility and optimally diversify the generation mix in Chile.

17. *Informed development of a risk mitigation framework for geothermal:* The proposed project will help design a risk mitigation framework for geothermal in Chile in order to address in a sustainable way a significant up-front barrier that is being faced by developers to advance geothermal development. While the risk mitigation framework will be developed with the benefit of global experience through an international survey of different schemes and approaches, it will need to be customized to be effective in the local context in Chile. In this regard, the work that is being carried out by IDB in MiRiG with CTF support as well as the World Bank engagement in the sector will provide valuable information that will help shape and define the approach that will be implemented in Chile. This feedback loop of on-the-ground investment experience that will inform the framework designed under the proposed project will significantly improve its applicability and success in Chile.

18. *Catalyze expansion of domestic industry:* The development costs, particularly for drilling, is quite high in Chile, and a concerted effort will be made by GoC through the proposed project to identify areas within domestic industries that could be incentivized to play a larger role in geothermal development. While the high costs are due to a number of reasons, developers in Chile often need to import drilling rigs and associated services and routinely undertake costly re-mobilizations due to seasonal variation. By catalyzing greater participation of domestic industries to locally provide services associated with geothermal development, it will not only lead to improving the prospective of these associated sectors but will help progressively reduce the cost of developing geothermal due to greater domestic content.

19. *Promote informed and inclusive development of geothermal industry:* Since the large scale development of geothermal is relatively new in Chile and operational power plants are yet to be commissioned, it provides an opportunity to develop the sector through informed and inclusive awareness and consensus from the ground-up. The proposed project will undertake a campaign to raise the overall awareness of geothermal development, its benefits and how any potential risks will be mitigated; for the benefit of all Chileans. It will also undertake specific efforts to consult and raise awareness amongst people in potential geothermal development areas including indigenous populations; to take into consideration their views in overall policies for promoting geothermal development in Chile.

20. *Ensure compliance with industry and international standards:* When developing a nascent industry, it is important to ensure that good industry practices are followed and international standards are met; and this will enable geothermal to be developed in Chile in a safe and sustainable manner. One specific reason for GoC's request for World Bank support was to ensure that it could benefit from global experience and internationally recognized practices can be put in place in Chile. The proposed project provides an opportunity to ensure that the policy and regulatory framework obliges the industry to meet industry standard while the various incentive mechanisms that will be developed through the project can also promote good practices in sector development.

D. Development Impact

21. *Help meet the needs of increasing demand to support economic growth:* the primary beneficiaries of the impact of the proposed project are energy consumers in Chile as it will help meet their growing energy needs. In doing so, geothermal will contribute towards economic growth in a country where economic growth is strongly correlated to the availability of efficient, reliable and affordable supply of energy. While the overall economy will gain from the proposed interventions, it is also important to note that people living in project areas, including those who are of indigenous origin, will also benefit from the availability of electricity and geothermal for alternate uses, and other co-benefits associated with sector development.

22. *Enhance the energy security of the country:* Increasingly, Chile has had to rely on imports of primary energy resources for power generation as the energy mix has shifted away from domestic resources such as hydropower. This has created vulnerabilities and energy security concerns, which were confirmed when several years ago, gas supply arrangements from Argentina were rescinded. It plunged Chile into an energy crisis, to necessitate the urgent construction of several liquefied natural gas (LNG) terminals and contracting alternate supplies. And even with the LNG terminals, security of supply is contingent upon adherence to the new contractual arrangements. By utilizing greater indigenous resources such as geothermal, the power generation mix would be diversified more towards non-tradable options enahcing the energy security of the country.

23. *Contribute to stabilizing and lowering electricity prices:* The increase in the utilization of fossil base fuels in Chile for power generation has also resulted in considerable volatility in electricity prices due to fluctuations in international commodity prices. This is particularly the

case in the largest system, SIC, and is reflected in the volatility of spot prices for electricity. In addition, the relatively high commodity prices in recent times have led to electricity prices that are also quite high in Chile. The high volatility in prices create significant uncertainties for businesses making their planning and business decisions unpredictable. The high electricity costs, which geothermal could reduce in some cases, can also undermine economic competitiveness of the country. Both factors also create hardship for household consumers as well. By contributing to long-term stable and competitive electricity prices, geothermal will contribute to the growth in the Chilean economy.

24. *Confer local and global environmental benefits:* Chile's greenhouse gas emissions, which are expected to double by 2025, are primarily from the energy sector. Its CO_2 emissions per capita is substantially higher than the average for other Central and South American countries[28]. The GoC is committed to re-directing the emissions trajectory, and the greater utilization of geothermal, which typically emits about 10 percent compared with an equivalent coal-fired power plant, will contribute to this goal. The progressive development of the geothermal sector will work hand-in-hand with the recent introduction of a carbon tax in Chile that has the same shared goal. Geothermal will also contribute to the reduction of local pollution since it will reduce pollutants such as sulfur dioxide (SO2), nitrogen oxide (NOx), and total suspended particulates (TSP) that are a common bi-product of fossil-based power generation. The reduction in these pollutants will also result in health benefits to the local population.

E. Implementation Potential

25. ***Public Policies and Institutions:*** The proposed project is designed specifically to impact policies and schemes that will address barriers and help internalize economic externalities to guide a predominantly laissez fair market into investing in a beneficial technology to a more optimal level. The overall effort is guided by the GoC's Energy Agenda, with the proposed project providing critical support to the MoE's efforts to reform the policy and regulatory framework for geothermal in order to level the playing field with other technologies. Connecting geothermal policy to the conditions of the broader power market will also be a critical linkage since serving electricity consumers with an additional reliable, clean energy options is a primary goal. The proposed interventions also go hand-in-hand with the GoC's overall efforts to be a good custodian of the environment through efforts such as the recently introduced carbon tax, which is designed specifically to more accurately cost the impact of pollution and promote clean energy sectors such as geothermal.

26. MoE is the key institutional that is mandated with overseeing the energy sector and the implementation of the GoC's Energy Agenda. The proposed project will specifically strengthen the capacity within the MoE and its Geothermal Unit within the Renewable Energy Directorate to better oversee sector development, implement the necessary policy and regulatory reforms, and more effectively manage the concession regime to ensure outcomes that are consistent with the GoC's overall geothermal development goals. Furthermore, the MoE will also coordinate closely when necessary with the Ministry of Environment to coordinate related policies that impact geothermal development.

27. ***Sustainability of Transformation:*** Sustainability of geothermal development over time is

[28] United States' Energy Information Administration (EIA).

a major aspect of the proposed project. While component 1 along with the IDB MiRiG project is intended to give an immediate boost to the geothermal program, component 2 is primarily aimed at improving the long-term market conditions that will help identify the extent to which geothermal can be commercially exploited in country and progressively and sustainably facilitate the scale-up of this nascent industry in Chile. Initially, proving the first geothermal operations in the country will demonstrate the viability of the sector and enhance investor confidence unlocking the potential to begin exploiting the large estimated geothermal potential. This will be aided by the IDB MiRiG support to further de-risk some of the geothermal projects that are more advanced, and also help inform the establishment of a geothermal risk mitigation framework with the assistance of the proposed project, which will facilitate the mobilization of risk capital towards drilling in the years to come. Better integration of geothermal in the broader power sector will also not only have an immediate impact, but is essential for the long-term sustained off-take and bringing additional geothermal projects online. The identification of domestic sectors that can be incentivized to contribute to geothermal development locally and expanding the market for drilling and other associated services by supporting alternate uses of geothermal will enhance the long-term competitiveness of geothermal contributing to the sustainability of the sector. Finally, the proposed project's support to raising awareness and acceptance of geothermal with the broader population will also bolster social support for sustaining sector development.

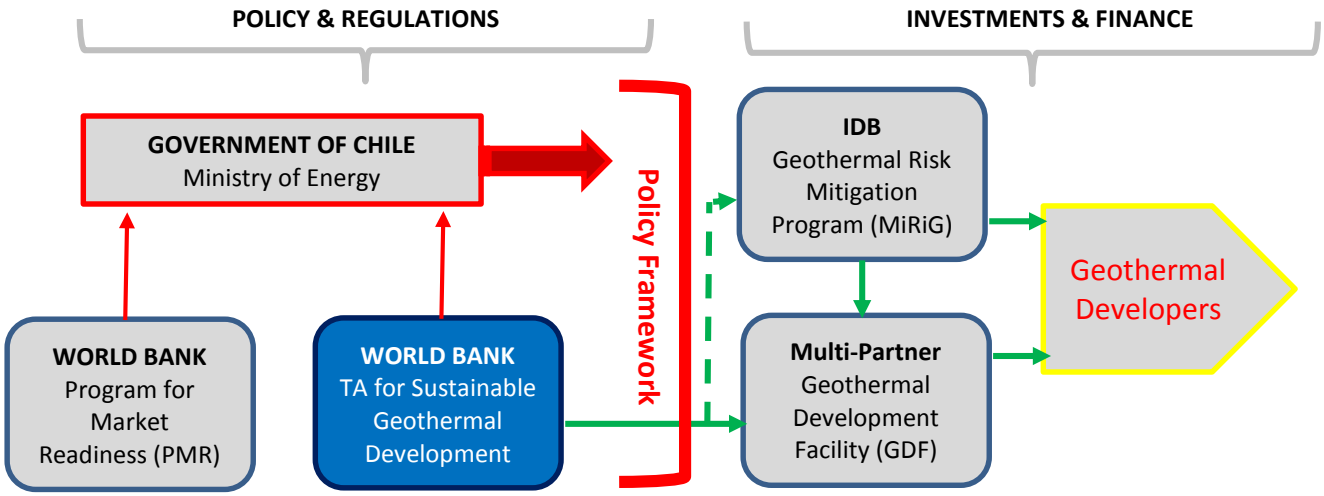
28. ***Leverage:*** Since the proposed project is entirely technical assistance, its design intentions are specifically to leverage and mobilize financing into geothermal investments. While it does not directly fund investments, the proposed project will provide the policy and institutional foundation that will facilitate immediate and future investments in the sector. A number of activities under the proposed project will complement the IDB's CTF support of $50 million for geothermal development in Chile. These investments are expected to further leverage private investments as well, leading anywhere from 50-100 MW of geothermal short-term geothermal capacity in the country. At a cost estimate of about $5 million per MW, and assuming 50:50 debt/equity ratio that can be common in geothermal financing, private funds of some $125-$250 million could be mobilized in the near to medium term.

29. ***IFIs and Donor Coordination:*** The proposed project is part of a coordinated effort between the World Bank and IDB to assist the GoC through CTF support. The proposed project and IDB supported MiRiG were envisaged originally and designed to be complementary in support of the GoC's geothermal development goals. While MiRiG will mobilize direct investment support, the proposed project will strengthen the policy and institutional foundation upon which immediate and sustained investments in geothermal can mobilize with the greater confidence.

30. Chile's CTF supported geothermal activities are also designed to better place geothermal developments in the country to access the Latin American Geothermal Development Facility (GDF), which is a multi-donor scheme to support geothermal energy development in the region. Its preparation is being led by KfW in cooperation with a variety of other donors and financiers, including the World Bank and IDB. The GDF for Latin America is foreseen to include: 1) a Risk Mitigation Fund to support early exploration drilling stage; 2) Investment Financing Windows to provide tailored financing for subsequent investments during the crucial production drilling and construction stages; and 3) a Technical Assistance Forum to coordinate existing and planned

technical assistance programs of participating donors and financiers. The goal is to facilitate an initial set of projects that could access the GDF.

31. The World Bank is also providing support to the GoC through MoE with a Partnership for Market Readiness (PMR) so that Chile can better access carbon financing through future bilateral or global mechanisms. Since geothermal is a clear climate mitigation investment option, the coordinated efforts between the PMR work and the geothermal reforms supported by the proposed project will be complementary.



F. CTF Additionality

32. The proposed project is critical to help provide the necessary market conditions to scale-up and sustain geothermal development in Chile. Evidence suggests that a nascent industry that is also bound with inherent risks significantly challenge the appetites of private investors to mobilize risk capital at the scale that is envisaged and needed. By introducing greater global experiences and international standards that will be customized to the Chilean context, the proposed project will help boost the confidence of developers to make greater investments in the geothermal sector in Chile. In a country where there is greater adherence to laissez fair principles, enhancing the investment climate to facilitate financing, including critical risk capital, towards geothermal development will be essential of the sector is to thrive and the GoC to achieve its development goals established in its Energy Agenda.

G. Implementation Readiness

33. The proposed project is ready to implement. In fact, recognizing the urgency of the GoC, the World Bank, with ESMAP support, has already begun providing some of the critical assistance to identify some of the specific reforms that will be designed with CTF funds. Therefore, the approval of the proposed CTF funds will be timely so that the reforms can be quickly and efficiently put in place, especially those that will support and clear the path for several projects that had made considerable advances to identify geothermal resources, but have faced difficulty moving further forward.