

Conference on Integrating Variable Renewable Energy into Power Grids, Chile-CNE



Gobierno
de Chile

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National Energy Commission, CNE (Comisión Nacional de Energía)



- The National Energy Commission is a public and decentralized organism, which analyzes and sets prices and tariffs.
- CNE fixes technical standards (grid codes), which each generation, transportation and distribution of energy company must follow, of course the ISOs must follow these rules too.
- In essence, CNE is the regulator of the electrical market in particular, and energy sector in general.



National Energy Commission, CNE (Comisión Nacional de Energía)



- The main objectives are to:
 - Technically analyze the structure and level of prices.
 - Set technical standards.
 - Plan and monitor the actual and the expected behavior of the energy sector.
 - Propose new transmission infrastructure for the trunk system (main transmission system).



National Energy Commission, CNE (Comisión Nacional de Energía)

- CNE does enforce standards in regards to generation units required for the electrical systems, but CNE may only give guidelines as to which power plants must be installed in the future to meet economic requirements and system security (Generation Planning is not mandatory) .
- *However, the planning in the trunk transmission system is made by CNE* and this plan could be a source for a mandatory decree (for the building of new elements of the trunk system) by the Ministry of Energy

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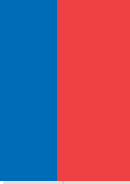
Chilean Electric System



- Electric Market is divided in three segments:
 - Generation
 - Transmission
 - Distribution
- 100% of propriety is owned by private companies.
- Electrical Systems are divided into four zones
 - SING
 - SIC
 - Aysen Electric System
 - Magallanes Electric System



Chilean Electric System



Actual production as of 2013

SING (Great North Interconnected System)

Annual generation (GWh) 17.230 (25%)

Population ~ 6%

Regulated Clients ~10% Free Clients ~ 90%

SIC (Central Interconnected System) + Los Lagos

Annual generation (GWh) 50.839 (74%)

Population ~ 92,4%

Regulated Clients ~ 60% Free Clients ~ 40%

Aysen Electric System

Annual generation (GWh) 155 (0,2%)

Population ~ 0,6% Regulated Clients 100%

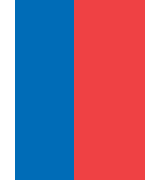
Magallanes Electric System

Annual generation (GWh) 291 (0,4%)

Population ~ 1% Regulated Clients 100%



Chilean Electric System



Total Installed Capacity (December 2013)

SING (Great North Interconnected System)

Total Installed Capacity (MW):	3.759		
NCRE* Installed Capacity:	0,4%	(16,3 MW)	21,2%
Conventional Installed Capacity:	99,6%		

SIC (Central Interconnected System) + Los Lagos

Total Installed Capacity (MW):	13.833		
NCRE* Installed Capacity:	6,94%	(960,1 MW)	78,0%
Conventional Installed Capacity:	93,06%		

NCRE*: The law contains a special definition of renewable energy, this is non-conventional renewable energy NCRE, defined as geothermic, wind, solar, biomass, tidal power, small hydroelectric power plant (<20 MW) and cogeneration.

Aysen Electric System

Total Installed Capacity (MW):	50,2		
NCRE Installed Capacity:	49,0%	(24,6 MW)	0,3%
Conventional Installed Capacity:	51,0%		

Magallanes Electric System

Total Installed Capacity (MW):	99,5		
Conventional Installed Capacity:	100%		0,6%



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Renewable Energy potential in Chile.



- Why is it necessary to review standards to allow large-scale development?
- The answer to the question is shown in the following graphs:

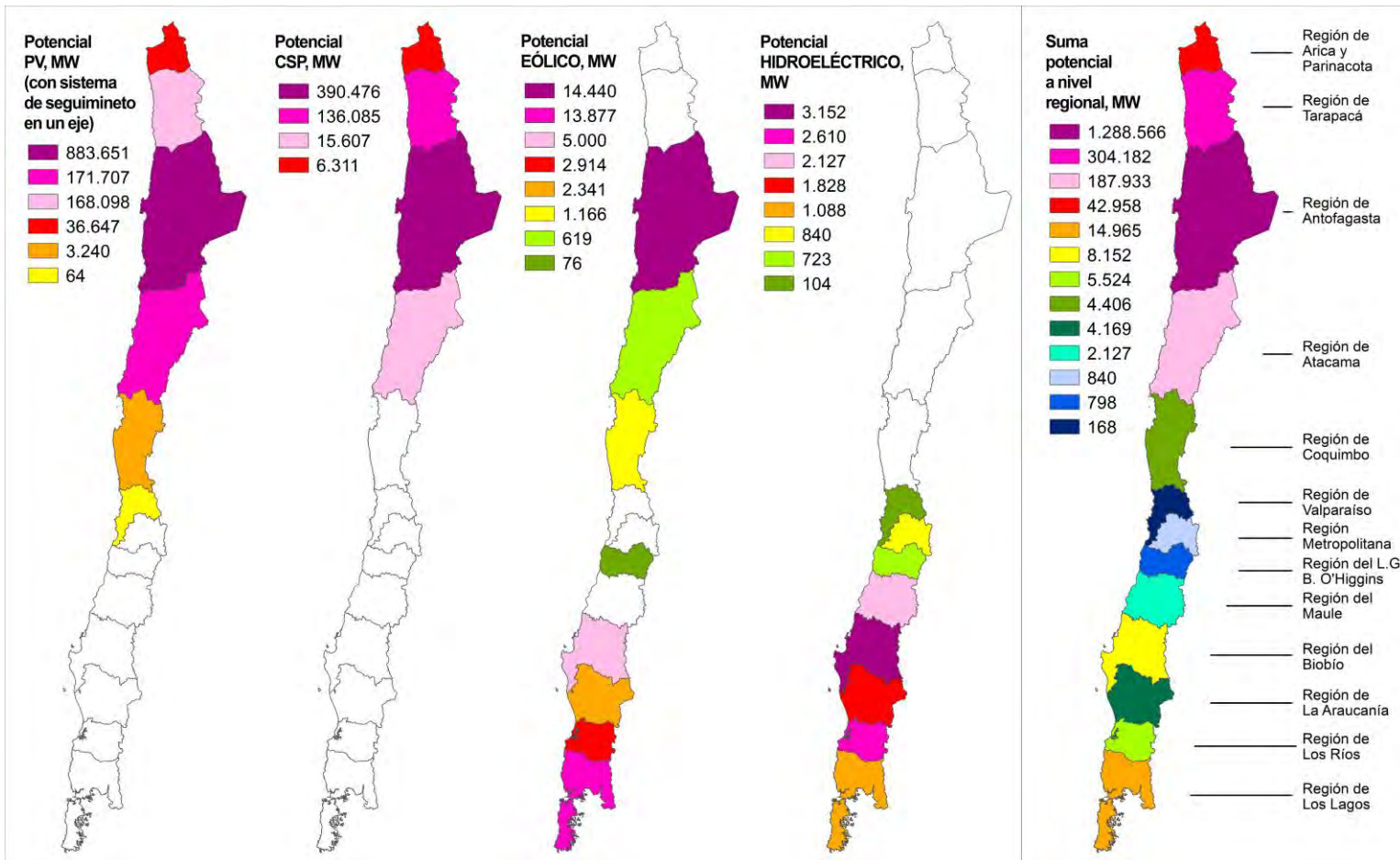
Región o zona	Potencial disponible								Cartera de proyectos eólicos		Total
	CSP		PV (seg. 1 eje)		Hidroeléctrico		Eólico		MW	f.p.	MW
	MW	f.p.	MW	f.p.	MW	f.p.	MW	f.p.			
De Arica y Parinacota	6.311	0,51	36.647	0,32							42.958
De Tarapacá	136.085	0,51	168.098	0,32							304.182
De Antofagasta (sin Taltal)	390.476	0,53	883.651	0,33			2.622	0,32	240	0,37	1.276.988
Taltal							11.479	0,36	99	0,41	11.578
De Atacama	15.607	0,51	171.707	0,34			86	0,34	533	0,34	187.933
De Coquimbo			3.240	0,31			389	0,36	777	0,35	4.406
De Valparaíso			64	0,30	104	0,75					168
Metropolitana de Santiago					840	0,65					840
Del L.B. O'Higgins					722	0,61	75	0,34			798
Del Maule					2.127	0,55					2.127
Del Biobío					3.152	0,62	4.581	0,33	419	0,32	8.152
De La Araucanía					1.828	0,66	1.933	0,33	407	0,38	4.169
De Los Ríos					2.610	0,67	2.863	0,35	51	0,39	5.524
De Los Lagos (sin Chiloé)					1.025	0,64	3.770	0,36			4.795
Isla Grande de Chiloé					63	0,66	9.678	0,34	428	0,39	10.169
Total	548.478	0,52	1.263.407	0,33	12.472	0,63	37.477	0,34	2.975	0,36	1.864.809

Source: Book of Ministerio de Energía y Cooperación alemana Deutsche Zusammenarbeit, "Energías Renovables en Chile, El potencial eólico, solar e hidroelectrico de Arica a Chiloé", 2014



Renewable Energy potential in Chile.

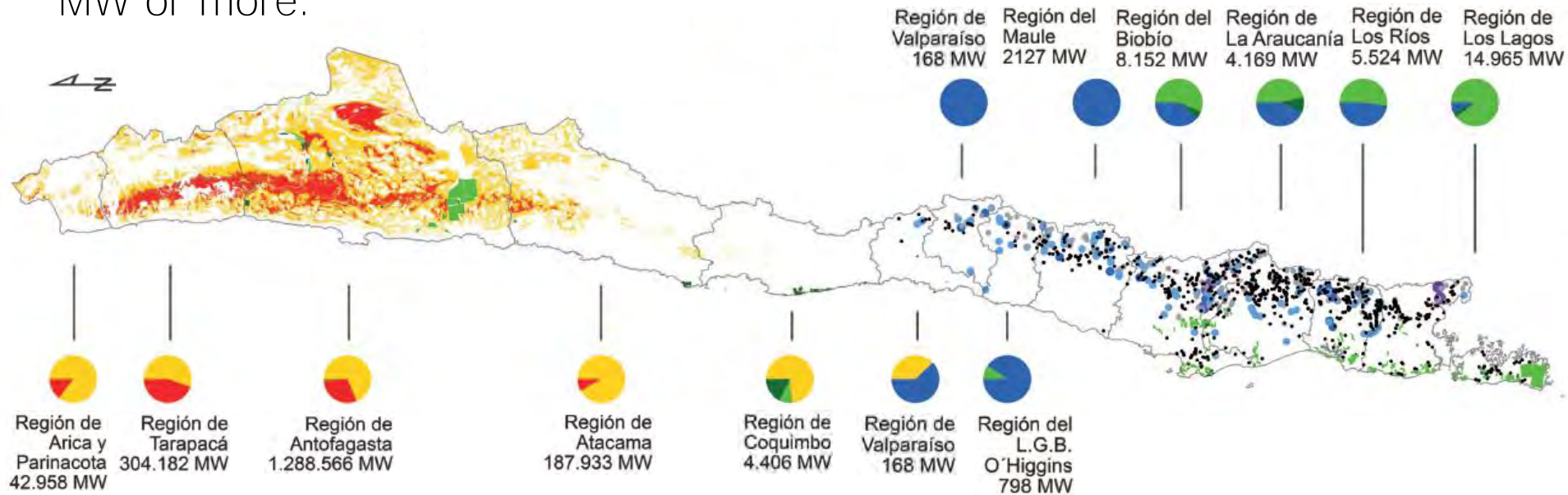
The potential shown in the previous slide is presented here in geographical terms:



Renewable Energy potential in Chile.



NCRE* (Non-conventional Renewable Energy) potential with size:
 Wind 40.000 MW, hydroelectric 12.500 MW (between Aconcagua and Puelo), solar more than 1.700.000 MW, geothermic probably 2.000 MW or more.



NCRE*: Defined by law as geothermic, wind, solar, biomass, tidal power, small hydroelectric power plant (<20 MW) and cogeneration.



Renewable Energy potential in Chile.

- The potential is over 1.800.000[MW] which is 100 times the current capacity in Chile.
- If we considered only half of this potential and 3% annual growth starting in 2013 (68.069 [GWh]), in 120 years we would be able to use this potential. In other words, this capacity for production is 35 times the actual production.
- This capacity is over 1.000 times the production of coal. (300 MW)
- This potential is equivalent to 60% of the 2013 actual production in the USA.

Renewable Energy potential in Chile.



- Chile does not have significant hydrocarbon reserves, which the country currently imports.
- For these reasons it is necessary to review the regulations.
- It is also necessary to research and develop large storage systems.



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New proposal in the Energy Agenda.

- The “**Agenda de Energía**”, this public document was presented by the government last May, this contains roadmap for the next four years of energy material.
- *Remove barriers that exist for development of NCRE (Non-conventional Renewable Energy) in Chile, commitment that 45% of the new capacity that will be installed between 2014 and 2025 will be NCRE. In this way the goal established in the law, 20% of generation from NCRE, will be completed.*

New proposal in the Energy Agenda.



- The Agenda was built on these 7 concepts:
 1. A New Role for The State in Energy Development.
 2. Reduction of Energy Prices with more competition, efficiency, and diversification of the energy market.
 3. Development of self-owned Energy Resource.



New proposal in the Energy Agenda.



- The Agenda was built on this 7 concepts:
 4. Connectivity for energy development.
 5. An efficient sector that manages consumption.
 6. Boost the energy investment for the development of Chile.
 7. Citizen participation and territorial organization.



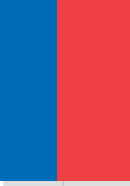
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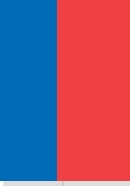
Roadmap for incorporating large-scale Unconventional Renewable Energy.



- The third concept of the Agenda is as follows:
- 3. Development of self-owned Energy Resource.
- “Promote the integration of NCRE **in conjunction with the law (special law to promote NCRE 20/25):**
- *In the development of future actions contained within this Agenda in relation to the expansion of trunk transmission systems, improve competency in the generation segment, to give flexibility to the operation of the electrical systems and the release of permits will always be given special consideration in regards to NCRE.*



Roadmap for incorporating large-scale Unconventional Renewable Energy.



- To make the Roadmap it is necessary to do the following:
 - Break Paradigms
 - Develop and analyze independent investigation.
 - Define changes to the rules and transitory steps for this changes.
 - Change the Status Quo.
- In the first place, according to a study made by GIZ and the Univ. de Chile for the Ministry of Energy last year, it is necessary to define adequate topology of the grid and technology must have the interconnected systems in order to incorporate a large volume of NCRE.
- Ministry of Energy with CNE are going to define the all topics to be adequate.



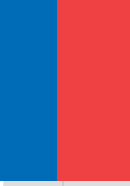
Roadmap for incorporating large-scale Unconventional Renewable Energy.



- We are going to develop at minimum the following studies :
 - System Security Analysis, statics and dynamic considered multisystem protection equipment. With these results we are going to define the feasible quantity of NCRE which can be incorporated to the system and the physical modifications to the system in order to operate safely and economically with this quantity of NCRE.
 - Changes in planning methodologies (short, medium and long term).



Roadmap for incorporating large-scale Unconventional Renewable Energy.



- Need to change the models in use by CDECs (ISO) for unit commitment. And the forecasting model to predict the actual capacity of production of wind and solar power.
- Changes in the regulation at various levels for example Capacity to Pay, Ancillary Services and others.
- Coherent modifications of pertinent standards or develop new standards(grid code): security and quality of service technical standard (NTSyCS); medium systems technical standard (NTSSMM); connections technical standard (NTCO).



**Thank you for your
attention**



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