CLEAN TECHNOLOGY FUND

INVESTMENT PLAN FOR CHILE

Revision

September 2013

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LIST OF ABBREVIATIONS AND ACRONYMS

AChEE	*Asociación Chilena de Eficiencia Energética* (Chilean Agency for Energy Efficiency)
ACHEGEO	*Asociación Chilena de Energía Geotérmica* (Chilean Association for Geothermal Power)
BAU	business as usual
BNEF	Bloomberg New Energy Finance
CEGA	*Centro de Excelencia de Geotermia de los Andes* (Geothermal Centre of Excellence of The Andes)
CER	*Centro de Energías Renovables* (Renewable Energy Center)
CFE	Comisión Federal de Electricidad (Mexican Public Utility)
CO_2	Carbon dioxide
CO_2e	Carbon dioxide equivalent
CONICYT	*Comisión Nacional de Investigación Científica y Tecnológica* (National Commission of Research and Technology)
CORFO	*Corporación de Fomento de la Producción de Chile (*Production Development Corporation)
CSPP	Concentrated Solar Power Project
CTF	Clean Technology Fund
EE	energy efficiency
ESMAP	Energy Sector Management Assistance Program
EUR	Euro
LFI	local financial intermediary
GDP	gross domestic product
GIZ	*Deutsche Gesellschaft für Internationale Zusammenarbeit GmbH* (German Technical Cooperation Agency)
GRRMP	Geothermal Resource Risk Mitigation Program
GHG	greenhouse gases
GoC	Government of Chile
GW	gigawatt
IBRD	International Bank for Reconstruction and Development
IDB	Inter-American Development Bank
IFC	International Finance Corporation
IP	Investment Plan
KfW	*KfW Entwicklungsbank* (German Development Bank)
KM	knowledge management
LAIF	Latin-American Investment Facility
LCOE	levelized cost of electricity
LSPVP	Large-Scale Photo-Voltaic Program
M	million
M&E	monitoring and evaluation
MDB	multilateral development bank
MinEne	Ministry of Energy
MiRiG	*Programa de Mitigación de Riesgos de Geotermia* (Geothermal Risk Mitigation Program)
Mtoe	megaton of oil equivalent
MW	megawatt
MWe	megawatt of electricity
NCRE	non-conventional renewable energy
PPA	power purchase agreement
PAEE20	*Plan de Acción de Eficiencia Energética 2020* (Energy Efficiency Action Plan 2020)
PV	photovoltaic
RE	renewable energy
RESSEE	Renewable Energy Self-Supply and Energy Efficiency Program
RPS	renewable portfolio standard
SAGS	steam above-ground systems
SERNAGEOMIN	*Servicio Nacional de Geología y Minería* (National Service of Geology and Mining)
SIC	*Sistema Interconectado Central* (Central Interconnected System)
SING	*Sistema Interconectado del Norte Grande* (Norte Grande Interconnected System)
t	ton
TC	technical cooperation (or technical assistance) activity
TCal	teracalories
TFC	Trust-Fund Committee
TWh	terawatt hour
UNFCCC	United Nations Framework Convention on Climate Change
USD	US Dollar

EXECUTIVE SUMMARY

The Clean Technology Fund (CTF) Investment Plan (IP) submitted by the Government of Chile (GoC) was endorsed by the CTF Trust Fund Committee (TFC) on May 3, 2012. The CTF IP provides support for the achievement of the renewable energy objectives contained in the National Energy Strategy of Chile. The CTF IP was designed by the GoC together with the Inter-American Development Bank (IDB) and the International Finance Corporation (IFC). The focal point for the CTF in the GoC lies in the Ministry of Energy.

The CTF IP includes one project — the Concentrated Solar Power Plant (CSPP) — to be executed by the IDB and two programs — the Large-Scale Photo-Voltaic Program (LSPVP) and the Renewable Energy Self-Supply & Energy Efficiency (RESSEE) — to be executed jointly by IDB and IFC. The IP expects to receive USD 200M in CTF resources, which will leverage additional resources from the GoC, the MDBs, the private sector, and other sources. So far, USD 118M of CTF resources have been approved by the TFC: USD 67M for the CSPP, USD 50M for the LSPVP, and USD 1M for the RESSEE preparation grant. In the initial IP USD 100M were requested from the TFC for the CSPP project, of which USD 67M were approved. After evaluating a number of alternatives, the GoC proposes to reallocate the USD 33M of unused CTF resources to a **Geothermal Risk Mitigation Program (MiRiG)**. The GoC has determined that this program is aligned with both the rationale of Chile's development priorities and the CTF investment criteria.

The inclusion of geothermal power in the IP is timely. The Congress passed in September 2013 the 20/25 Law, which requires that 20% of the energy of new energy contracts comes from non-conventional renewable energy (NCRE) sources by 2025. This further supports the clear goal of the GoC to increase the share of RE in the current energy matrix.[1] Additionally, in March 2013, a new regulation concerning the geothermal resource concessions was approved. This regulation (Decree No. 114-2012) will streamline the concession process for geothermal projects and provide developers with long-term certainty over development rights to tap into Chile's geothermal resource potential.

The proposed MiRiG Program will be designed to catalyze investments in geothermal energy using risk transfer mechanisms that reduce exploration and development costs and risks, and mobilize private capital to ensure sustainable, long term growth. This mechanism will be combined with an ambitious technical assistance and capacity building component. MiRiG will be executed jointly by the IDB and the World Bank (International Bank for Reconstruction and Development, IBRD). IDB will execute the financial component (risk mitigation mechanisms), and IBRD will execute the technical assistance component. A preliminary concept note for the Program is included in this IP Revision (Annex I).

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

CTF Proposed Allocation and Updated IP Financing

Table 1: Chile CTF Indicative Financing Allocation Plan Endorsed in 2012 (USD Million)

Financing source	Component I (CSPP)	Component II (LSPVP)	Component III (RESSEE)	Component IV (RESSEE Prep Grant)	TOTAL
CTF loans and grants	100	50	49	1	200
Other Sources	386	250.6	372.8	0	1009.4
TOTAL	**486**	**300.6**	**421.8**	**1**	**1,209.4**

Source: Modified from Chile's IP data (http://bit.ly/Chile-CTF-IP, p.35, 2012)

Table 2: Proposed Chile CTF Financing Reallocation Plan (USD Million)

Financing source	Component I (CSPP)	Component II (LSPVP)	Component III (RESSEE)	Component IV (RESSEE Prep Grant)	Component V (MiRiG)	TOTAL
CTF loans and grants	67	50	49	1	33	200
Other Sources	434	670	372.8	0	265	1,741.8
TOTAL	**501**	**720**	**421.8**	**1**	**298**	**1,941.8**

Co-financing figures to be revised at the time of program design

STATUS OF ORIGINAL INVESTMENT PLAN IMPLEMENTATION

IDB: Concentrated Solar Power Project (CSPP)

Description

The project goal is to contribute to the transformation of Chile's energy matrix towards a low-carbon growth path. The objective of the CSPP project is to enable the construction of the first CSP power plant in South America. The approximate capacity is targeted for 50MW with a load-factor of 40%.[2] This will be achieved by lowering the existing energy price gap between conventional power solutions and CSP technology through the provision of subsidies and concessional credit lines. These resources will be allocated to the winning project of the competitive tender issued through CORFO (a national development corporation).

The CTF will provide a concessional loan of USD 67M through IDB, and KfW will provide further EUR 100M through local commercial banks. In addition to the USD 20M grant from Chile, an EUR 15M grant of the Latin-American Investment Facility (European Commission) has been approved.

Rationale

Chile is among the most carbon-intensive economies in Latin America. Power generation in the northern region of Chile, where most of the mining companies are located, is a significant contributor to Chile's GHG emissions. Most mining companies are unregulated clients who buy their energy from energy generators. Although the northern region has ideal solar conditions for solar energy, more than 95% of the electricity generated comes from conventional energy sources. This is explained by the preference of mining companies to buy continuous — baseload —and as cheap energy as possible. Concentrated solar power with storage could offer baseload energy, but it is currently not price-competitive in comparison to conventional baseload power solutions.

That being said, CSP could be a potential solution for off-takers who need to comply with the renewable energy portfolio standard (RPS) and need baseload power. CSP has therefore the potential to be an important player among NCRE technologies.

Blending CTF with other financing resources could help lower the LCOE of CSP and make it more attractive to off-takers. As the first CSP plant in Chile, this project will help remove market barriers and risks associated with a new energy technology solution. As a result, it is expected that the first CSP plant will fast-track CSP development.

Progress

The CSP tendering process is still open. The participants can submit their proposals until October 22nd, 2013.[3] In order to increase the participation in the bidding process, the GoC with the collaboration of the IDB and GIZ offered workshops to the main stakeholders. A group of representatives from local financial intermediaries (LFIs) traveled to Spain and obtained first-hand experience of how CSP works.

[2] The GoC's tender requires a minimum of 10MW and three storage hours. However, it is expected that with the finance that is being made available, a larger power plant will come out of the competitive process.

[3] The previous deadline was August 22, 2013, but in August Chile's national Comptroller approved a 2-month extension.

Additionally, local banks and CSP developers participated in financial workshops to have a better understanding of the financial instruments available in the CSP bidding. Moreover, informative workshops were offered by the Ministry of Energy, IDB, and KfW during the recent event "CSP today" in Antofagasta.

IDB/IFC: Large-Scale Photo-Voltaic Program (LSPVP)

Description

The project goal is to contribute to Chile's drive to increase the share of RE sources in its overall generation and to reduce GHG emissions. The objective of the LSPVP is to finance the first group of large-scale PV projects connected to the grid. The LSPVP is expected to comprise two to four large-scale private sector solar PV projects ranging from 30 to 100 MW each, with a combined capacity of about 300 MW and a total cost of approximately US$700 million. The project aims to achieve this objective by utilizing USD 50M of CTF resources as concessional loans to co-finance the projects. The LSPVP will be expected to support projects that operate either under long-term PPAs and/or a merchant strategy selling their output at spot market tariffs directly into the grid.

Rationale

Solar PV is worldwide one of the fastest growing renewable energy technologies and is projected to play a major role in electricity production in the future. Chile has a world-class solar resource, which encompasses a wide area of the Atacama Desert in the north of the country. Given this high level of solar irradiation, solar PV technologies are likely to be front-runners among NCRE in northern Chile. Nowadays, LFIs are already financing wind projects in this region and are fairly comfortable with their technical aspects. In contrast, large-scale solar represents a challenge for LFIs and is perceived to have higher risk due to a lack of technical familiarity.

Through the creation of this financing facility, these loans will help reduce the initial barriers for the adoption of large-scale PV grid-connected projects. The first projects will provide a demonstration effect and help create a track record of these technologies in the market. As a result, large off-takers would be more confident to enter in long-term contracts, and LFIs will be more willing to finance projects, either with PPAs or a merchant basis –spot market-, ultimately enabling the scale-up of LSPVP projects.

Blending CTF with other MDB and LFI resources will make the investment capital available for private developers, which otherwise may not have had the financial resources for these projects.

Progress

By March 2013, the CTF trust committee approved the LSPVP program (USD 50M). The IDB and IFC are in the process of identifying projects where CTF resources may be needed. To date, CTF sources have not been used.

IDB/IFC: Renewable Energy Self-Supply and Energy Efficiency (RESSEE)

Description

This program's goal is to fast-track the scale-up of Renewable Energy Self-Supply and Energy Efficiency projects, in order to decrease the carbon footprint of Chile's energy matrix.

The main challenges that self-supply and energy efficiency projects face in Chile are: (i) financial barriers resulting from a lack of knowledge and experience among financial institutions related to project-based financing for self-supply and EE projects; (ii) lack of information on potential technologies and use of alternative energy resources; and (iii) lack of experience among energy end-user clients and technical service providers on the potential technologies and energy business models.

The program objective is to promote the market development for RESSEE projects by increasing the demand of potential off-takers and removing financial barriers. Financial access will be developed in coordination with capacity building –through RESSEE preparation grant- among off-takers, LFIs, and technical service providers. The projects targeted are small-scale and will be financed either by LFIs, a government agency, or a private fund. The preparation grant of RESSEE will design how CTF funds will be channeled.

Rationale

Energy efficiency curbs the growth of energy demand, reduces energy imports, and is one of the most cost-effective mechanisms to reduce GHG emissions. Despite the vital role of EE, only a small fraction of its potential has been tapped. In contrast to some OECD countries, Chile has not yet decoupled its energy consumption from its economic growth. Given that Chile has one the highest energy prices in the region, EE can help spur economic growth and reduce energy bills, which are of particular importance to the private sector in this period of persistent high energy prices.

The GoC has been working to tap the potential of EE to deliver economic, environmental, and energy security gains. On May of 2013 the Ministry of Energy launched the Plan de Acción de Eficiencia Energética 2020 –PAEE20- (National Plan of Energy Efficiency 2020). The aim of PAEE20 is to reduce by 12% the energy demanded by 2020 relative to the projected business as usual case (BAU) scenario. The PAEE20 expects a reduction of 43,000 TCal, equivalent to an installed capacity of 1,100MW relative to the BAU scenario.

To tap the benefits of RESSEE, the program will promote capital market financing to small and medium-sized companies that are currently unable to implement sustainable energy measures due to lack of information, transaction costs, and lack of financing.

Progress

The program will start on January 2015, following completion of the project preparation grant, which is estimated to be finished by August 2014.

IDB/IFC: RESSEE preparation grant

The preparation grant of the RESSEE program will contribute in overcoming the barriers mentioned in the program description by providing tools to the market such as potential sub-economic sectors, workshops to key stakeholders, and pilot projects ready for financing. The RESSEE preparation grant includes the following activities:

- Market development (executed by IDB) intended to validate and refine the target market and develop concrete actions to reduce the entry barriers for energy efficiency (EE) and renewable energy self-supply (RESS) production schemes;
- Capacity development (executed by IFC) aimed to increase awareness, knowledge and expertise of key stakeholders in the market;

- Project development (executed by IDB) to develop a series of EE and RESS production pilot projects ready for financing, by documenting the entire process so as to provide guidance for future projects;
- Identification of possible financial structures and mechanisms (executed by IFC); and
- Program evaluation (executed by IDB) to develop the design of a randomized experiment or other methodology to evaluate the impact of the intervention

Progress

The technical assistance started on July 2013 and is estimated to be finalized by August 2014. A consortium –KSW, Econer, and Aries- was selected to develop the first component –market development-. The outputs of component 1 are necessary to initiate the subsequent components. In other words, components 2-5 will start in parallel, approximately in October, once component 1 is finished.

CIRCUMSTANCES AND RATIONALE FOR INVESTMENT PLAN REVISION

In the initial IP, USD 100M were requested from the TFC for the CSP project, of which USD 67M were approved. The GoC is requesting the reallocation of the remaining USD 33M of unused CTF resources to a new program.

After the submission of Chile's IP, the GoC published a new geothermal regulation. The investment plan revision seeks to support the initiative of the GoC to boost the development of its geothermal resources.

The GoC proposes to reallocate USD 33M to a **Geothermal Risk Mitigation Program (MiRiG)**. The GoC has determined that this program is aligned with both the rationale of Chile's development priorities and CTF's investment criteria (see p.19). A preliminary concept note is included in this IP Revision (see Annex 1). Additionally, the recent passing of the 20/25 Law, which requires that 20% of the energy of new energy contracts comes from NCRE sources by 2025, further supports the clear goal of the GoC to increase the share of RE in the current energy matrix.[4]

Geothermal Law

The Chilean government set a new regulation, Decree No. 114-2012[5], for geothermal concessions to streamline project initiation. This regulation came into effect on March 8th, 2013, and aims to reduce market risks and expedite the regulatory processes. The new regulation grants an exclusive right of exploitation concession to the exploration concessionaire and reduces the requirements associated with concessions.

With the publication of the new regulation of geothermal energy, the Ministry of Energy made a significant regulatory change to encourage the development of this non-conventional renewable energy

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

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

technology. The new regulatory body eliminates one of the main barriers of the geothermal industry, which is the lack of legal certainty in obtaining geothermal exploitation concessions. The main change in the new regulation is that it gives the exclusive right to the exploration concessionaire to obtain an exploitation concession. This means that exploration concessionaires may work on developing high-cost investments with the certainty that in the future they will be entitled to obtain the exploitation concession. Additionally, the new regulation eliminates a number of requirements to apply for a concession of geothermal energy exploration, expediting the application process.

Despite these recent changes, private developers still face barriers to raise risk capital and enter the market (see Annex 1).

National Energy Efficiency Strategy

During the last two decades, Chile's energy consumption grew from 122,464 Tcal in 1991 to 271,429 Tcal in 2011 (or 122% net growth).[6] The electricity consumption is projected to grow 5.5%-6.5% annually until 2020. To meet this energy demand, Chile will require adding an energy capacity of 7,000 to 8,000 MW by the end of this decade.[7] Although the Chilean foreign energy dependency has been slowing down, it continues to be very high: 78% of its energy was imported in 2011, as compared to 84% in 2004.[8]

Energy efficiency has been identified as part of the solution to decrease energy dependency, increase the security of supply, and lower GHG emissions. Moreover, it contributes to increase the national competitiveness by lowering the cost of production.

The aim of PAEE20 is to reduce by 12% the estimated energy demanded by 2020 relative to a business as usual case (BAU) scenario. The base year of the BAU scenario is 2010. The PAEE20 expects a reduction of 43,000 TCal, equivalent to an installed capacity of 1,100MW, relative to the BAU case.

Table 3. Energy savings targets in the National Energy Strategy

Sector	Savings by 2020 (Tcal)	Savings by 2020 (%)
Industry and Mining	16,900	39
Transportation	5,000	12
Building	8,500	20
Devices	3,500	8
Firewood	8,000	19
Others	1,100	2
Total	**43,000**	**100**

Source: MinEne, (http://bit.ly/PAEE20, p.20, 2013)

The PAEE20 defines an action plan by sector –industry and mining, transportation, building, devices, firewood, and others- and a knowledge awareness activity which is transversal to all the sectors.

[6] http://bit.ly/PAEE20, p.8, 2013
[7] http://bit.ly/PAEE20, p.9, 2013
[8] http://bit.ly/PAEE20, p.10, 2013

PROPOSED CHANGES TO THE INVESTMENT PLAN

Table 4 below shows the original financing plan. Table 5 shows the revised financing plan.

Table 4: Chile Original CTF Financing Plan (2012) (USD million)

Financing source	Component I (CSPP)	Component II (LSPVP)	Component III (RESSEE)	Component IV (RESSEE Prep Grant)	TOTAL
CTF loans and grants	100	50	49	1	200
GoC	14	0	20	0	34
IDB loans	100	50	50	0	200
IDB grants	1	0	0	0	1
GEF	1	0.6	2.8	0	4.4
IFC Loan	100	50	50	0	200
Bilaterals	40	0	0	0	40
Other private sector	130	150	250	0	530
TOTAL	**486**	**300.6**	**421.8**	**1**	**1,209.4**

Source: Chile's IP (http://bit.ly/Chile-CTF-IP, p.35, 2012)

Table 5: Chile Revised CTF Financing Plan (2013) (USD million)

Financing source	Component I (CSPP)	Component II (LSPVP)	Component III (RESSEE)	Component IV (RESSEE Prep Grant)	Component V (MiRiG)	TOTAL
CTF loans and grants	67	50	49	1	33	200
GoC	20	0	20	0	14.5	54.5
IDB loans	125	50	50	0	50	275
IDB's Canadian Fund loan	30	0	0	0	0	30
IBRD grants	0	0	0	0	0.5	0.5
IDB grants	1	0	0	0	0	1
GEF	0	0.6	2.8	0	0	3.4
IFC loans	0	50	50	0	0	100
Bilaterals (KfW & LAIF)	148.6	295	0	0	0	443.6
Other private sector	109.4	274.4	250	0	200	833.8
TOTAL	**501**	**720**	**421.8**	**1**	**298**	**1,941.8**

Co-financing figures to be revised at the time of program design

In the case of component 1 - CSPP, the CTF loan was complemented by a grant of USD 20M from GoC, an expected bilateral grant of EUR 15M from the LAIF of the European Union, and a loan of USD 30M from the Canadian Climate Fund for the Private Sector in the Americas. The financial plan will be completed using equity contribution from the private developer, as well as debt financing from IDB, KfW (through LFIs), and commercial banks.

POTENTIAL IMPACTS OF PROPOSED CHANGES ON INVESTMENT PLAN OBJECTIVES

Table 6: M&E framework, Original CTF IP (2012)

Result	Indicator	Baseline	Target	Means of verification	Timing of reporting
CTF Transformative Impact					
Transformed energy supply to low-carbon development pathways	GHG emission factor per unit of electricity generation (weighted average) [Ton CO_2e/MWh]	0.468Ton CO_2/MWh (2011)	0.444 Ton CO_2/MWh (2030)	National Statistics	2019, 2030
Decreased carbon footprint of Chilean industry	Carbon footprint of Chilean copper [Ton CO_2e / Ton copper]	[tbd] (2011)	[tbd] (2030)	Energy Ministry, national statistics	2019, 2030
CTF Catalytic Replication Outcomes					
Increased employment generated	Number of people finishing EE+RE-related technical, undergraduate or graduate studies men/women per year	Men: 13,216 (2011)	Men: 15,860 (2019)	Ministry of Education, CONICYT	2016, 2019
		Women: 3,504 (2011)	Women: 5,040 (2019)		
	New EE+RE-related enterprises per year	[tbd] (2011)	[tbd] (2019)		2016, 2019
	% of CSP plants supplied locally	Not applicable (2011)	70% (2030)	Questionnaire to be sent by Energy Ministry	2019, 2030
Increased development of solar power plants	Number of MW of capacity of solar PV in pipeline	0 (2011)	280 MW (2030)	Environment impact assessment system (Environment Ministry)	2016, 2019, 2030
	Number of MW of capacity of CSP projects in pipeline	0	150 MW (2019)		
Increased investment in RESSEE	Number of operations / financed by commercial banks for RESSEE initiatives	0 (2011)	(2019) tbd with the prep. Grant	Commercial banks participating in program	2016, 2019
CTF Project/Program Outputs & Outcomes					
Direct GHG emissions avoided	M Tons of CO_2e mitigated	0 (2011)	(2016) RESSEE: tbd with the prep. Grant CSP: 129,300 t CO_2eq/yr	Energy Ministry[9] + experimental impact evaluation considered for RESSEE	Annually (March)
Increased energy generation and capacity from solar power plants	Number of MWh generated by RE CTF-funded projects/ programs	0 (2011)	CSP: 175,200MWh/yr (2016) LSPVP & RESSEE: TBD with prep grant	CNE, MDBs	Annually (March)

[9] See footnote 10.

Result	Indicator	Baseline	Target	Means of verification	Timing of reporting
	Number of MW of capacity of CTF-funded projects in operation	0 (2011)	CSP: 50MW (2016) LSPVP & RESSEE: TBD with prep grant	CNE, MDBs	Annually (March)
Leveraging – new and additional resources for clean technology projects	Leverage factor of CTF Funding	Not applicable (2011)	[1:4] (2016)	Energy Ministry, MDBs	Annually (March)
Increased investment in RESSEE	Number of operations by CTF-participating commercial banks to RESSEE measures	0 (2011)	tbd with prep. Grant	Commercial banks participating in program	2016, 2019

Source: Chile's IP (http://bit.ly/Chile-CTF-IP, p.33, 2012)

Table 7: M&E framework, Revised CTF IP (2013)

Result	Indicator	Baseline	Target	Means of verification	Timing of reporting
CTF Transformative Impact					
Transformed energy supply to low-carbon development pathways	GHG emission factor per unit of electricity generation (weighted average) [Ton CO_2e/MWh]	0.468Ton CO_2/MWh (2011)	0.444 Ton CO_2/MWh (2030)	National Statistics	2019, 2030
Decreased carbon footprint of Chilean industry	Carbon footprint of Chilean copper [Ton CO_2e / Ton copper]	[tbd] (2011)	[tbd] (2030)	Energy Ministry, national statistics	2019, 2030
CTF Catalytic Replication Outcomes					
Increased employment generated	Number of people finishing EE+RE-related technical, undergraduate or graduate studies men/women per year	Men: 13,216 (2011)	Men: 15,860 (2019)	Ministry of Education, CONICYT	2016, 2019
		Women: 3,504 (2011)	Women: 5,040 (2019)		
	New EE+RE-related enterprises per year	[tbd] (2011)	[tbd] (2019)		2016, 2019
	% of CSP plants supplied locally	Not applicable (2011)	70% (2030)	Questionnaire to be sent by Energy Ministry	2019, 2030
	TBD (geothermal program)	[tbd] with the program	[tbd] with the program		
Increased development of solar power plants	Number of MW of capacity of solar PV in pipeline	0 (2011)	280 MW (2030)	Environment impact assessment system (Environment Ministry)	2016, 2019, 2030
	Number of MW of capacity of CSP projects in pipeline	0	150 MW (2019)		
Increased investment in RESSEE	Number of operations / finance by commercial banks to RESSEE measures	0 (2011)	(2019) tbd with the prep. Grant	Commercial banks participating in program	2016, 2019

Result	Indicator	Baseline	Target	Means of verification	Timing of reporting
Increased development of geothermal power plants	Number of MW of capacity of geothermal in pipeline	0 (2013)	[tbd] with the program	Environment impact assessment system (Environment Ministry)	2016, 2019, 2030
CTF Project/Program Outputs & Outcomes					
Direct GHG emissions avoided	M Tons of CO_2e mitigated	0 (2011)	(2016) RESSEE: tbd with the prep. Grant CSP: 129,300 t CO_2eq/yr MiRiG: [tbd] with the program	Energy Ministry[10] + experimental impact evaluation considered for RESSEE	Annually (March)
Increased energy generation and capacity from solar power plants	Number of MWh generated by RE CTF-funded projects/ programs	0 (2011)	CSP: 175,200MWh/yr (2016) LSPVP & RESSEE: TBD with prep grant	CNE, MDBs	Annually (March)
	Number of MW of capacity of CTF-funded projects in operation	0 (2011)	CSP: 50MW (2016) LSPVP & RESSEE: TBD with prep grant	CNE, MDBs	Annually (March)
Increased energy generation and capacity from geothermal power plants*	Number of geothermal fields supported by MiRiG program	0 (2011)	[tbd] with the program	CNE, MDBs	Annually (March)
Leveraging – new and additional resources for clean technology projects	Leverage factor of CTF Funding	Not applicable (2011)	[1:4] (2016)	Energy Ministry, MDBs	Annually (March)
Increased investment in RESSEE	Number of operations by CTF-participating commercial banks to RESSEE measures	0 (2011)	tbd with prep. Grant	Commercial banks participating in program	2016, 2019

*To be confirmed/revised at the time of program/project submission

[10] Renewable energy emission reduction data will be based on energy generation data from the Dispatch Centers (CDECs) and emission factors for each of the national grids from the Energy Ministry using standard IPCC methodologies. Renewable energy self-supply and energy efficiency emission reduction data will be based on the following: the climate change monitoring framework to be developed by the Energy Ministry with the support of the World Bank's Partnership for Market Readiness; the verification tool for energy efficiency measures to be developed by the Energy Ministry in collaboration with the AChEE and as established in the ENE; and on the verification tool for RE self-supply yet to be developed (a request for the support of the UK's Prosperity Fund has been submitted for this purpose).

Table 8: Risks and Mitigation Measures: Revised CTF IP (2013)

Risk	Mitigation Measure	Residual Risk (low/moderate/high)
Policy and regulatory framework	Policy and regulatory framework for investment in the energy sector and promotion of renewable energy and energy efficiency is clear and applied with transparency. CADE suggestions are expected to be indicative of adjustments in power sector regulations; no major market distortion is expected.	Low
Implementation capacity	Institutional strength of the Ministry of Energy, Ministry of Environment, Renewable Energy Center, Chilean Energy Efficiency Agency, and robust participation of private sector in the country reduce the implementation risk significantly.	Low
Technology	Particular interest in the less developed RESSEE. Selection of RESSEE technologies will be done by the market reducing the technology risk.	High
Finance	The country is perceived as very attractive for investment in infrastructure by foreign and local investors. However, there is financing risk access in NCRE technologies, as a result of a risk return imbalance.	Medium
Environmental	Chilean environmental legislation is being updated and institutional capacity of implementing agencies strengthened.	Medium
Social	Efforts will be made by stakeholders to raise public awareness about impacts and benefits.	Low
Performance	While there are very few existing solar plants developed the country shows excellent natural conditions for development of solar, together with a very positive business environment and a long tradition of enforcement of clear and transparent policies and regulations. Concerning geothermal power, the program will include provisions to enhance good practices and enhance performance.	Medium
Procurement	Risk of improper practices in procurement is low. Country ranks very high (always first in the region and above several OECD countries) in governance and transparency.	Low

STAKEHOLDER ENGAGEMENT

A Joint Mission of IDB and IBRD, in support of the revision of the IP for the CTF for Chile was carried out between July 25th and 26th, 2013. The mission was coordinated by the MinEne, as technical focal point for the CTF.

The Joint Mission included meetings with:

The national government:
- The Renewable Energy Center (CER)
- The Renewable Energy division of MinEne
- Production Development Corporation (CORFO)

Private sector representatives:
- Geothermal power developers
- The Chilean Association for Geothermal Power (ACHEGEO)
- Local insurance companies

Development agencies:
- German cooperation agency (GIZ)
- British Embassy

Academic agencies:
- Geothermal Centre of Excellence of The Andes (CEGA)

Civil society representatives:
- Members of the Civil Society Council of the Ministry of Energy[11]

The revision of the IP considers the inputs, summarized below, of the stakeholders that participated in the Joint Mission.

Comments on the Renewable Energy Programs.

- The LFIs and the IDB have found that mining concessions may be a barrier for financing solar PV projects. The large majority of the mining concessions associated with the Atacama Desert have been allocated. According to the Chilean Constitution, the mining sector has the highest priority to exploit the land for mining purposes, which poses a risk to energy projects utilizing the same land and may limit financing options for the projects.

[11] Chilean Law No. 20.500, regarding the associations and citizen participation in public management, established that every agency of the national government shall establish civil society councils, of consultative character, which should be shaped in a diverse, representative and pluralist manner by members of nonprofit associations that are related to the competence of the agency concerned.

- The possibility of submitting the RESSEE program proposal before the preparation grant of RESSEE is finished should be considered. According to the CER, there are potential RESSEE off-takers that could need financial resources by mid 2014.
- The renewable energy self-supply NAMA may be integrated to the RESSEE program.
- A geothermal program fits the Chilean IP criteria of selecting technologies, which include high resource potential, lack of consolidation, and technical viability.
- Big and medium size geothermal developers agreed that the main barrier to developing a project is the high risk and lack of finance (see p.19; Major constraints).They also agreed that a risk mitigation instrument combined with loans would help to unlock the geothermal market by helping in creating bankable business models.
- An insurance company –Marsh- jointly with an international geothermal insurance company -Munich Re- is currently working in the design of a geothermal exploration risk instrument.

Comments on geothermal power risks

- Access to the grid is a risk for most NCRE solutions. Long distances from the grid could make geothermal projects financially infeasible.
- Munich Re may not have the capacity to increase in number its portfolio of geothermal insurance projects. However, Munich Re has expressed its interest in entering the Chilean market.
- The non-reimbursable portion of the CTF resources would be used to subsidize a drilling risk mitigation instrument. This mechanism will facilitate access to finance at prices that allow developers to take full advantage of leverage and scale up investment. Access to finance would make new ventures attractive and projects that would only be undertaken sequentially may now be undertaken simultaneously. IDB is partnering with insurance companies in order to develop appropriate insurance products
- According to the civil society council, if not done properly, geothermal projects could harm the environment and potentially generate conflicts with the local communities. For instance, there is a misperception in some indigenous communities that geothermal drilling and operation of geothermal wells can dry out the nearby aquifers (normally aquifers are not affected by geothermal wells). It is important to create awareness in local communities about the real advantages and risks of geothermal energy in order to minimize the likelihood of community resistance.

Other general suggestions of the civil society council

- The price of conventional energy solutions does not include costs such as pollution and other environmental hazards.
- A sustainable transport program may be included in the CTF, such as a bicycle-friendly street program.
- Marine energy may be fostered considering that Chile has a high resource potential. A marine grid may be assessed as a long term solution for Chile.
- In Santiago, neighborhoods with fewer resources have extensive visible grid wiring causing visual pollution.
- There are civil society councils of other Ministries that could be invited to participate. For instance, the civil society council of the Ministry of Environment may be interested in clean energy initiatives.

ANNEX I: GEOTHERMAL RISK MITIGATION PROGRAM (MIRIG; IDB AND IBRD)

Problem Statement

Chile today has an installed capacity of 17.6 GW, of which approximately 74% corresponds to the Central Interconnected System (SIC) and 25% to the Norte Grande Interconnected System (SING). The remaining 1% corresponds to the intermediate systems of Aysen and Magallanes. Electricity Consumption in Chile is projected to grow at a 5.5%-6.5% rate annually until 2020.[12] These projections indicate that by 2020 Chile will need an additional 7-8 GW of installed capacity. Given that Chile is a net importer of energy resources, dependent on fossil fuels, whose cost have been continuously rising over the past years, the GoC has been promoting the development of non-conventional renewable energy (NCRE) to diversify its energy sources in a sustainable way, contributing to a diversified, clean and safe energy matrix. Hydropower expansion could meet an important percentage of the expected demand, but one important project has been put on hold because of environmental concerns. The GoC recently approved legislation to increase the percentage of NCRE up to 20% of all new contracts by 2025, which demonstrates the ambitious path being followed by the GoC.

The production of electricity from geothermal resources[13] is a mature, proven generation technology for which Chile has enormous potential. Geothermal energy could be an alternative source of renewable and low-carbon energy to produce a relatively stable supply of electricity. It does not depend on weather conditions, and can provide a supply of low-cost baseload power, thereby complementing other sources whose supply is intermittent.

According to the most recent data,[14] by the end of 2011, 10,700 megawatts (MWe) of geothermal electricity generation capacity were in operation around the world.[15] Global geothermal electricity generation is projected to grow from 68TWh in 2010 to 315TWh in 2035 assuming that new policies take place, and to 217TWh in 2035 assuming current policies.[16]

Chile is located in the Pacific Ring of Fire, a belt of volcanoes and earthquake epicenters, where a high potential for thermal energy development is estimated. Chile is one of the countries with the highest potential for geothermal energy development in Latin America. Nevertheless, there is no robust estimation for the potential of geothermal development, and relatively little data is available. The growing economy and electricity demand, jointly with potential geothermal prices below market prices, suggest an opportunity for geothermal development. Although geothermal developers have been increasingly arriving to Chile since 2008, the market remains untapped. The private sector requires additional incentives to promote this clean source of energy. Thus, policy solutions are necessary to unlock the market before the private sector interest wanes.

[12] http://bit.ly/PAEE20
[13] Energy generated by the use of natural heat from the inside of the Earth, which moves from the interior of the crust toward the surface levels, transported through rock and / or fluids.
[14] Santoyo-Gutiérrez and Torres-Alvarado, 2010. *Escenario futuro de explotación de la energía geotérmica: Hacia un desarrollo sustentable*. Revista Digital Universitaria, UNAM. http://bit.ly/futGEOT.
[15] http://bit.ly/IFC-Geothermal, p.4, 2013
[16] http://bit.ly/IEA-WEO2012, p.216, 2012

Chile has been a pioneer in studying its geothermal potential. The first exploration was conducted in 1907 in a geyser field in the north of the Country. Today, Chile has a center of geothermal research, the Andean Geothermal Centre of Excellence, supported by the National Commission of Scientific and Technological Research (CONICYT), which seeks to generate the necessary scientific knowledge to turn geothermal energy into a sustainable, environmentally friendly and economically competitive resource.

Development potential

Geothermal energy in Chile may have a high development potential because it offers a domestic, clean, cost-competitive, high potential resource -16GW, that can be produced domestically, according to available estimates- and generate baseload energy in an environment of rapidly growing energy demand. The goals set by the GoC (20% NCRE by 2025) further support this intention. To date, the Ministry of Energy has granted 70 exploration concessions and 6 development concessions (although none of these projects have installed generation capacity yet). Recently, the Chilean government set a new rule (Decree No. 114) for geothermal concessions to streamline project initiation and to give developers more certainty about the right to use the geothermal resources. This rule came into effect in March 2013 and aims to speed regulatory reviews by reducing concession requirements. The new rule grants the concession exclusive rights to both exploration and development (see p.9; Geothermal Law)

Major constraints

The main barriers that should be removed to increase investment and accelerate development of the geothermal resource occur during exploration and production drilling. As a result of the challenges in this and other areas described below, Chile has not yet generated any geothermal power.

- **High risk and cost**, including: (i) inability to determine resources *ex ante* (before drilling has taken place); and given the limited experience and knowledge of the geothermal resource in Chile, this results in failure rates much higher than in other places; (ii) high capital costs: activities encompassing exploration and production drilling can represent up to 60% of the total investment to be financed, a particularly severe issue in Chile, where the lack of local availability of adequate rigs requires sourcing rental equipment from abroad, thereby doubling or tripling drilling costs; (iii) long periods of maturity of the investment; (iv) insufficient knowledge on how to assess the feasibility of projects by investors, which increases risk perception; (v) costly transmission infrastructure investment needed given remote location of geothermal fields; and (vi) merchant project risk given the difficulty in securing PPAs in early stages of development and/or for an adequate duration (PPAs normally available in Chile are for no longer than 7-10 years; geothermal power production assets are normally amortized over 20+ years). All this creates shortage of funding or inadequate funding conditions (collateral requirements and excessive fees) and acts as a deterrent of private investment in the sector (See Fig.1-3)
- **Time to commissioning:** Project development lead times of geothermal (9-13 years) are longer than other renewable projects such as solar (1.7-2.7 years) and wind (5.5-9 years),[17] making it more difficult to obtain a PPA with unregulated clients such as mining companies, or to have access to commercial financing.
- **Local capacity:** Limited supply of value chain players and technical expertise given the lack of a domestic oil and gas sector. The gas and oil sectors share similar activities with geothermal such as

[17] Source: Bloomberg New energy Finance.

drilling. Additionally, the mining sector in Chile already utilizes much of the human resources by offering attractive labor conditions to those with technical expertise, such as geologists.

- **Sites in remote locations:** Most of geothermal resources are far away from the grid and other essential services, making it challenging to connect to the grid and increasing the investment costs for developers. Harsh geographic and weather conditions in some of the fields (high altitude, low temperature) make access to them difficult and costly for much of the year, allowing only 3-4 months of work per year in some cases.

Figure 1: Geothermal Financing Gap

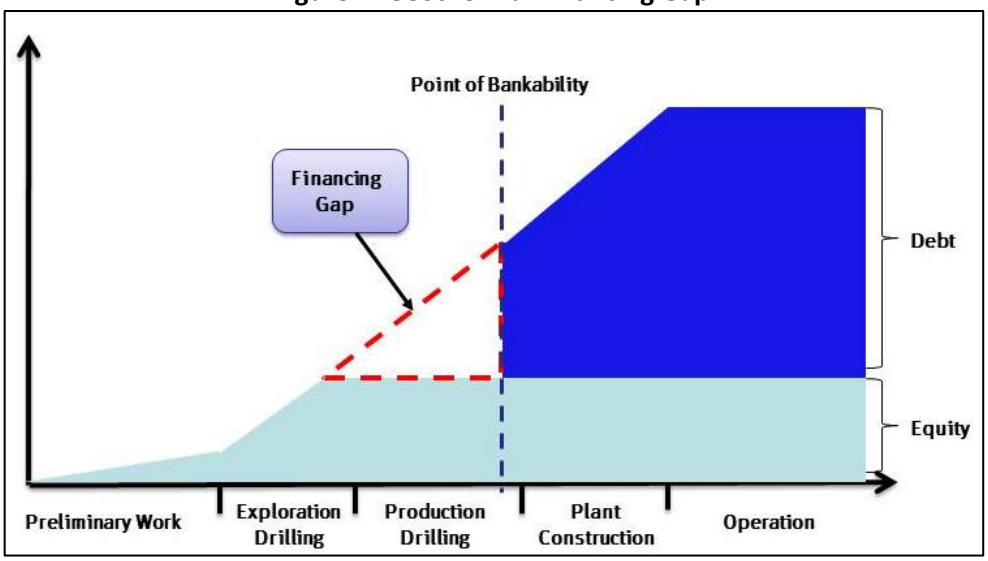


Figure 2: Phases in Geothermal Development

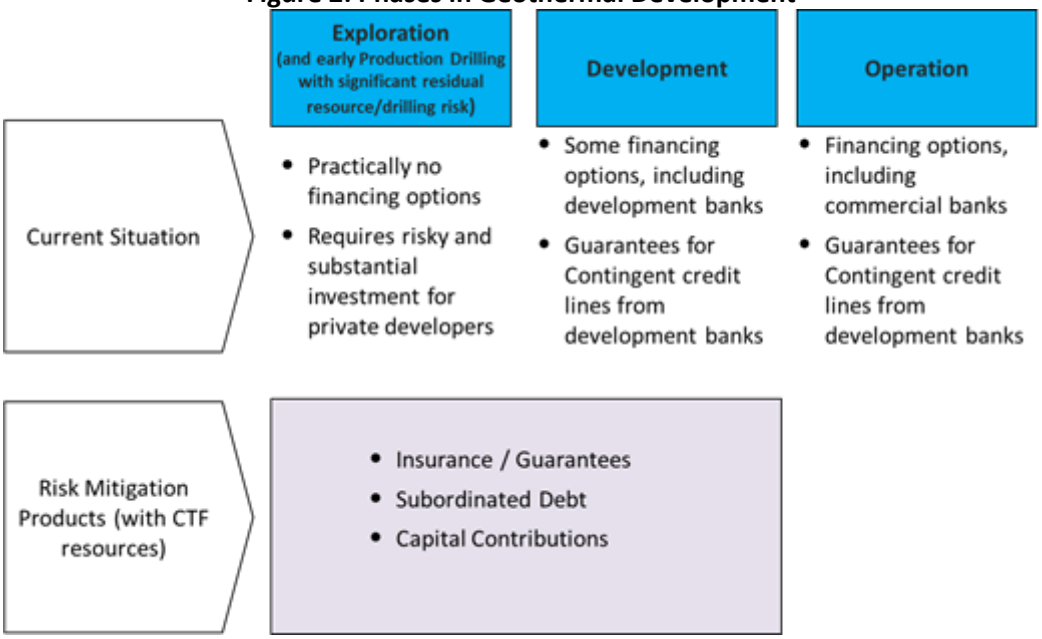
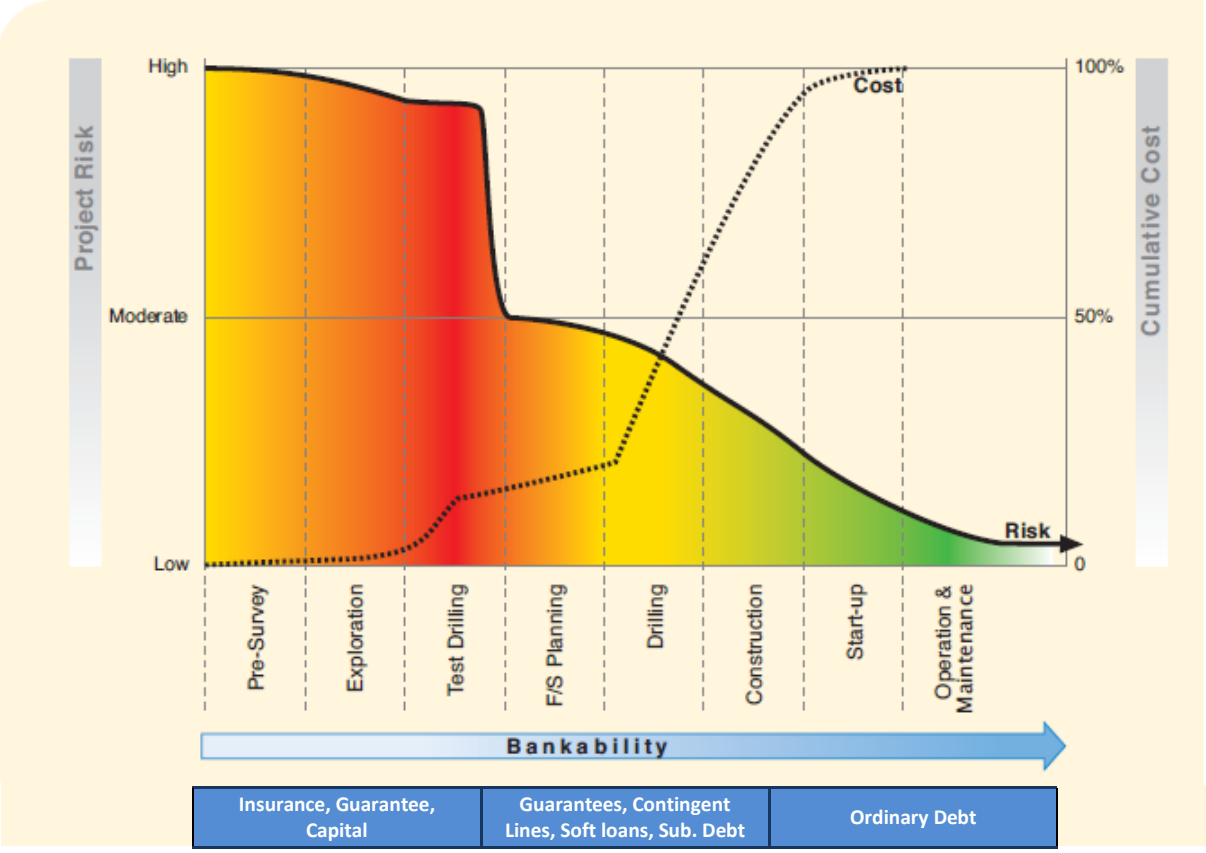


Figure 3. Cost and risk profile of an average 50MW geothermal project, and financing instrument possibilities for each stage



Source: ESMAP Geothermal Handbook Planning 2012, and IDB team

Two-pronged Structure of the Program

In order to face these constraints, the MiRiG Program proposes the following two components:

1. A financial mechanism component, to be executed by IDB; and
2. A technical assistance to strengthen domestic capacity, to be executed by IBRD.

Table 9 shows the indicative financing of both components. This allocation is subject to further review at the stage of Component design.

Table 9. Indicative Allocation of MiRiG components (USD million)

Component	CTF	MDB	GoC	Private sector
1. Financial mechanism component	30	50		200
2. Technical assistance to strengthen domestic capacity	3	0.5	14.5	
TOTAL	**33**	**50.5**	**14.5**	**200**

Co-financing figures to be revised at the time of program design.

Component 1: Financial Instrument (IDB)

Rationale for CTF support

The early stages of geothermal development present an imbalance in the risk/reward ratio that limits the availability of private risk capital willing to make such initial investments. The uncertainty over the financial viability of projects before drilling, given the high initial resource risk, makes commercial and even MDB financing almost impossible, unless such risk is mitigated. Unless sufficient equity is available to be put at risk –normally only an option for sizeable developers with big balance sheets– donor or public support is needed to mitigate such risk. Geothermal development in Chile has been directed to the private sector through a concession system. While some public funding has been utilized for exploration work in the past, no public funding is currently available for exploration, appraisal or early production drilling. CTF funding is therefore needed to provide such risk mitigation, to allow third party financing and risk-sharing, reduce the risk/reward imbalance for developers, and thus accelerate investment and development of the sector.

Proposed Transformation

The MiRiG's proposed transformation is two-fold:

1) To provide and demonstrate geothermal development risk mitigation mechanisms that allow attracting additional investment (both equity and debt) for drilling activities (i.e. when resource and field development risk still hinder –along with other factors such as interconnection and price/market risk- access to adequate financing). This would accelerate the rate at which projects can reach the stage where they can access other sources of financing for further development of the project.
2) To demonstrate the technical and financial viability of this technology to provide cost-effective base-load power in the Chilean context.

The scaling in investment in the development of geothermal energy would also generate environmental and economic benefits, including:

- For the environment: Reduction of GHG emissions at a competitive generation cost relative to other clean energy sources.
- For the economy: reducing dependence on imported fossil fuels, stable power for the power system, development of private industry with high export potential and high added value, generating new investments, employment and regional development.
- From the point of view of competitiveness of the economy, geothermal power is in many parts of the world on of the most cost-effective RE technologies.

Proposed strategy to achieve transformation

To achieve the proposed transformation, IDB, in partnership with GoC and with CTF support, will evaluate, develop and implement geothermal development risk mitigation mechanisms to overcome the high cost/high risk obstacle of the drilling phases of geothermal development. For this, during project preparation the IDB team will explore with project developers and financiers various possible risk mitigation mechanisms to allow them to secure required financing to enable and accelerate project development. Unlike the cases of PV solar and wind, geothermal power projects are extremely heterogeneous, and the best tool for any given project will depend on its size, location, stage of development, the extent to which the resource has been studied, the financial capacity of the project

developer, the existence of an offtaker, transmission constraints, and a number of other variables. Thus, IDB's plan would allow the flexibility to consider a number of options for the use of CTF resources to maximize their effectiveness to result in installed MWs of geothermal capacity in Chile. The current experience of the IDB in the development of a Risk Mitigation Instrument for Mexico (expected to be supported by the CTF) enhances the possibilities of cooperation between the two countries. Mexico has the fifth largest geothermal capacity installed worldwide, but the investment has been so far limited to CFE, the public utility. Both Mexico and Chile share the interest to promote private investment in geothermal development and the collaboration would enrich the design of the instrument for the Chilean case.

The financial leverage and coverage that CTF resources would allow will depend on two main variables: ***i) the risk mitigation mechanism***, and ***ii) the type of resources CTF provides (grant-loan ratio)***. The options and implications are discussed below:

I. *Risk Mitigation Mechanisms*

There are various options to be considered, including insurance, guarantees, mezzanine financing or capital contributions to projects to mitigate and/or share the risk associated with the existence, amount, quality and cost of development of the geothermal resource.

a) Insurance

An insurance scheme would likely have the higher risk-sharing and financial leverage potential, resulting in the possibility of greater coverage (number of fields) for a limited amount of available resources. Insurance would provide coverage for the lenders, enabling the project sponsor to leverage its equity, reducing capital at risk and improving the risk/reward balance and the internal rate of return (IRR). CTF resources could subsidize the cost of the insurance premium, making the project economically and financially viable despite its high cost. While a geothermal resource risk insurance product is not currently available in the Chilean market, IDB is currently working with the insurance industry to determine its viability, time for development, and cost and coverage profile.

b) Other risk mitigation mechanisms

While the development of an insurance scheme is GoC's initial preference, given the uncertainty over its viability at this early stage, other risk mitigation instruments will be considered as project developers and financiers are engaged. Such instruments will include guarantees, capital contributions and mezzanine financing, all of which have been used successfully in other cases. While these instruments may have lower leverage than an insurance product, they can also be effective tools to achieve the program objectives, and would likely be easier to structure and implement.

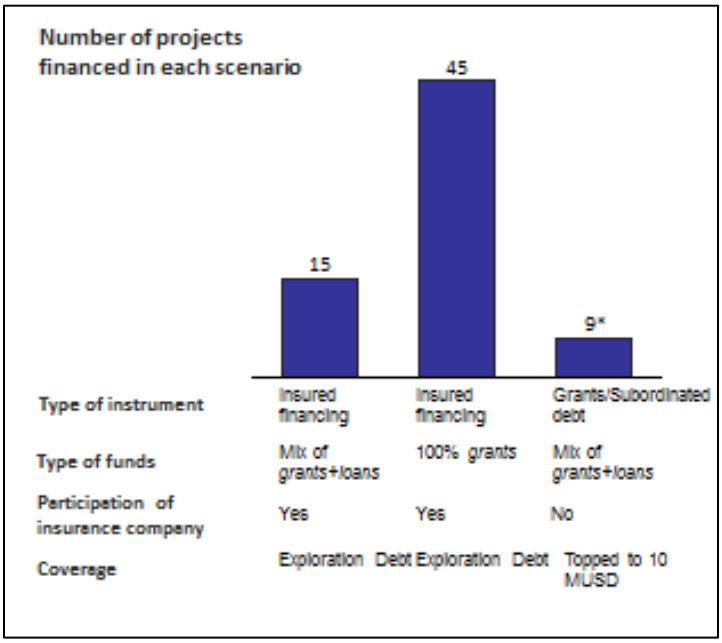
II. Type of CTF contribution

In light of the limited concessional resources available relative to the high cost of drilling (especially in the Chilean context) the type of funding provided by CTF would have a significant effect on the way they can be utilized, the leverage they could generate and the coverage (number of projects supported) they could offer.

In simulation studies, recently performed by IDB for the case of Mexico, it was determined that CTF resources provided as a full grant and directed to subsidize an insurance premium allow coverage for 3 times as many projects as if they were provided as a 25% grant–75% loan mix. Given the limited resources available and the higher cost of geothermal development in Chile relative to other countries, the GoC would welcome consideration by the CTF TFC of providing an optimal grant/loan ratio in order to maximize the number of projects that can be supported and thus the possibility of enhancing risk diversification, economies of scale, and the demonstration potential of the program.

Figure 4 below illustrates the different leverage potential of CTF resources in the Mexican simulation, based on the different types of CTF contribution (full grant or grant-loan mix) and type of risk mitigation mechanism (insurance vs. guarantee).

Figure 4. Leverage potential / number of projects that can be supported based on the risk mitigation tool and the type of concessional finance received (Mexican case)



The financing instruments and implementation arrangements of the MiRiG will be defined during project preparation, after completing the necessary due diligence analysis. The following section presents an overview of aspects to be analyzed at that stage. Program financing sources (see Table 9) will be more clearly determined as project preparation advances. As the two variables described above (risk mitigation mechanism and type of CTF contribution) are defined, the estimated benefits and target values for the indicators will be estimated. The project preparation and approval timeline will require some insight from the early stages of preparation (possibility and timing of developing an insurance product, for example) to be defined.

Project preparation

Project preparation will encompass the following assessments, as needed:

1. Geothermal status survey. At this stage there will be a survey of the status of each geothermal project. The objective is to determine the potential portfolio of projects in need of financial and/or risk mitigation support as well as to understand the specific status of each of them, including level of

resource confirmation, expected costs (drilling, transmission, etc.), timeframe (drilling schedule, feasibility studies, project development, negotiation / confirmation of funding, etc.) and current access to capital for each project. This will help determine more precisely:

- The kind of support required for each project (both financial and technical assistance support).
- The specific cost profile of each project until they reach the stage where they can access commercial funding.
- The time needed for the development of each project. Understanding this will contribute to the determination of the optimal choices of financial instruments and funds allocation mechanisms.
- Fundraising capacity and funding options for each project (access to equity and debt), to understand the instrument and level of financing needed in each case. This includes financial and contractual commitments (PPAs, for example) that projects already have.

2. Market analysis, sector regulation and policy context. In addition to the analysis of the projects, a review of all aspects of financial and electricity markets in Chile will be conducted, including analysis of the policy and regulatory aspects most relevant to the development of the sector. In particular, the analysis will include:

- The policy and regulatory framework of the sector, and gaps that hinder their development or opportunities for developing incentives
- The capabilities of the developers / existing sponsors, and strengthening opportunities
- The availability and interest of potential funders for the geothermal sector, including banks, investment funds, other financial agents, bilateral agencies and multilateral agencies.
- The interest and ability of insurers to develop an insurance product.
- The electricity market in terms of potential off-takers who could offer a PPA, as well as of market price levels and their possible evolution based on supply and demand projections.
- Availability of necessary equipment and technology, and development opportunities.

3. Assessment of the viability of developing an insurance instrument adequate to the Chilean context. In coordination with the ongoing work for the Mexico program, the team will advance the exploration of the feasibility of developing a geothermal resource risk insurance product. The team will determine the interest of the insurance companies, the relevance of the various models of insurance, the type of coverage that could be offered, the indicative costs of the policies, the processes and time required to develop such an insurance product, and the possibility of developing a portfolio of projects that allows to diversify the risk and reduce the cost of the insurance premium.

4. Modeling of the options of risk mitigation instruments. Based on the status and costs of ongoing geothermal projects in Chile, and capitalizing on the analytical model developed for the Mexico program, various scenarios will be modeled for Chile using different mitigation instruments (insurance, guarantee, subordinated debt, capital contribution, among others) to assess the coverage potential, cost-effectiveness and leverage of each of these options. Also the minimum requirements and critical mass of resources (CTF and other sources) needed to ensure the success and sustainability of the program will be assessed for each case.

Besides the type of instrument, in this analysis the following variables will be modeled:

- Subsidy levels of the insurance premium or other forms of subsidy / concessionality
- Type of CTF contribution (grant vs. loan)

- Recovery mechanisms for a revolving/sustainable Fund

5. Definition of risk mitigation and/or promotion instruments. Based on the results of the modeling, the evaluation of available co-financing sources, and the feasibility of developing and implementing the various risk mitigation mechanisms, the industry will be consulted (developers of projects and potential funders) on the interest and feasibility of these alternatives. The most suitable instrument will be then selected based on the best combination of acceptance, ease of implementation, coverage (number of MWs or projects), cost-effectiveness and leverage potential, among other parameters to be considered.

6. Project Design. Based on the assessment of the previous points, GoC will define:

- Objectives to be achieved by the project, Results framework and Monitoring and Evaluation arrangements.
- Risk mitigation instruments or promotion scheme to be used.
- Technical assistance activities needed for the proper implementation of the program
- Allocation of funds for investment and technical assistance
- Relevant implementation arrangements

Timeline for preparation

Table 10: Project Preparation Timeline, Component 1

Milestone	Date
Eligibility/Quality Review	December 2013
Submission to TFC	January 2014
Approval by IDB Board	April 2014

IDB Board approval date will depend on the type of operations to be included in the Program

Component 2: Technical Assistance to Strengthen Domestic Capacity (IBRD)

Rationale for CTF support

In order to have a truly transformational impact, the domestic institutions in Chile including MinEne will need to steward priority investments through the multi-phase geothermal development process in order to achieve the ultimate goal, which is to install and operationalize power generation capacity. Although geothermal resource risks presents a particular barrier to mobilizing investments in the sector for resource confirmation, there are a number of additional important constraints that will also need to be addressed in order to be successfully transformational. Given that Chile's geothermal sector is at a nascent stage of development, it would also benefit from exposure to other successful international experiences in geothermal development, in designing its own unique way forward with sector development. Therefore, the strengthening and maintaining of domestic capacity to oversee and guide sector development and investments is integral to the proposed CTF intervention, and to achieving Chile's geothermal development goals. In line with this, the primary aim of the technical assistance component is to strengthen domestic capacity in order to:

- Support critical oversight activities necessary for implementing the risk mitigation instrument described under Component 1. At present, there are a large number of concessions that have been issued for geothermal development, and it will be important to determine the development priorities as well as developers' adherence to industry standards in project preparation and practices, and compliance with domestic regulatory requirements. Such oversight is necessary to

support the implementation of component 1 and will also greatly enhance the success of geothermal resource confirmation operations.

- Once the resources are confirmed, there will still be a number of critical phases of development such as production drilling, installation of the steam above-ground systems (SAGS) and the construction of the power plant that will take several years to complete. Although the resource risks are significantly diminished, there will remain risks associated with the large-scale financing that will need to be mobilized, various construction and other risks associated with operations. These can be considerable impediments during the early stages of developing the geothermal sector, as is the case in Chile. Therefore, the technical assistance will provide critical support for the domestic institutions to have in place strategic solutions that will help guide the longer-term development of the geothermal resource following the exploration drilling/resource confirmation stage.

The World Bank, which has the largest portfolio of investments supporting geothermal amongst MDBs, has been requested to support this component given its far ranging global experience. The World Bank Group is currently supporting some of the largest geothermal expansions in the world including in Indonesia and Kenya, along with additional strategic investments and sector reforms related to geothermal in countries such as Djibouti, Turkey, Nicaragua, Costa Rica, Dominica, and Ethiopia. The World Bank has also assembled a global sounding board of geothermal professionals, whose assistance will be extended to Chile on an as-needed basis through the technical assistance component.

TC Activities Under Consideration

The TC component will be designed to support the authorities in Chile with a number of possible activities:

- Preparation of a Geothermal Masterplan that will comprehensively guide the long-term scale-up in development of the sector. Although geothermal resource risks are a particularly challenging barrier, a number of additional barriers also pose challenges to developing all necessary stages until geothermal power generation capacity is on-line. Some key additional challenges concerning the sector in Chile include the need to raise large scale financing for production drilling following resource confirmation when commercial options still remain limited, certainty regarding off-take and interconnections given the particularly challenging geographical terrain in the country, and compliance with internationally accepted safeguard policies that is increasingly necessary for mobilizing international financing. Therefore, the Masterplan will need to indicate a path through which the sector in Chile is expected to address these critical issues and progressively develop the geothermal sector in the country, including:

    - A sequenced development program based on advanced stage of preparation as well as power off-take priorities
    - Information on the concessioning arrangements and developer rights
    - Opportunities for geothermal exploration and risk mitigation (including the highlighting of outcome in Component 1 and other market based opportunities for hedging investment risks and mobilizing risk capital)
    - Financing prospects and expectations for stages following resource confirmation including production drilling, steam gathering and power plant construction.
    - Environmental, social and safety requirements in compliance with domestic and international standards

- Strategy for technology transfer and training for domestic skills
- Monitoring and evaluation of program
- Clarification of the role of Government in sector oversight and management

- Monitoring and evaluation of geothermal concessions to oversee the progressive and successful achievement of development milestones covering the full project cycle, for all concessioned pipeline of projects under the purview of the GoC.

  - Surface Level Reconnaissance: It is important to independently review the geological, geochemical, and geophysical assessments that have been carried out to ensure that they meet industry standards, which will significantly enhance drilling plans and well design; ensure that support for scaled-up development is targeted towards fields that are power sector expansion priorities; and review the technical and financial capabilities of developers/concessionaires.
  - Exploration and Production Drilling: Review of drilling plans and well designs to ensure compliance with sound industry practice, independent evaluation of well testing and resource confirmation assessment, review of feasibility work for ensure project viability as well as adherence to environmental and social policies and practices in drilling operations including compliance with domestic regulations and international practices (Equator Principles).
  - Construction of SAGS and Power Plant Facilities: Independent review of specifications, its interconnection and integration into power system, facilitation of off-take agreements, ensure compliance with critical environmental and social requirements.

- Training and Capacity Building: Specially designed training programs and on-the-job training for MinEne and other stakeholders to progressively develop the capacity for managing geothermal development including technical, regulatory, financial, and safeguard aspects. This support will be extended to private developers who may wish to participate and enlist additional assistance.
- Just-in-Time Support from Global Advisory Panel on Geothermal: Provide access for GoC and other stakeholders to an Advisory Panel of Global Experts on Geothermal Development, assembled by the World Bank. The group primarily includes geothermal resource specialists, geothermal power engineers, drilling specialist, and geothermal finance specialist – all of them with extensive international experience working geothermal developments in the United States, New Zealand, Mexico, Nicaragua, Indonesia, as well as Chile. A specialized group could be established for Chile that could support the public as well as the private sector on an as-needed basis.

Transformational Benefits

The TC component, which is integral and complements the investments, is designed to have the following transformation impacts:

- Strengthen the long-term domestic capacity to manage and monitor the development of geothermal on a sustained basis, where Chile is attempting to develop power generation capacity for the first time;
- Ensure that geothermal developments in Chile meet industry and international standards to ensure safe and successful project development. Ultimately, such standards lead to optimized development of the sector;
- Disseminate global best-practice knowledge so that Chile can leap frog and advance the development of its geothermal resources.

Timeline for preparation

Table 11: Project Preparation Timeline, Component 2

Milestone	Date
Eligibility/Quality Review	April 2014
Submission to TFC	May 2014
Approval by IBRD Board	October 2014