

Unlocking Geothermal Investments in Central America: Strengthening Enabling Policy and Regulatory Frameworks

San Salvador - August 2017

Geothermal Regulatory Framework in Chile

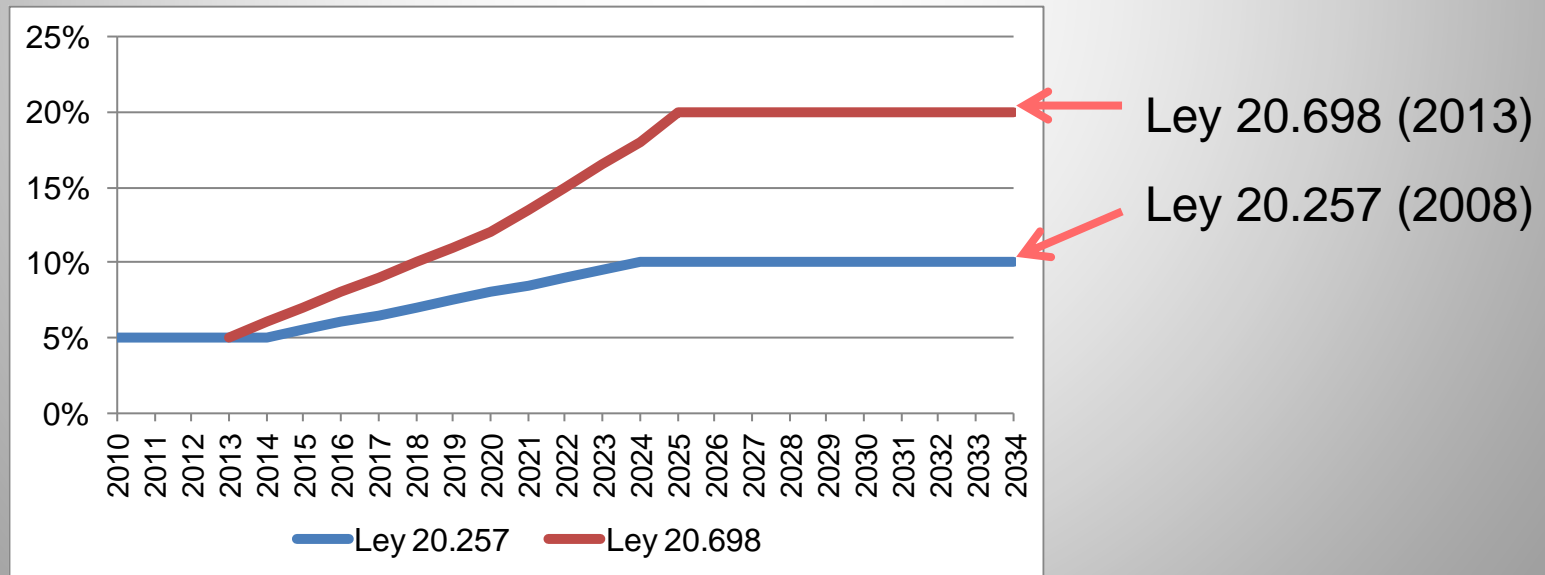


**Gobierno
de Chile**

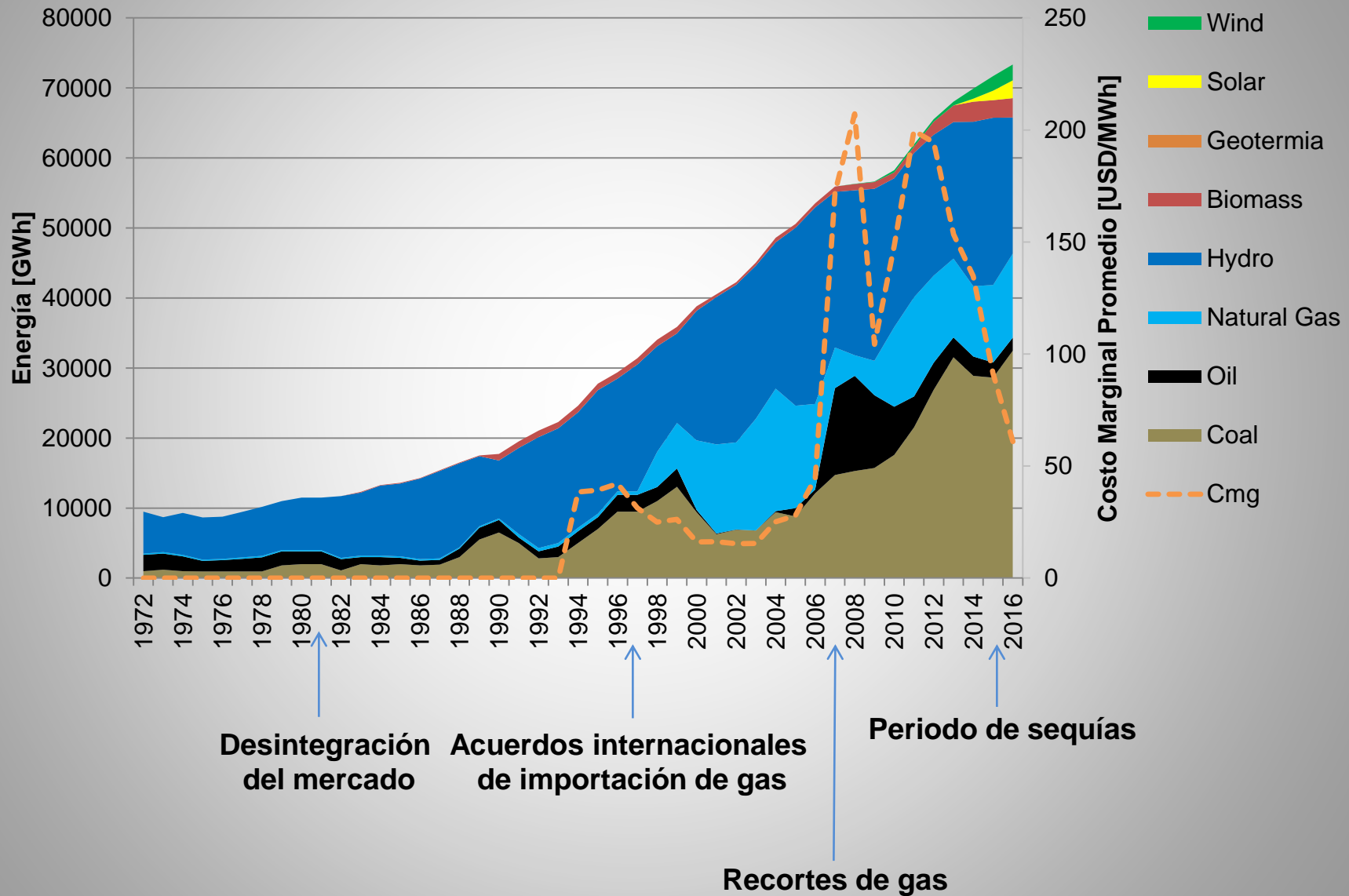
Rubén Muñoz Bustos
Head of Geothermal Unity
Renewable Energy Division
Ministry of Energy
Government of Chile

Geothermal Energy in Chile – Electric Market Context

- Generation sector is conceived open and competitive.
- While the market is structured as exchanges marginal cost, there are PPAs to stabilize prices.
- The investment is free private initiative: Freedom to decide technology, size, date of entry, etc.
- Renewable Portfolio Standard for Non-Conventional Renewable Energy (ERNC, does not include hydro > 20 MW): 20% by 2025 goal.

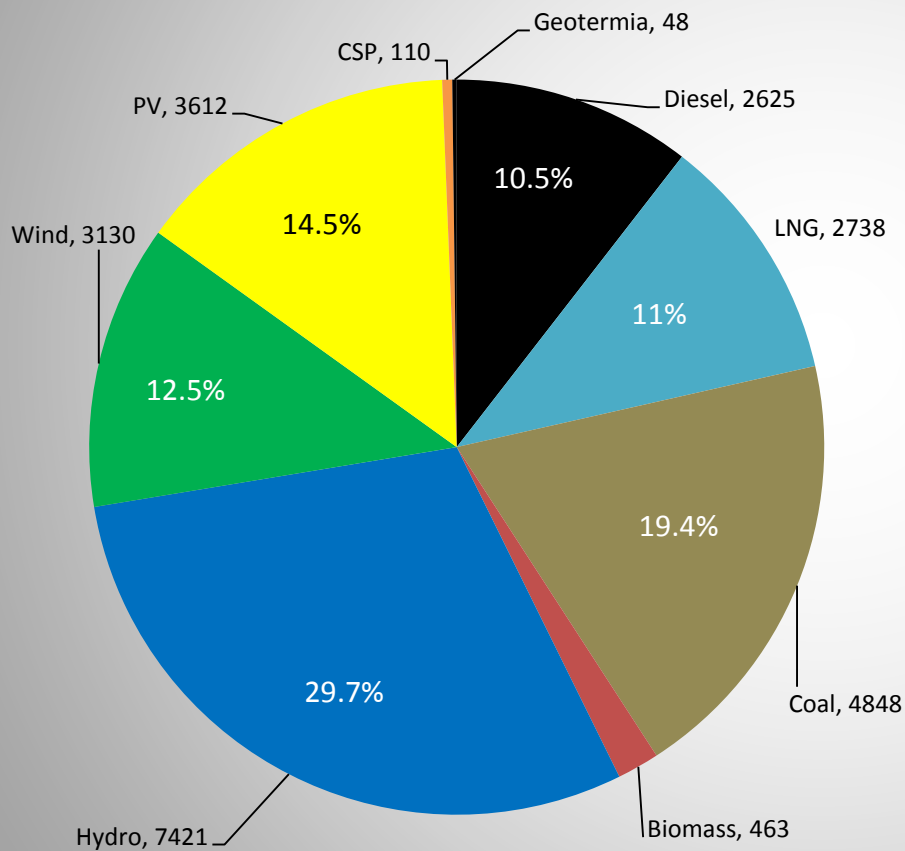


Energy Generation Evolution

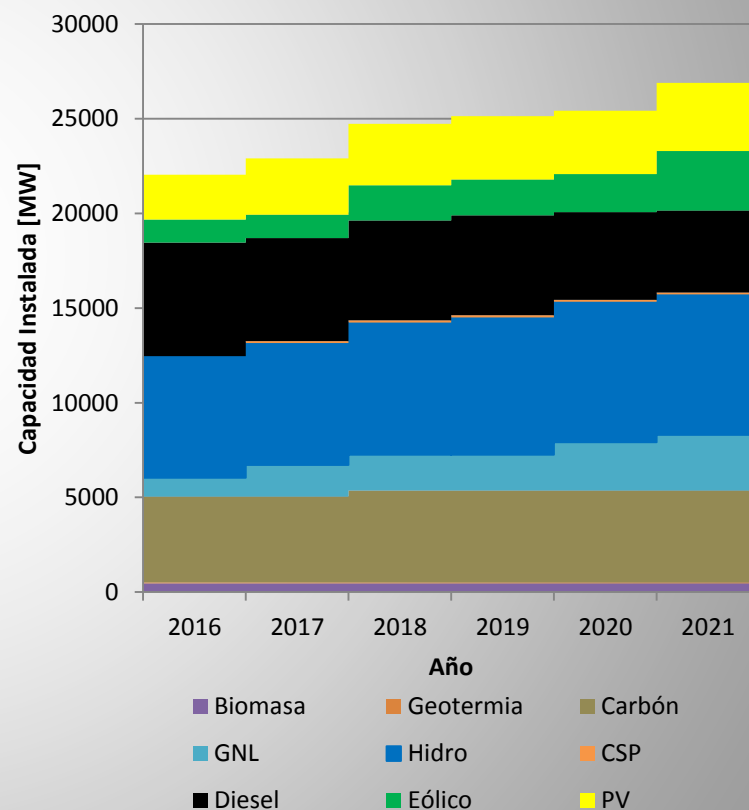


Expected installed capacity by 2021

Installed capacity [MW]

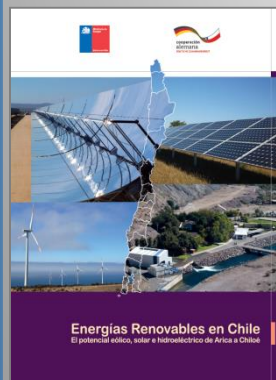
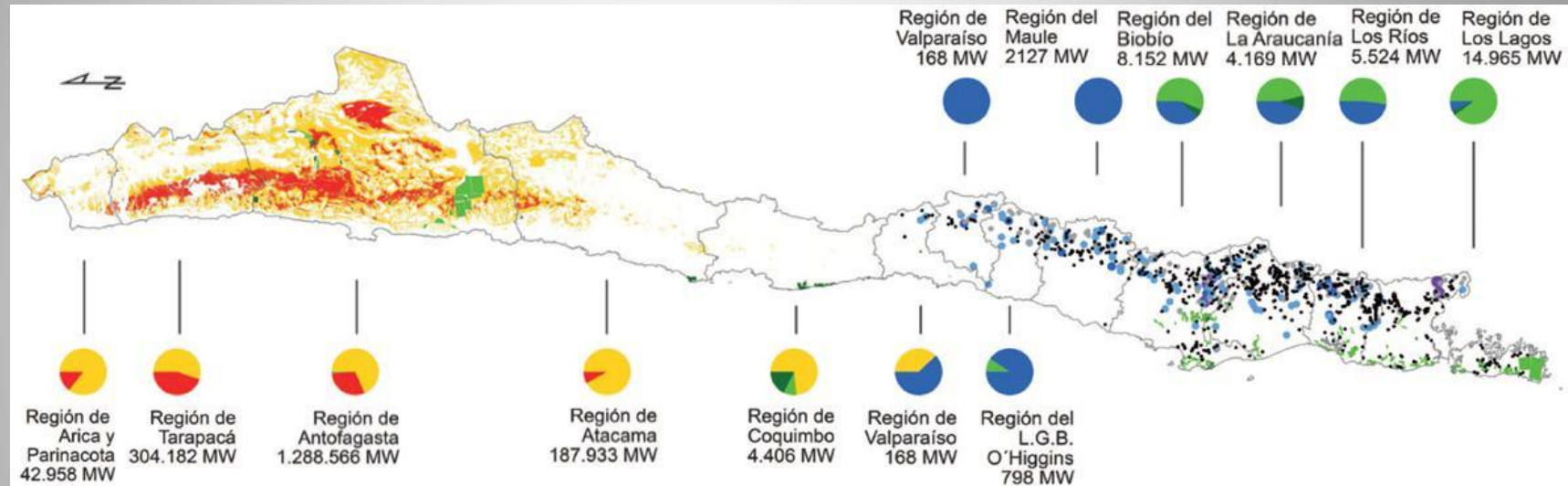


Installed capacity = 27 GW app
 Peak demand = 12 GW app
 Generación Neta = 89.600 GWh/año



Renewable Energy Potential

Chile has enormous potential, more than 1,865,000 MW of wind, solar and hydro energy, and probably 2,000 MW geothermal power and 2,000 MW of biomass...that is about 100 times Chile's total installed capacity.



Available RE potential without overlap.

Technology	Potential [MW]	Environmental Assessment Approved [MW]	Under Evaluation [MW]
Mini-hydro	7,951	337	215
Wind	37,477	5,513	1,960
Hydraulic	4,521	1,352	611
Solar-PV	1,263,407	8,173	4,792
Solar -CSP	548,478	760	370
Geothermal	2,120	120	0
Total	1,863,954	10,478	7,948

<http://www.minenergia.cl/documentos/estudios/2014.html>

RE and Energy Policy

Vision and Pillars of our energy policy

Reliability, Inclusiveness, competitiveness and sustainability

Pillar 1:
Security and
quality of
supply

Pillar 2:
Energy as
development
force

Pillar 3:
Energy and
environment

Pillar 4:
Energy
efficiency and
education

Long Term Goals

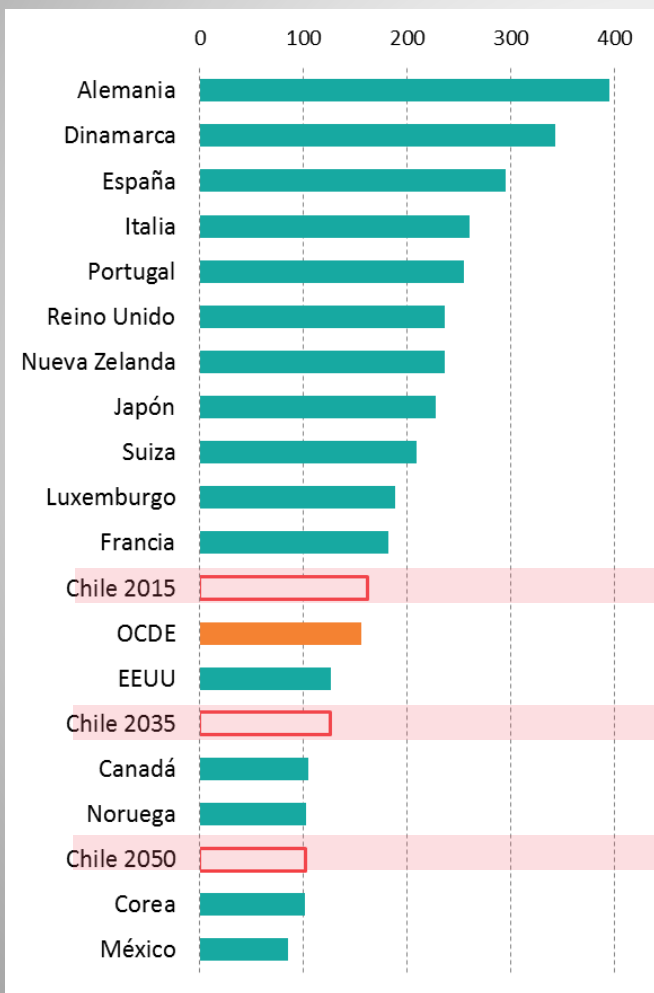
- 2035: 60% of electric generation from RE.
- 2050: 70% of electric generation from RE.

First South American country to implement a carbon tax for large power plants.

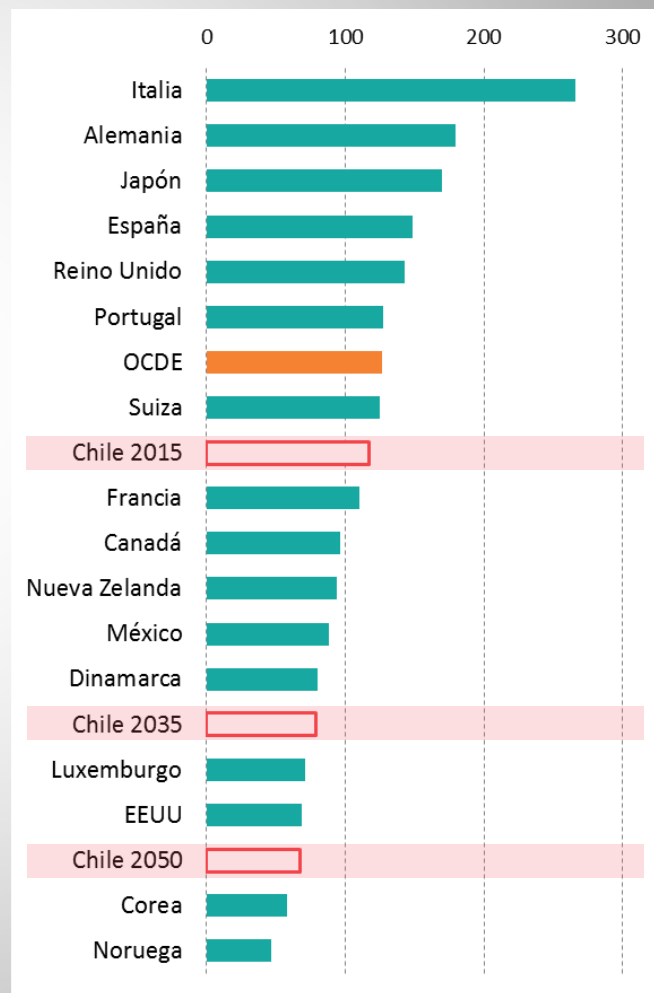
Voluntary target of cutting GHG emissions 30% from 2007 levels by 2030, up to 45% if there is any international cooperation.

The long-term goal is to be among the OECD countries with the cheapest electricity

RESIDENTIAL CUSTOMERS



INDUSTRIAL CUSTOMERS



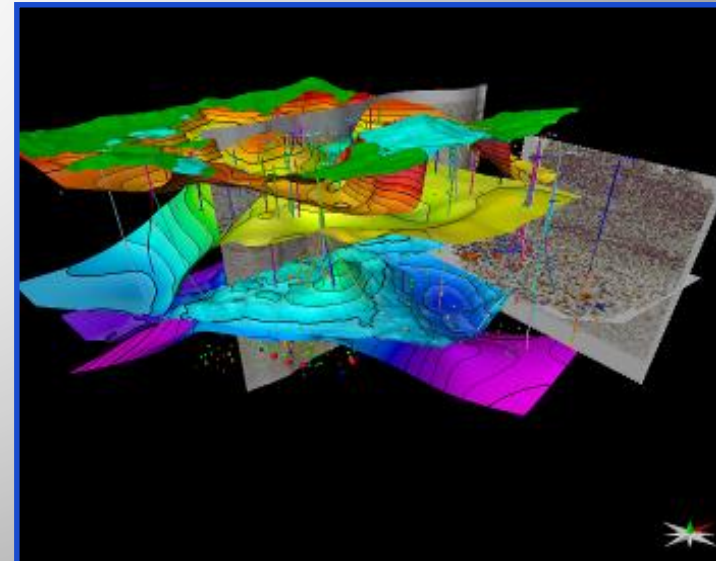
Geothermal Energy in Chile - Regulatory Framework

Law No. 19,657 on Geothermal Energy Concessions (January, 2000); governs the granting of concessions by the Government to geothermal developers.

The concession system was defined in two step:

1. Exploration Concessions: Gives the developer the right to carry out exploratory work to determine geothermal potential.

- Duration: 2 years, extendible for 2 years more (if the 25% of the investment for the project is materialized)
- Maximum area: 100,000 ha.
- Exclusive right to obtain the exploitation concession in the same exploration area. 2 years after it expired



Geothermal Energy in Chile - Regulatory Framework

The concession system was defined in two step:

- 2. Exploitation Concessions:** It confers the right to use the geothermal energy that exists within its boundaries. Awards the developer the right to carry out all the activities required for a geothermal energy generation plant.
 - Duration: permanent.
 - Maximum area: 20,000 ha.
 - There are the obligation to pay a fee: $\frac{1}{10} UTM * ha \sim 7,2USD * ha$
 - There are not obligation to development de project.



Geothermal Energy in Chile - Regulatory Framework

Who owns the geothermal resources? Can private parties own the resource?

The Law N° 19.657 provides that geothermal energy belongs to the State, but may be explored and extracted by private parties holding a geothermal concession.

Who can grant permit to exploit the geothermal resources?

Ministry of Energy by direct application or by public tender process.

Do landowners have the right to exploit resources without a license?

The only way to exploit geothermal resources is through an exploitation concession

Is exploration/exploitation open to foreign investment?

Yes. These activities are open to foreign investment through a legal entity duly incorporated in Chile

Geothermal Energy in Chile - Regulatory Framework

Are exploration license holders granted pre-emptive rights with regards to exploitation?

- The holder of an exploration concession has an exclusive right to obtain the exploitation concession in the same exploration area.
- This right may be required to the State through an app, during the term of the exploration concession and up to two years after it expired.
- The exploitation concession and the environmental approval for a power plant are separate permits

The license could be revoked or terminated?

- The exploration concession expires after 2 years (extendible for another 2 years, if applicable) and the concessionaire can renounce totally or partially to it.
- The exploitation concession is indefinite, but it expires if two consecutive annual fees are not paid. The concessionaire can renounce totally or partially to it.

How the rights of indigenous peoples are related to the development of geothermal energy

Chile ratified the ILO Convention 169 on Indigenous and Tribal Peoples. As a result, before granting any geothermal energy exploitation concession, the Ministry of Energy conducts an indigenous consultation process when the project can directly affect them.

Geothermal Energy in Chile - Regulatory Framework

Is there any classification of the geothermal resources (temperatures/enthalpy)?

- Currently neither Law 19,657 nor its regulations make any distinction between types of geothermal resources, however the Ministry of Energy interprets that projects of direct use (eg heat pumps), less than one hectare, do not require a concession.
- Ministry of Energy is working on a modification of the regulation to clarify it

What regulatory issues could be improved and lessons learned?

- Classification of geothermal resources and regulation of low enthalpy
- Single stage concession system (exploration plus exploitation)
- Mechanism to enforce investments that have been committed

Geothermal Concessions in Chile

	Exploration	Exploitation
Concessions in force	10	12
Concessions expired with right to obtain exploitation	15	N/A
Applications	2	13
N° concessionaires	7	8

July 2017

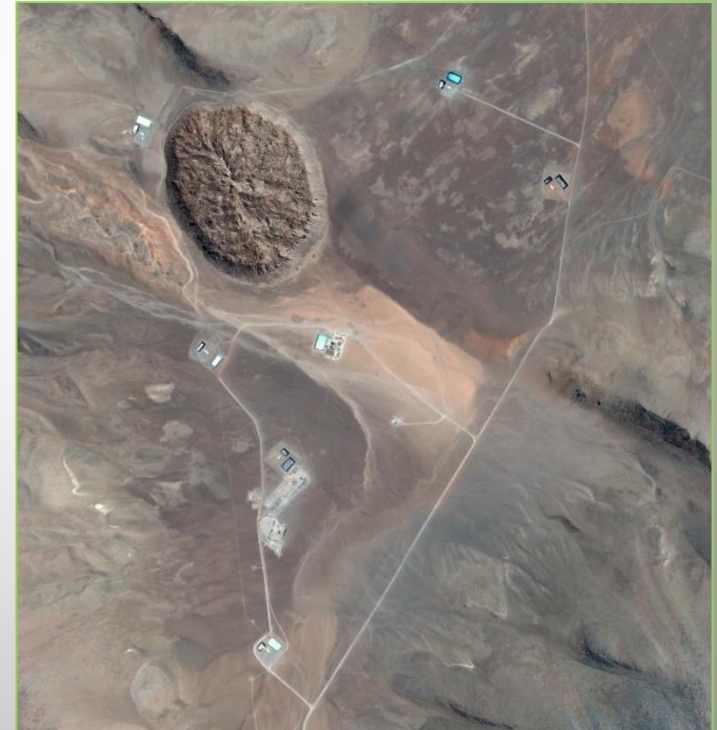
Two years ago Exploration Applications	73
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More advanced project in Chile: “Cerro Pabellón”



- Exploitation Concession “Apacheta”, 2009
- Owner: Geotérmica del Norte (Enel + ENAP)
- Power Capacity: 48 MW.
- First commercial scale electricity generation project in South America.
- Geothermal project at highest altitude in the world (4,500 meters above sea level).
- Geothermal wells are estimated to be from depths of between 1.9 and 2.7 kilometers.
- Estimated investment: US\$ 320 million, or US\$ 6.7 million / MW
- Project was supported with USD 30 million by the MiRiG, funded by the Clean Technology Fund (CTF) and managed by the IDB



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rmunoz@minenergia.cl

Potencial Geotérmico: 2.086 MW al Año 2050

- Se han identificado 27 zonas geotérmicas para la estimación del potencial geotérmico.

Potencial Geotérmico Consolidado Actualizado: Período 2017 – 2050:

Período	Potencial Mínimo (MW)	Potencial Máximo (MW)	Potencial Referencia (MW)
Período 2017-2030	471	599	599
Período 2031-2050	827	3.243	1.487
Total 2017-2050	1.298	3.842	2.086

Fuente: Mesa de Geotermia 2017

Antecedentes en: <http://www.minenergia.cl/mesa-geotermia/>

Que Hemos Hecho-En Que Estamos

4) Mesa de Geotermia: Potencial Geotérmico al 2050

ID	Nombre Proyecto/Concesión	Potencial Mínimo (MW)	Potencial Medio (MW)	Potencial Máximo (MW)
1	Cerro Pabellón	48	140	102
2	Chillan	27	27	27
3	Tinguiririca	100	200	100
4	Piuquenes 1	40	230	40
5	Piuquenes 2	30	160	30
6	Chiguana	40	200	40
7	Pampa Lirima 1-2-3	20	127	20
8	Mariposa	92	290	100
9	Peumayén (Tolhuaca)	12	72	70
10	Licancura III	50	150	50
11	El Valle	12	100	20
12	Colpitas	30	50	40
13	Polloquere 2	50	100	75
14	Puchuldiza	30	100	65
15	Irruputuncu	50	100	75
16	El Tatio/La Torta	100	250	175
17	San Alberto	50	100	75
18	Calabozo	80	200	140
19	Callaqui	40	100	70
20	Olca	180	757	468
21	Alitar	120	232	176
22	Azufre Norte 1	40	40	40
23	Azufre Oeste	40	40	40
24	Cordón Caulle	17	77	47
Total		1.298	3.842	2.086

Antecedentes en: <http://www.minenergia.cl/mesa-geotermia/>