

# The Electric Power System

## - Chile -



# Basic facts

- ❑ Area: 756,102 km<sup>2</sup>
- ❑ Population: 17,574,003 (2017)
- ❑ Number of electricity consumers: 373
- ❑ Number of ISOs: 1
- ❑ Number of DSOs: 0
- ❑ Peak load: 10,363 MW
- ❑ Average interruption of electricity:  
SAIDI 18.77 hours (2017)

# Global map of the grid and of its interconnections

□ Interconnectors with:

- Argentina (SADI)





# Grid facts and characteristics

## □ SEN

The National Electric System of Chile, includes the installations for electrical generation, transmission and consumption encompassing the territory from the regions of Arica - Parinacota (North) to the Tenth Region (Isla Grande de Chiloé, South).

This system is the largest (32,100 km of transmission lines in 3,300 km of territory) and provides electrical energy to the Chilean territory, with an installed capacity through of 23,729 MW, and a supply coverage that reaches about 98.5% of the population.

# Structure of electrical power system

The National Electric System of Chile (SEN) functions along in Chile as well as the Electrical System of Aysén and Magallanes.



# Map of the high voltage grid

## PRINCIPALES CIFRAS

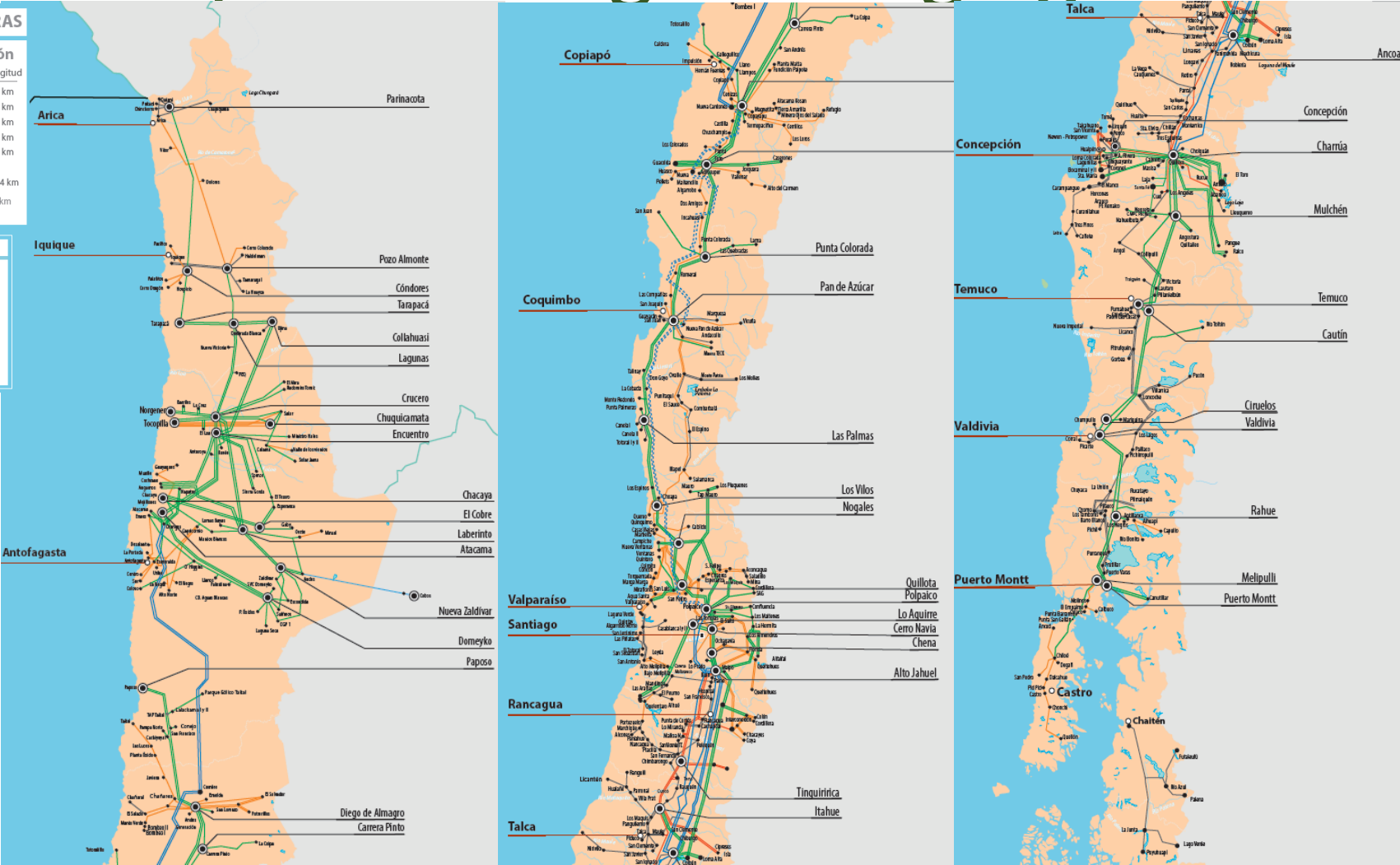
### Líneas de Transmisión

Tensión	Longitud
500 kV	2.774,3 km
345 kV	408,0 km
220 kV	16.764,7 km
154 kV	1.502,8 km
110 kV	5.847,2 km
>=33 y < 110 kV	5.800,4 km
<b>TOTAL:</b>	<b>33.097,4 km</b>

\* Suma total de largos por circuitos

### SIMBOLOGÍA

- Línea 500 kV
- Línea 345 kV
- Línea 220 kV
- Línea 154 kV
- Línea 110 kV
- Línea 66 kV y menores
- - - Línea 500 kV en construcción
- - - Línea 220 kV en construcción
- Nudo principal
- Subestación





# Information on ISO(s)

- Name: Coordinador Eléctrico Nacional
- Network length (km): 32,100
- Served area (km<sup>2</sup>): 515,569
- Annual transmitted energy (TWh): 74.22
- Website: <https://www.coordinador.cl/>



# Cooperation of ISO and DSOs

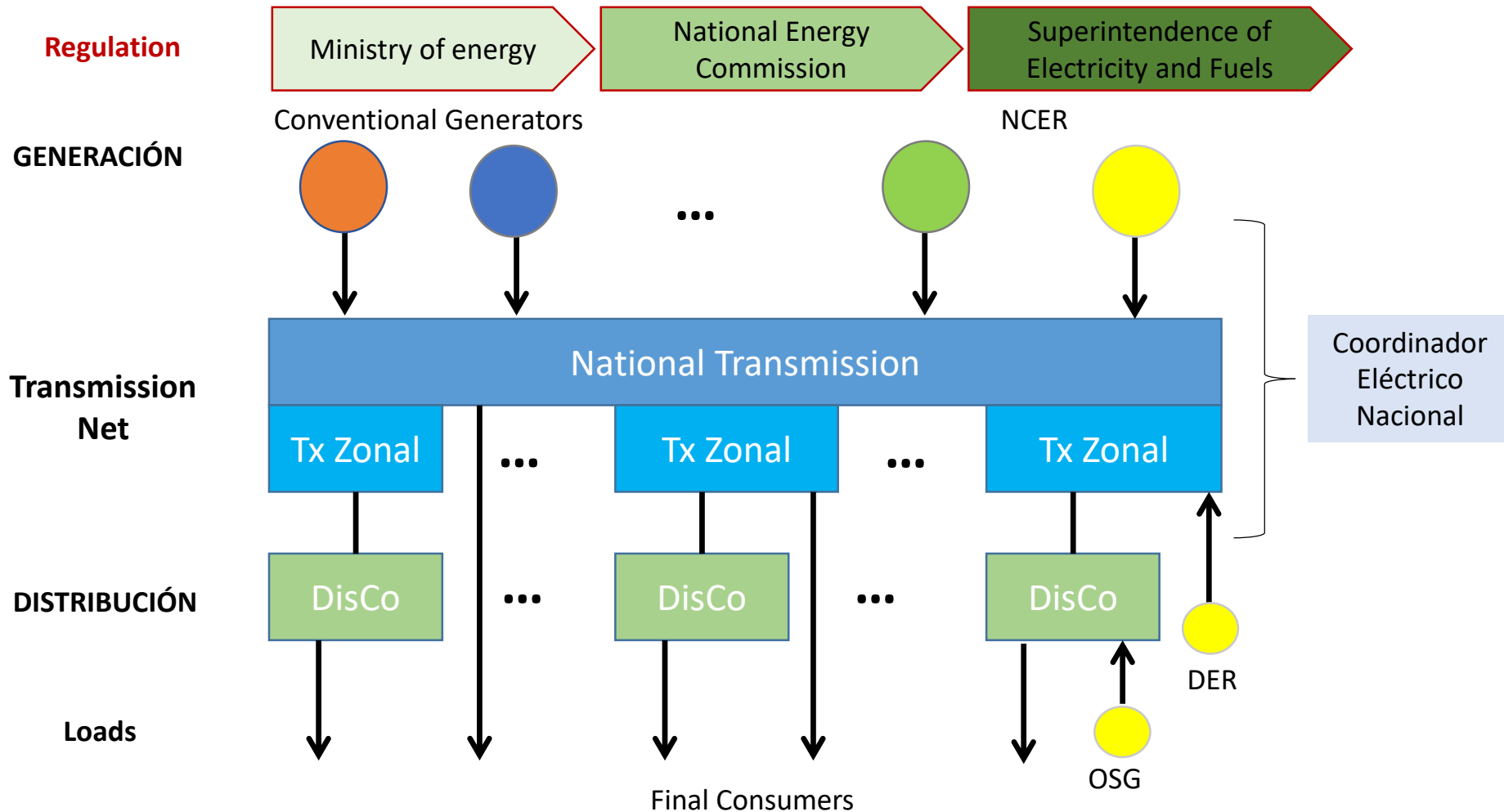
- Currently there are no DSOs in Chile.

# Responsibilities of ISO

## □ SEN

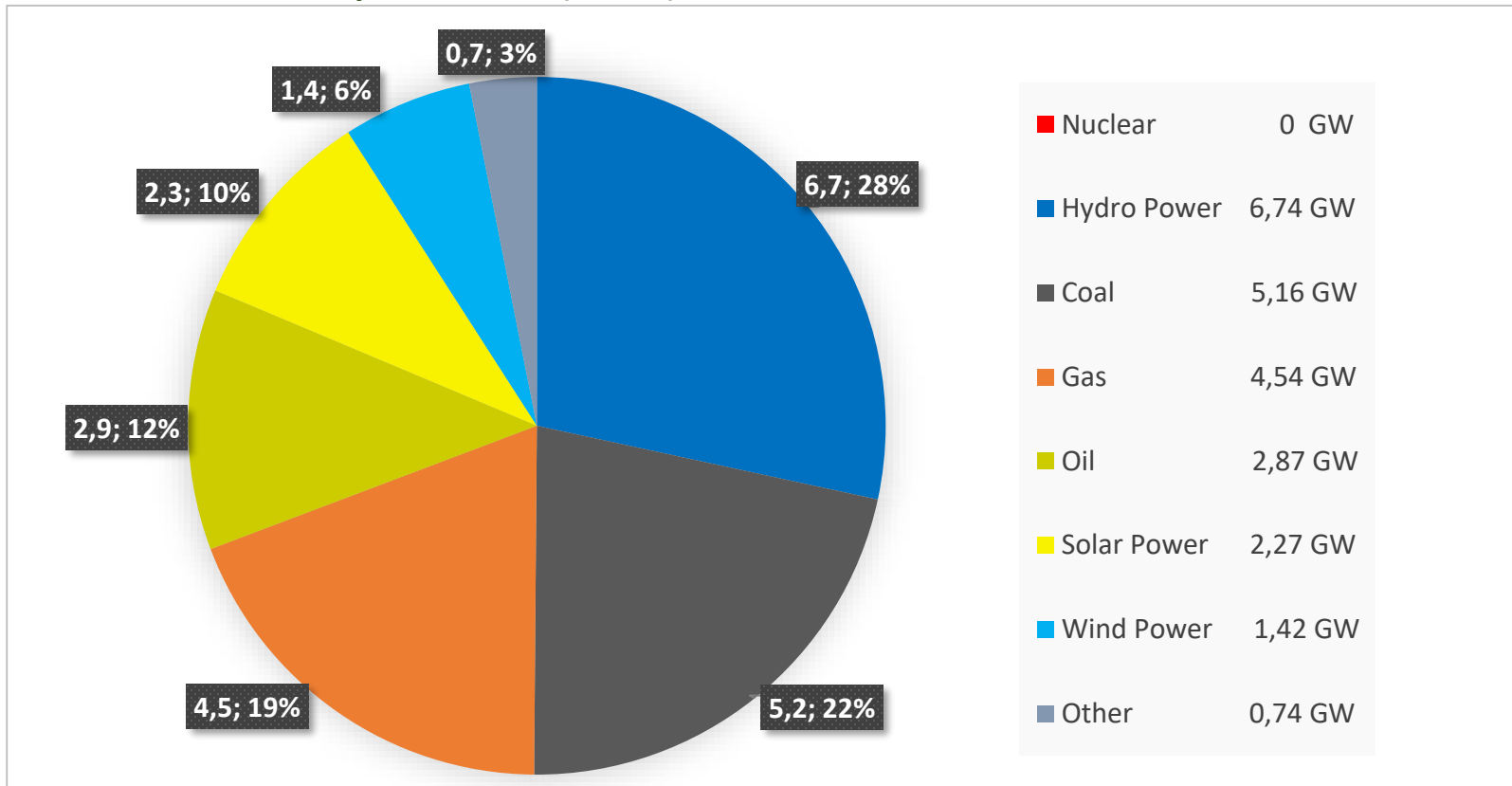
- Preserve the security of service in the electrical system.
- Ensure the most economical operation for all the facilities of the electric system.
- Ensure open access to the grid.

# Power structure of the country



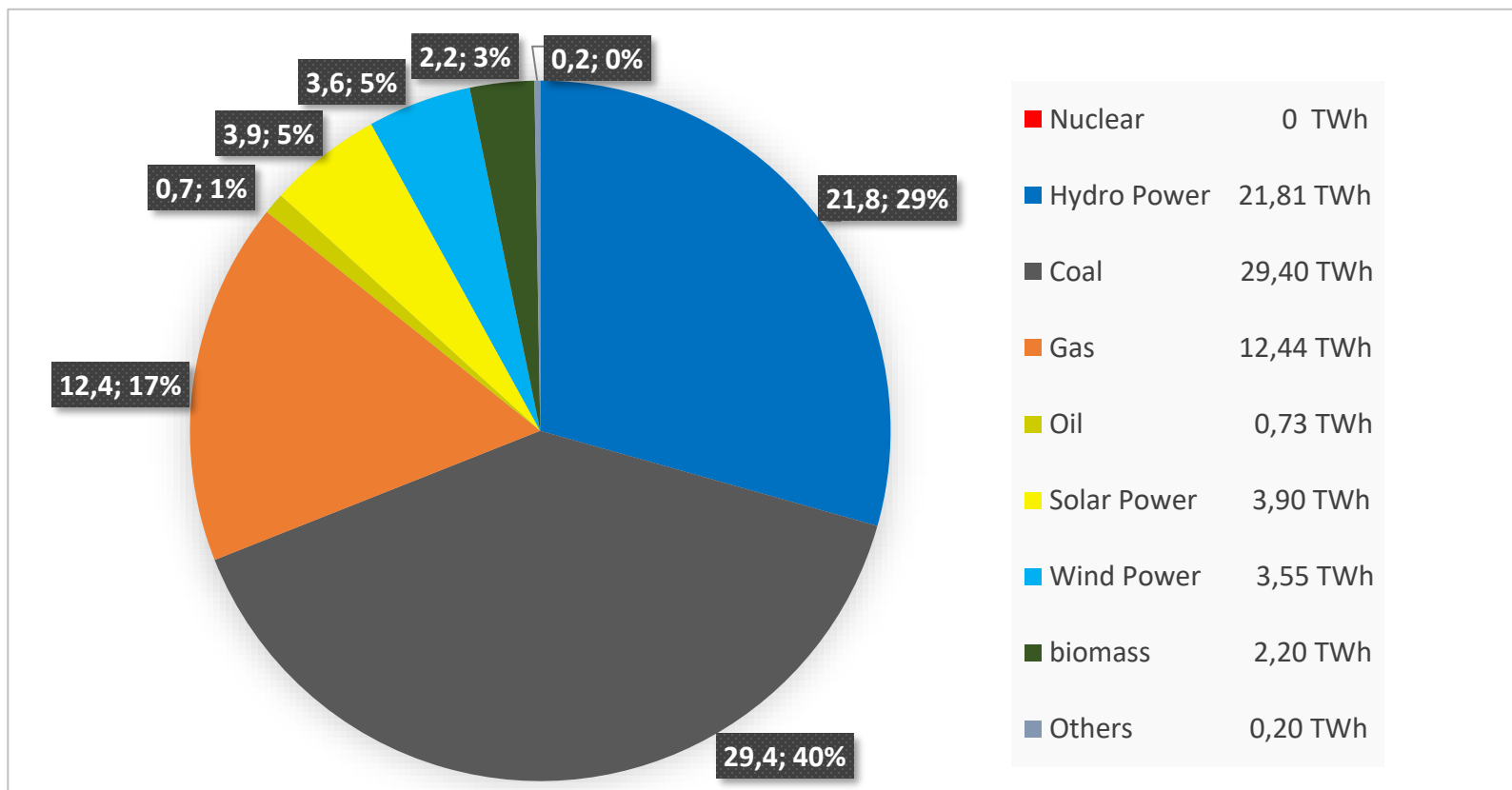
# Installed capacity with reference to primary resources

☐ Installed capacities (GW), Year 2017

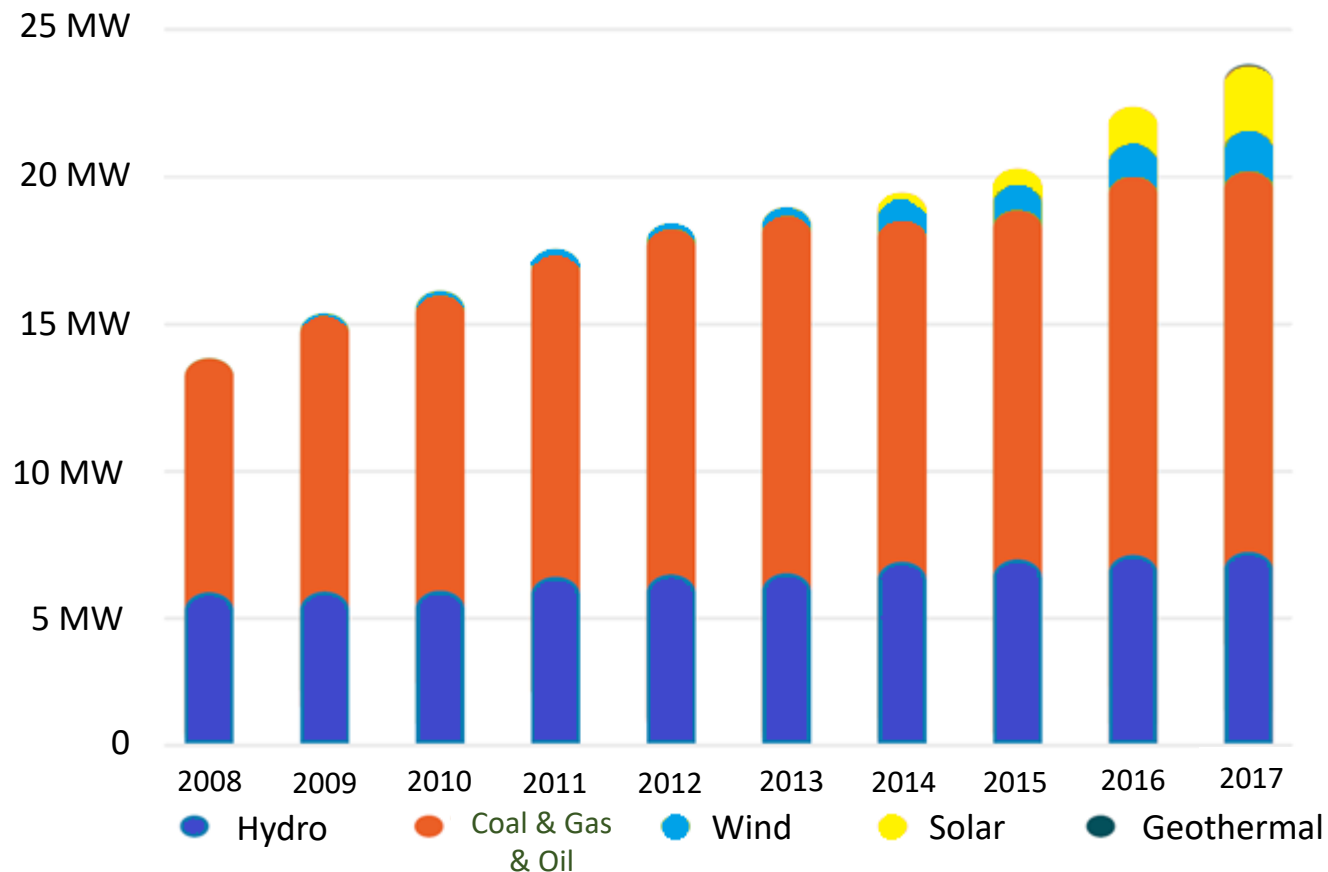


# Energy production with reference to primary resources

□ Electricity generated (TWh), year 2017



# Development of generation capacity since 2008



# Consumption per customer groups

Customer Group	SEN
	Clients Sales [GWh]
Mining	25,317
Industrial	8,009
Energetic	440
Transport	510
Distributors	32,893
Other	1,099
<b>TOTAL</b>	<b>68,270</b>



# Location of renewable energy sources

## □ SEN

Renewable energy in Chile is a fast growing sector that in 2017 provided 15% of the country's electricity.

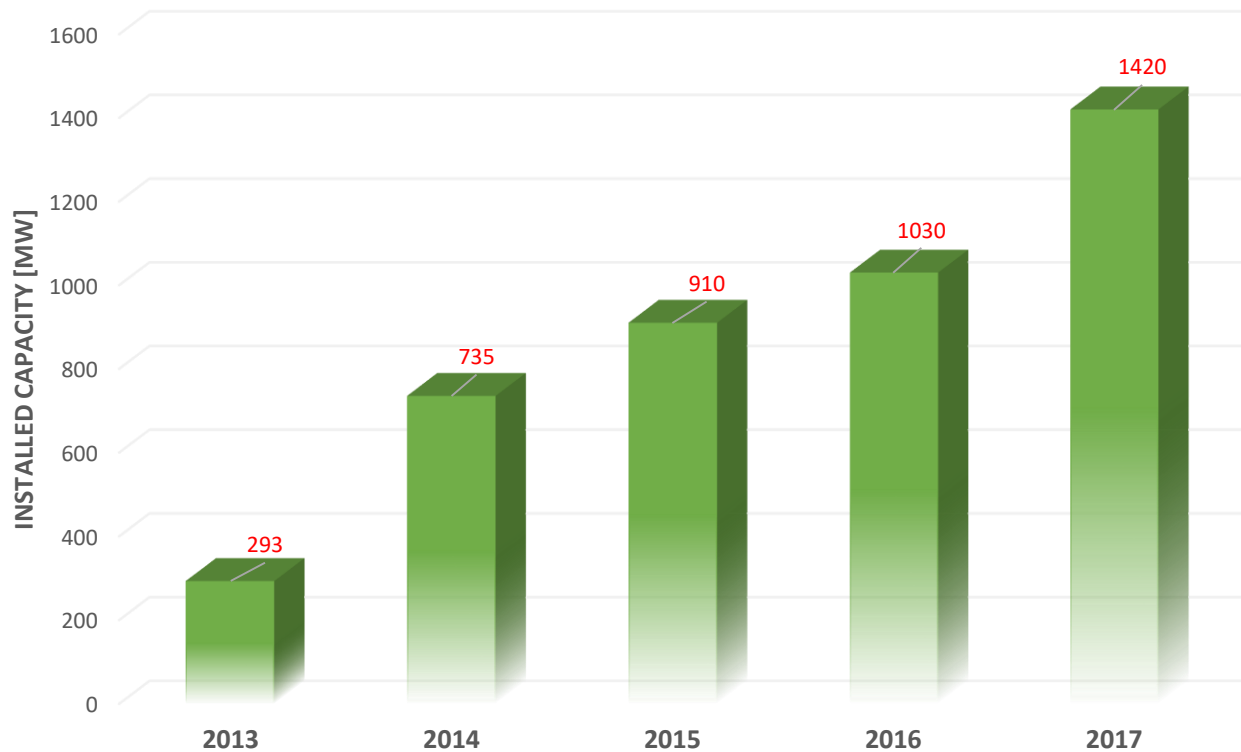
Chile has solar and wind energy, which are located mainly in the Third Region and Fourth Region respectively.

Atacama (in the Third Region) increased 6.3 times the injection of non-conventional renewable energies (ERNC) to the National Electric System (SEN), according to measurements made from April 2014 to 2017. In addition, the area recorded an electricity generation of 454,552 MWh. 38% of it from ERNC.

According to the government data, electric power generation as a region will inject a total of 170,334 MWh of Renewable Energies (ER) into the National Electric System (SEN). This is a milestone because in 2014 it was only 26,826 MWh.

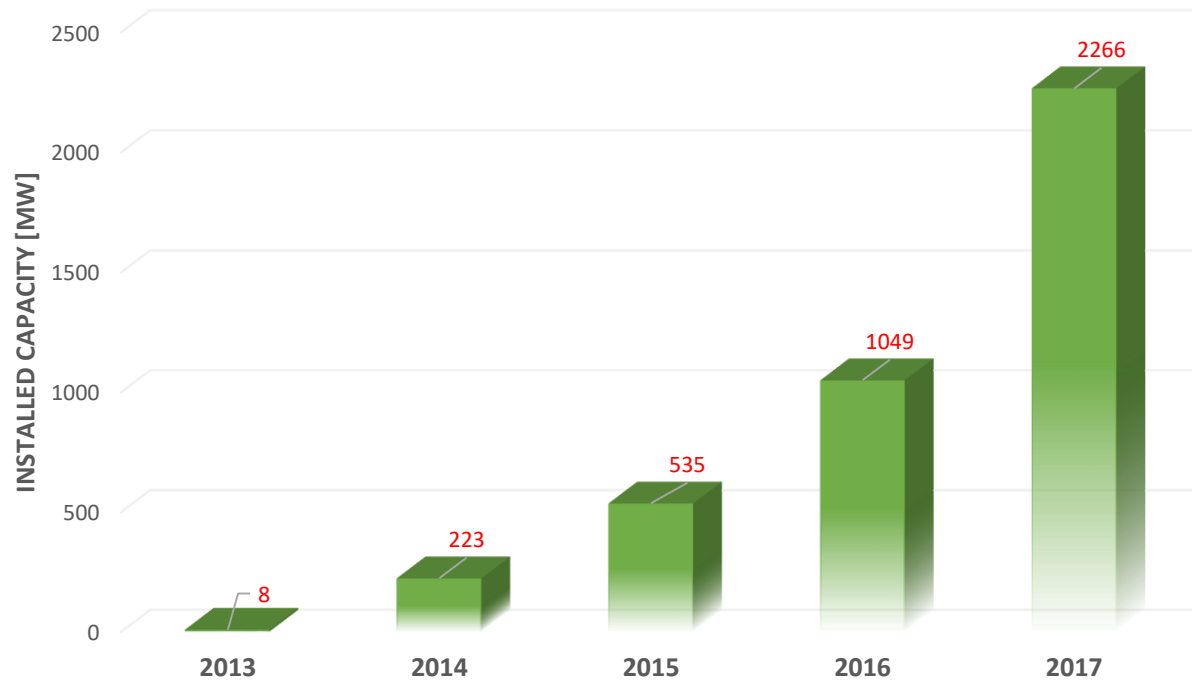
# Development of wind power

DEVELOPMENT OF WIND POWER  
SINCE 2013



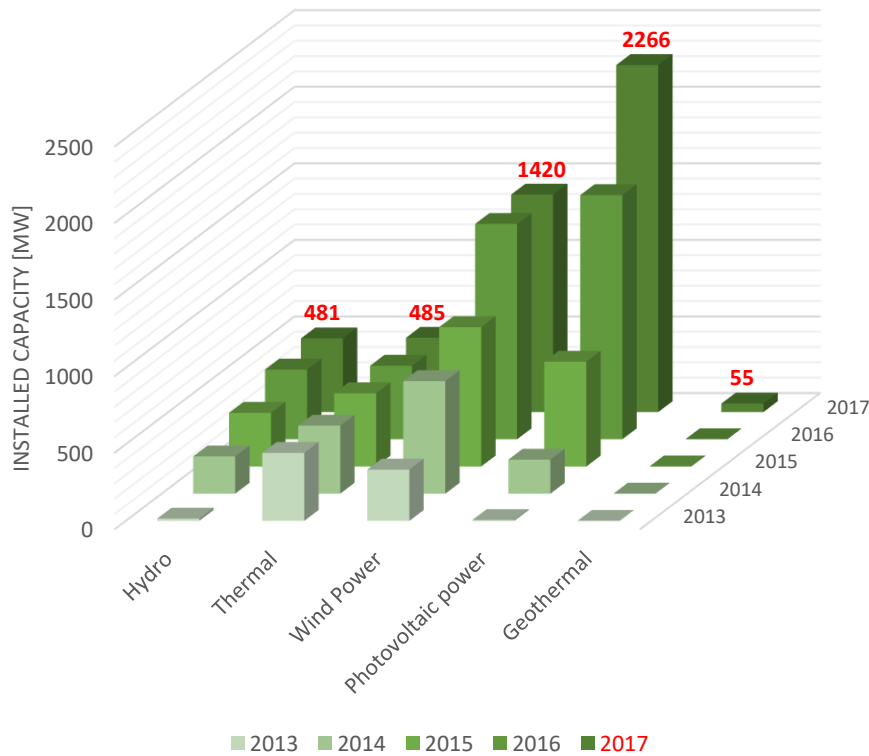
# Development of photovoltaic power

DEVELOPMENT OF PHOTOVOLTAIC POWER  
SINCE 2013

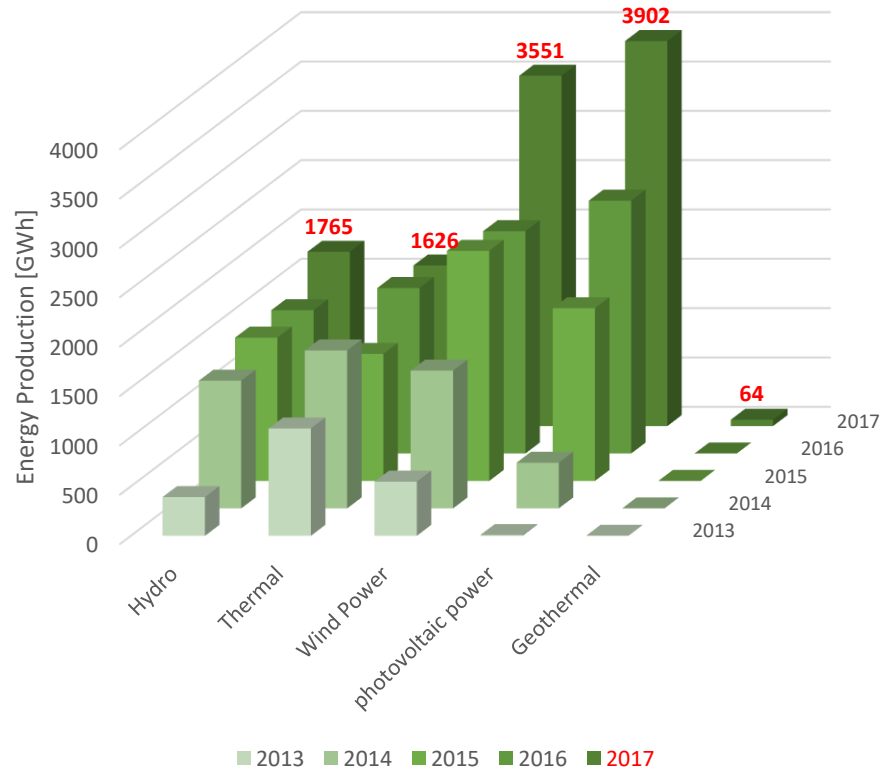


# RES installed capacity and production since ...

RES Installed Capacity [MW]



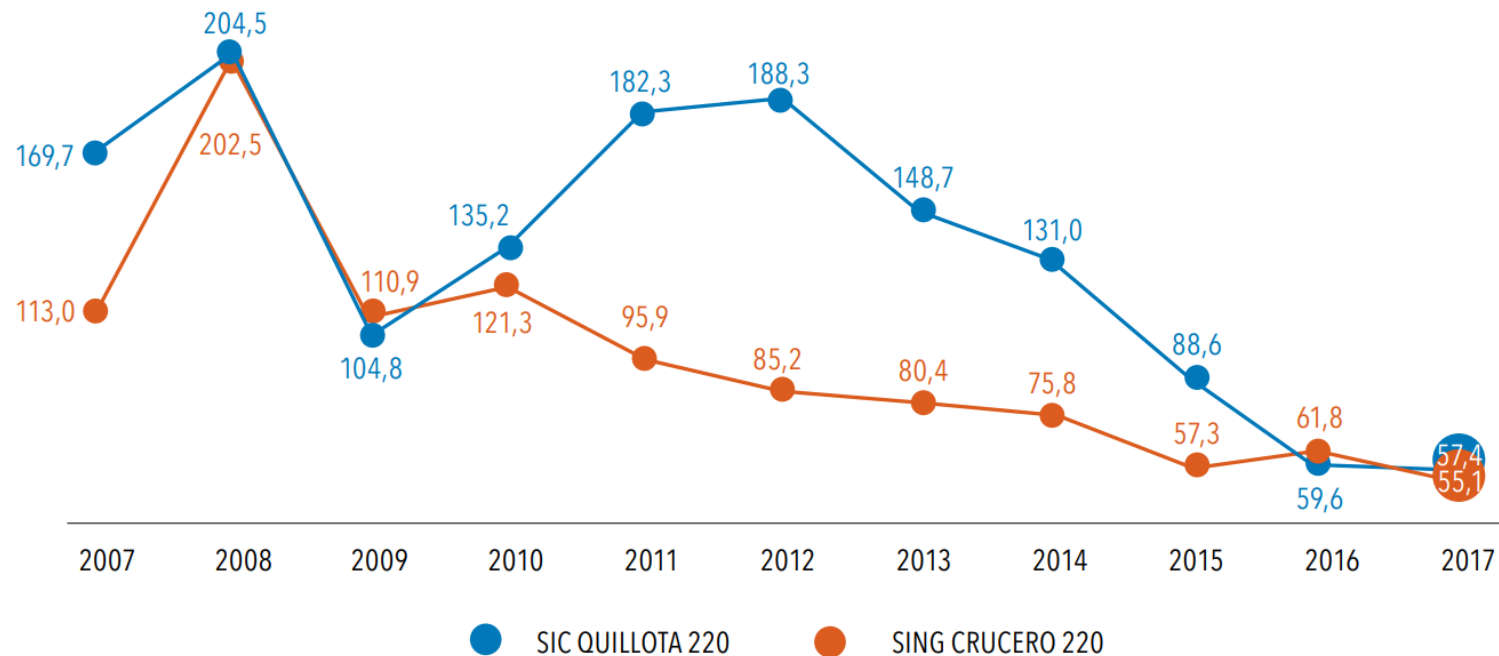
RES Energy Production [GWh]



# Price development for industry consumers

## Market Spot Prices (USD/MWh)

Evolution of marginal costs (annual average) per system between the years 2007 – 2017 [USD/MWh]



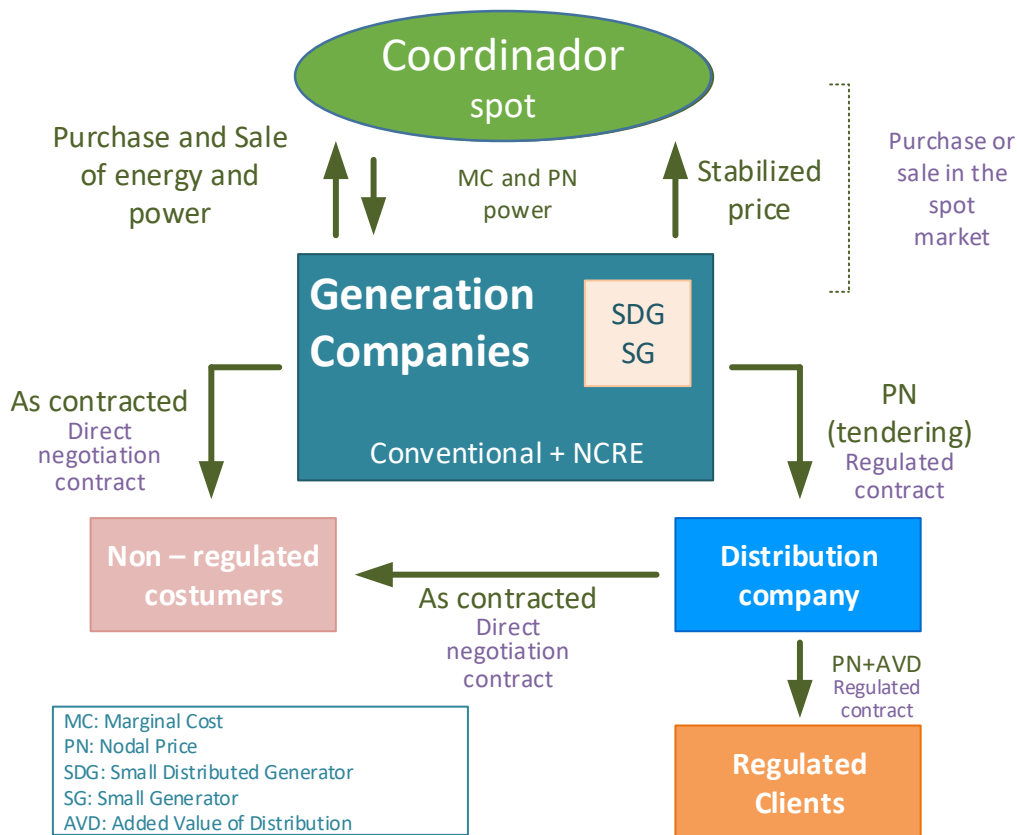
Note: SIC and SING systems were interconnected to form SEN in November 2017

# Price development for households

Region	Price 01-12-2017 [USD/MWh]
Arica	213
Tarapacá	202
Antofagasta	168
Atacama	192
Coquimbo	226
Valparaíso	228
Metropolitana	192
O'Higgins	209
Maule	220
BioBío	217
La Araucanía	226
Los Ríos	226
Los Lagos	226



# Electricity market organisation



Open Access to Transmission Grid

Regulated Payment of Toll

3 Grid Segments: National, Zonal and Distribution

# Power balance in 2017

	<u>SEN</u>
<input type="checkbox"/> Generation (TWh)	74.22
<input type="checkbox"/> Consumption (TWh)	68.27
<input type="checkbox"/> Imports (TWh)	0.0
<input type="checkbox"/> Exports (TWh)	0.0
<input type="checkbox"/> Losses (TWh)	5.95

# Energy exchanges in 2017

## Commercial flows

	Commercial Flows[MM USD]	
System	Injection [MM USD]	Withdrawal [MM USD]
SEN	756	-756

## Physical flows

	Physical Flows[MW]	
System	Injection [MW]	Withdrawal [MW]
SEN	1,651	1,651



# Specific aspects of the electricity market

- ❑ Chilean Market operates as pool
  - There are no bilateral markets
- ❑ By using Locational Marginal Prices (LMP), the congestion management is not an issue
- ❑ In 2016 the Chilean Electricity Law was reformed on transmission regulation and a unique independent system operator was created (Coordinador Eléctrico Nacional)