PROJECT INFORMATION DOCUMENT (PID)

CONCEPT STAGE

Report No.: 99764

Project Name	CL Technical Assistance for Geothermal Development in Chile
Region	LATIN AMERICA AND CARIBBEAN
Country	Chile
Sector(s)	Other Renewable Energy
Theme(s)	Infrastructure services for private sector development (50%) Climate change (50%)
Project ID	P152820
Borrower(s)	GOVERNMENT OF CHILE
Implementing Agency	Ministerio de Energía
Environmental Category	B
Date PID Prepared/Updated	November 21, 2014
Estimated Date of Board Approval	April 30, 2015

I. Introduction and Context

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 17 million inhabitants, and $277 billion GDP in 2013[1], the country recorded an average annual growth rate of 3.5 % while per capita 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%).[2]

Sectorial and Institutional Context

2. **The energy sector is a key determinant of economic growth in Chile. Electricity demand in Chile has been out pacing economic growth, at around 7 percent per annum, doubling every 10 years.** This reflects the relative energy intensity that is driving economic growth, especially in the industrial as well as 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 estimates that electricity demand will continue to grow at 6% - 7%[3] per year through 2020, which will require an additional 8 gigawatts (GW) of power generation capacity and associated infrastructure.

[1] The World Bank

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

[3] National Energy Strategy 2012-2030

3. **The predominant share of thermal and hydro resources in the generation mix has impacted the reliability of the power system.** In 2013, thermoelectric installed capacity accounts for 64% of the total power generation mix in Chile while hydropower makes-up 34%, wind contributes 1.6%, and solar power provides just 0.4% of the total installed capacity in the country. The large scale hydropower plants have had reduced availability due to vulnerability to extreme weather resulting in the severe drought of 2010 in Chile and multiple years of below average rainfall. Chile's energy supply vulnerabilities were clearly evident when there were a series of disruptions in the significant amount of natural gas supplies imported from Argentina between 2004 and 2008. This situation created severe constraints, including impacting power generation, which was later alleviated through diversification of supply sources and the construction of two LNG terminals for domestic storage and regasification. Nonetheless, reducing excessive reliance on imported fuel supplies through the development of alternate indigenous power generation options continues to be an imperative for strengthening the energy security of the country.

4. **Stable and predictable energy sources may reduce electricity price fluctuations.** Given the structure and regulation of the sector, electricity prices are mostly determined through market forces. In the recent past electricity prices have fluctuated reflecting various factors including volatility in fossil fuel prices, availability of hydro, and shortages created by the disruption of gas supplies from Argentina. Although electricity prices have moderated somewhat in 2014, fluctuations in electricity prices have been significant, making it less predictable for investors and consumers alike. Since the uncertainty in prices undermines business competitiveness and creates hardship for people, thus, the Government of Chile (GoC) has made reducing prices and stabilizing volatility in the power sector a primary objective for the energy sector[4].

5. **Chile is also determined to develop the energy sector in a sustainable manner that limits global greenhouse gas (GHG) emissions.** Chile's greenhouse gas emissions, which are expected to double by 2025, are primarily from the energy sector. The CO2 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]. Redirecting the emissions trajectory is an important objective for the Government of Chile, especially since, as an OECD country, it may face commitments to reduce emissions as a part of a future global agreement on climate change. Thus Chile is making efforts to reduce its dependency on fossil-based electricity and diversify its generation mix. It is already a signatory to the Copenhagen Accord where Chile agreed to take mitigation measures to deviate by 20% its business-as-usual emissions trajectory.

6. **Expanding renewable energy as a part of a better diversified generation mix will also have considerable local environmental benefits, if developed prudently in compliance with safeguards requirements.** 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. 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 can arise during construction and operation.

7. **Chile's latest "Energy Agenda" 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 newly elected administration in Chile established an "Energy Agenda" that aims to address some of the key issues facing the sector. Consistent with its long-term National Energy Strategy 2012-2030, some of the strategic objectives are to boost the utilization of non-conventional renewable energy (NCRE), reduce the marginal cost of electricity, and improve energy efficiency to reduce consumption. In 2008, the GoC established a NCRE target of 10% by 2024, which, in 2013, was increased to 20% by 2025[6]. To meet this goal, it is estimated that between 3,500-4,000 MW of NCRE generation capacity will need to be installed in the next 10 years[7].

8. **Chile's abundant geothermal potential provides a good renewable energy option to further diversify**

[4] National Energy Strategy (2012-2030), Chile.
[5] US Energy Information Administration (EIA).
[6] Law 20,698, commonly referred to as the 20/25 Law
[7] Center for Economic Load Dispatch (CDEC)

the country's power generation mix, reduce price volatility, and improve energy security. The mountainous eastern backbone of Chile is the Andes Range that comprises almost 3,000 active and dormant volcanoes. 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 can be in excess of 3 GW[8]. The main advantage of geothermal energy among other renewable energy technologies is that it can provide reliable base-load power on a 24/7 basis, as geothermal is a non-intermittent source[9].

9. **The GoC has made a concerted effort to develop the nascent geothermal industry in the country.** In 2000, the GoC promulgated the Geothermal Concessions Law (Law Number 19.657), with the objective of issuing geothermal development concessions to mobilize investments in the sector, resulting in over 100 geothermal concessions being issued (with many securing multiple concessions). Despite what appeared to be a promising start, very little investments were mobilized in a small number of fields for the risky exploration drilling investments and resource confirmation efforts that are necessary before advancing green field development. The GoC issued a revised regulation in 2013, to ease some of the administrative constraints in adequately applying the law. However, despite these efforts and the large potential, presently there are no geothermal power plants in operation in Chile. Reforms to the policy and regulatory framework alone have demonstrated insufficient so far to address some of the additional key barriers that are impeding the progressive development of geothermal in Chile. They reflect challenges related to the technology as well as the circumstances specific to the Chilean energy market, like geothermal resource-confirmation risks, integration of geothermal in the power market, long-term competitiveness of geothermal and Environmental and social considerations.

10. **The GoC is intensifying its efforts to address critical challenges in order to advance geothermal, and is seeking international assistance to help achieve its goals.** The GoC recognizes that it will be important to develop geothermal as a viable alternative energy option if Chile is to meet its NCRE targets. Therefore, the Energy Agenda already includes a number of reforms specific to promoting geothermal development that include: a) the preparation of a new geothermal law, b) design of risk mitigation schemes to mobilize investments in exploration drilling, and c) launch a program to promote the utilization of low and medium enthalpy geothermal for direct uses such as heating.

Relationship to CPS

11. **The Technical Assistance for Sustainable Geothermal Development project in Chile is fully consistent with the World Bank's Country Partnership Strategy (CPS).** The CPS aims to support Chile's vision for eradicating extreme poverty and achieving high-income developed status by 2018, for which a major strategic pillar is promoting sustainable investments in infrastructure in 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 new administration in Chile, including issuance of the Energy Agenda, confirm that geothermal development is a national priority that is consistent with its long-term development objectives. The proposed project and its associated activities are expected to contribute to promote private investments in geothermal towards achieving Chile's development goals.

12. **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. Furthermore, the World Bank through its Energy Sector Management Assistance Program (ESMAP) is spearheading the Global Geothermal Development Plan, 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 working with KfW and other development partners to establish the Latin America Geothermal Development Facility (GDF), to channel funds towards geothermal exploration and

[8] With some estimates suggesting that the potential may be as much as 16GW.

[9] The other presently available renewable technology is hydro with storage.

development. Chile is expected to be a key market for the GDF, if it can reform the sector and transition towards a vibrant and sustainable market for geothermal development.

II. Proposed Development Objective(s)

Proposed Development Objective(s)

17. Assist the Government of Chile to improve geothermal energy market conditions by addressing key barriers.

Key Results

- Draft geothermal concession law drafted and submitted for approval
- Create an incentive framework for the geothermal sector

III. Preliminary Description

Concept Description

13. The proposed Technical Assistance for Sustainable Geothermal Development project will assist the GoC undertake a number of key reforms to i) improve the market conditions and ii) facilitate greater immediate as well as long-term investments in the sector, so that geothermal can eventually become a key pillar in an optimally diversified power generation mix. It is with these intentions 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.

14. This operation forms a complementary part of a package of initiatives being undertaken by the GoC with development partners through the support of the CTF. This initiative provides funding towards a concerted and catalytic effort to advance geothermal development in Chile to begin to exploit its large estimated potential. For this purpose, it will be important to simultaneously address some of the associated barriers that are hampering efforts to invest in geothermal exploration and preventing Chile's significant prospects from being unlocked. These reforms should also help prepare the groundwork beyond the riskier resource confirmation.

15. The proposed Technical Assistance for Sustainable Geothermal Development project will entail a number of activities that will be carried out under the two components described below in order to comprehensively address several key barriers to geothermal development in Chile:

- **Component 1- Improve policy framework and strengthen management capabilities for mobilizing investments in geothermal.** Some of the envisaged activities under this component include:
    a. Legal and regulatory reform related to the geothermal sector, in particular the submission of a new geothermal concession draft law
    b. Strengthen the concession management system, including resolving issues related to the large number of existing undeveloped concessions, and improving the capabilities within GoC to oversee the progress of these developments
    c. Stakeholder engagement to raise awareness regarding geothermal development with local communities taking into account environmental and social considerations; and provide guidance to developers on compliance with international standards and domestic requirements

- **Component 2 – Enhance market conditions for promoting sustainable development of the sector.** Some of the envisaged activities under this component include:
    d. Develop a geothermal resource risk mitigation framework to help mobilize investments in exploration and production drilling
    e. Identify and address issues related to integration of geothermal power in the broader power market in Chile
    f. Identify and address ways in which the long-term competitiveness of geothermal can be improved

including an industrial analyses for sourcing services from domestic sectors and exploring medium and low enthalpy uses that would expand the market for geothermal in the country.

IV. Safeguard Policies that Might Apply

Safeguard Policies Triggered by the Project	Yes	No	TBD
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 Waterways OP/BP 7.50		X	
Projects in Disputed Areas OP/BP 7.60		X	

V. Financing (in USD Million)

Total Project Cost:	3.50	Total Bank Financing:	3.50
Financing Gap:	0.00		

Financing Source	Amount
Borrower recipient	0.00
ESMAP	0.50
Clean Technology Fund	3.00
Total	3.50

VI. Contact point

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