



Colloque 2019

Transition énergétique

Moteur de développement économique



ENERGY TRANSITION AND RENEWABLES IN CHILE

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Agenda

- About Chile
- National Electric System
- Energy Market Framework
- National Electric Coordinator (Chilean ISO)
- Renewable Energy (RE) in Chile
- Transmission Sector
- Challenges and Opportunities

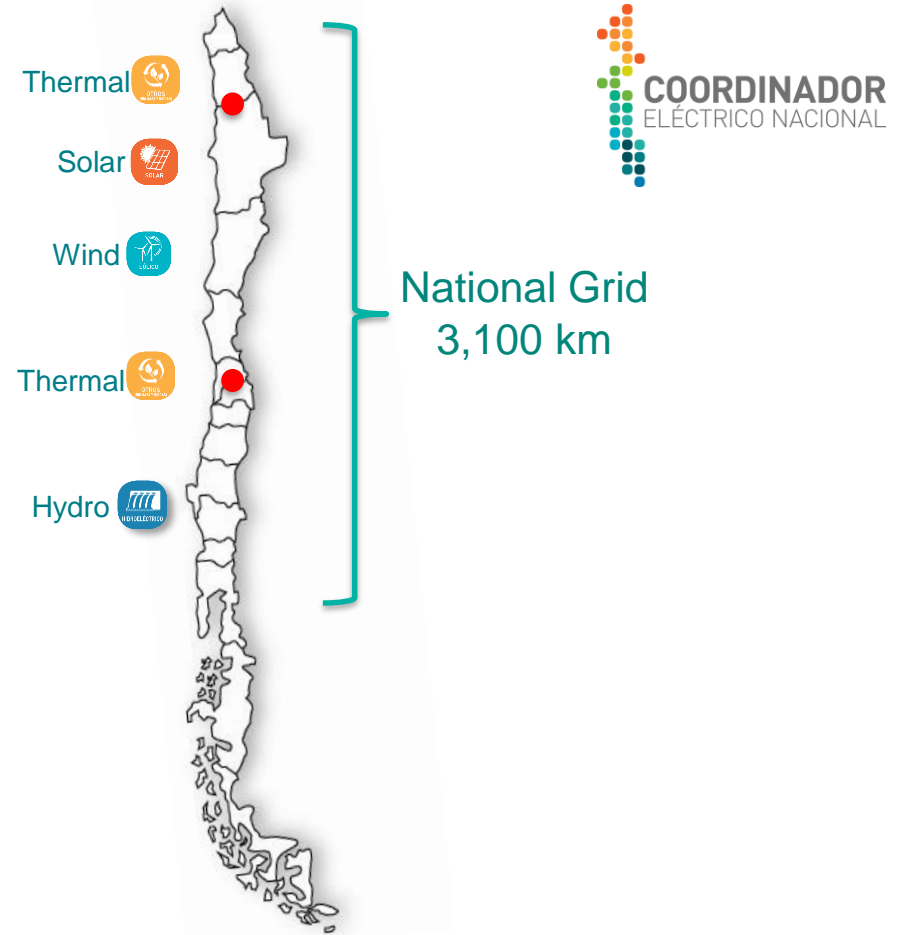
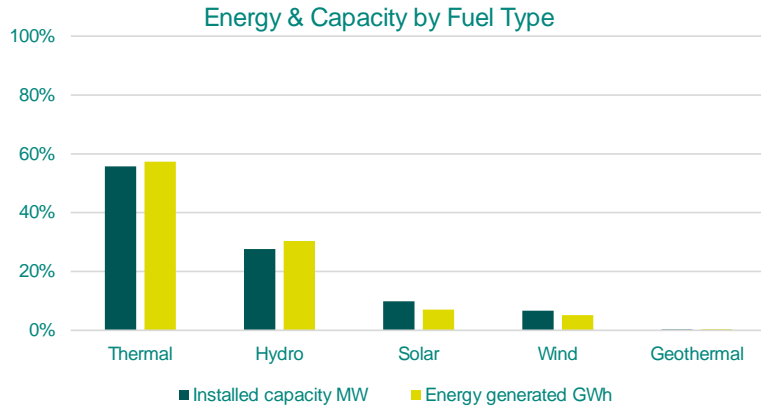
ABOUT CHILE...

Chile is long and
narrow country
(4,270 km)

- ✓ **Population: 17.6 millions**
- ✓ **Surface (continental): 755,915 km²**
- ✓ **GDP per capita: USD\$ 15,900 (4,0% growth)**
- ✓ **Energy investment: USD\$ 3.120 million (50% RE)**
- ✓ **Highest solar radiation in the world**
- ✓ **Law 20698-2013 → RE Target: 20% by 2025**
- ✓ **2050 Energy Policy (2016) → 70% RE by 2050**

ELECTRIC SYSTEM – 2018

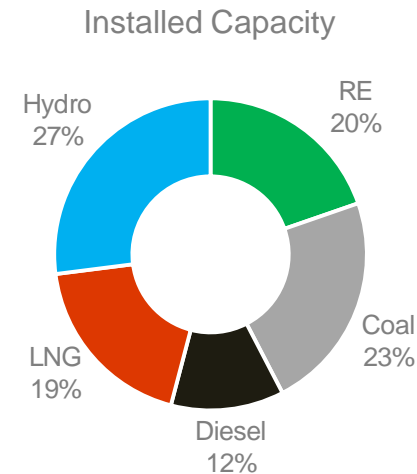
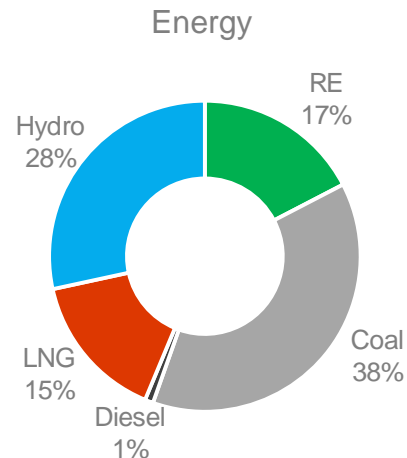
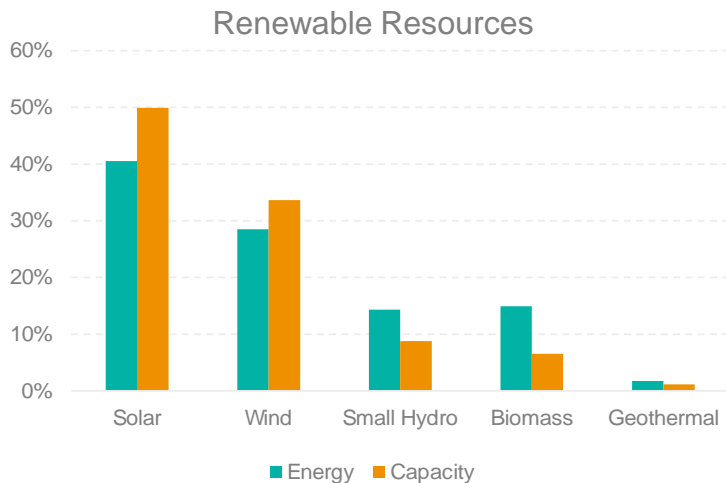
- Installed Capacity: 24,487 MW
- Energy Generated: 76,526 GWh
- Peak Demand: 10,570 MW
- Energy growth: 3.1 %
- Transmission Lines: 33,000 km



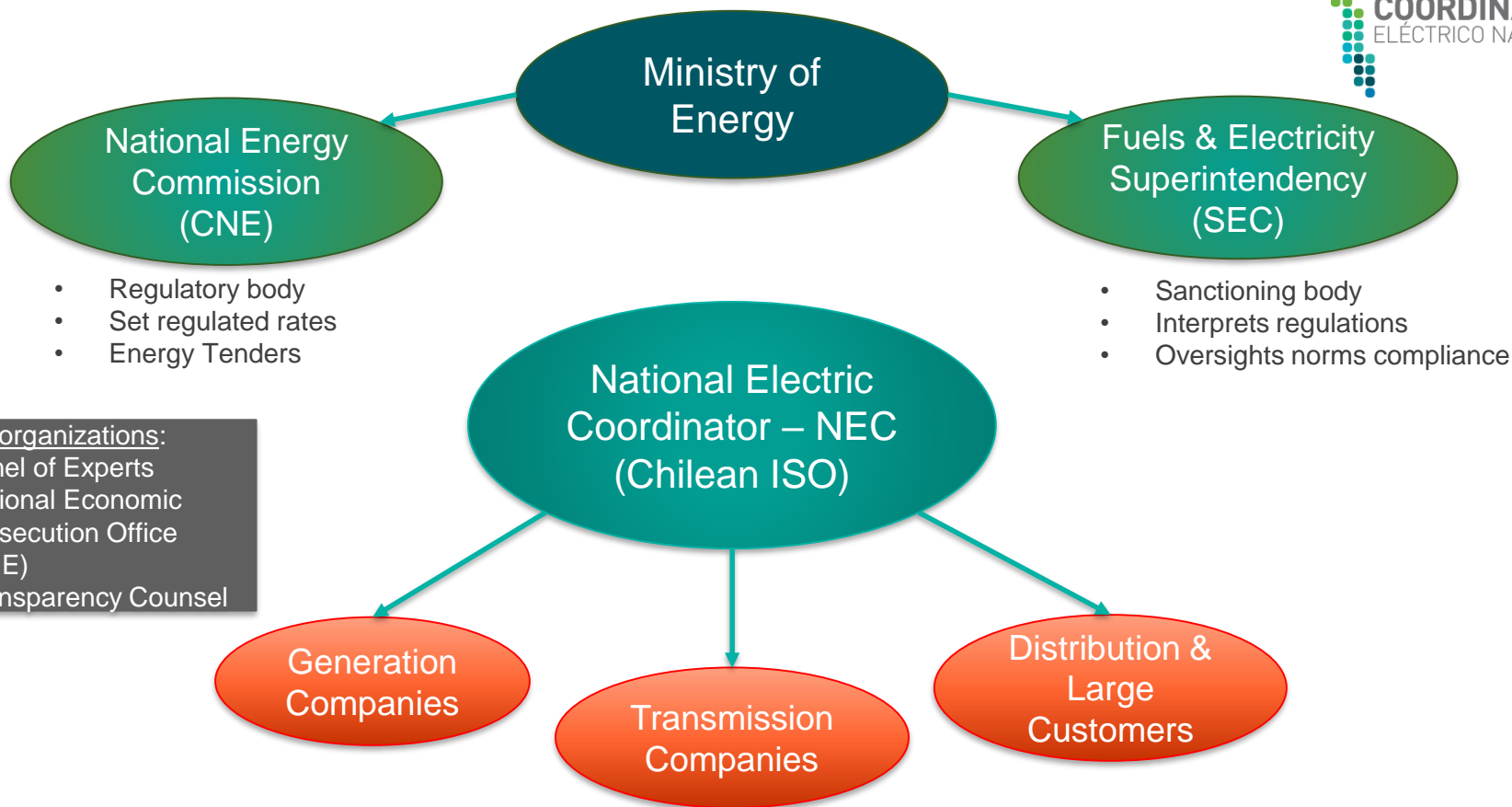
RENEWABLE ENERGY – 2018

Law 20,698 from 2013 → Target: 20% RE by 2025

- RE Generation = 13,342 GWh (17,4%) Total = 76,526 GWh
- RE Capacity = 4,829 MW (19,7%) Total = 24,487 MW



ENERGY INSTITUTIONAL FRAMEWORK



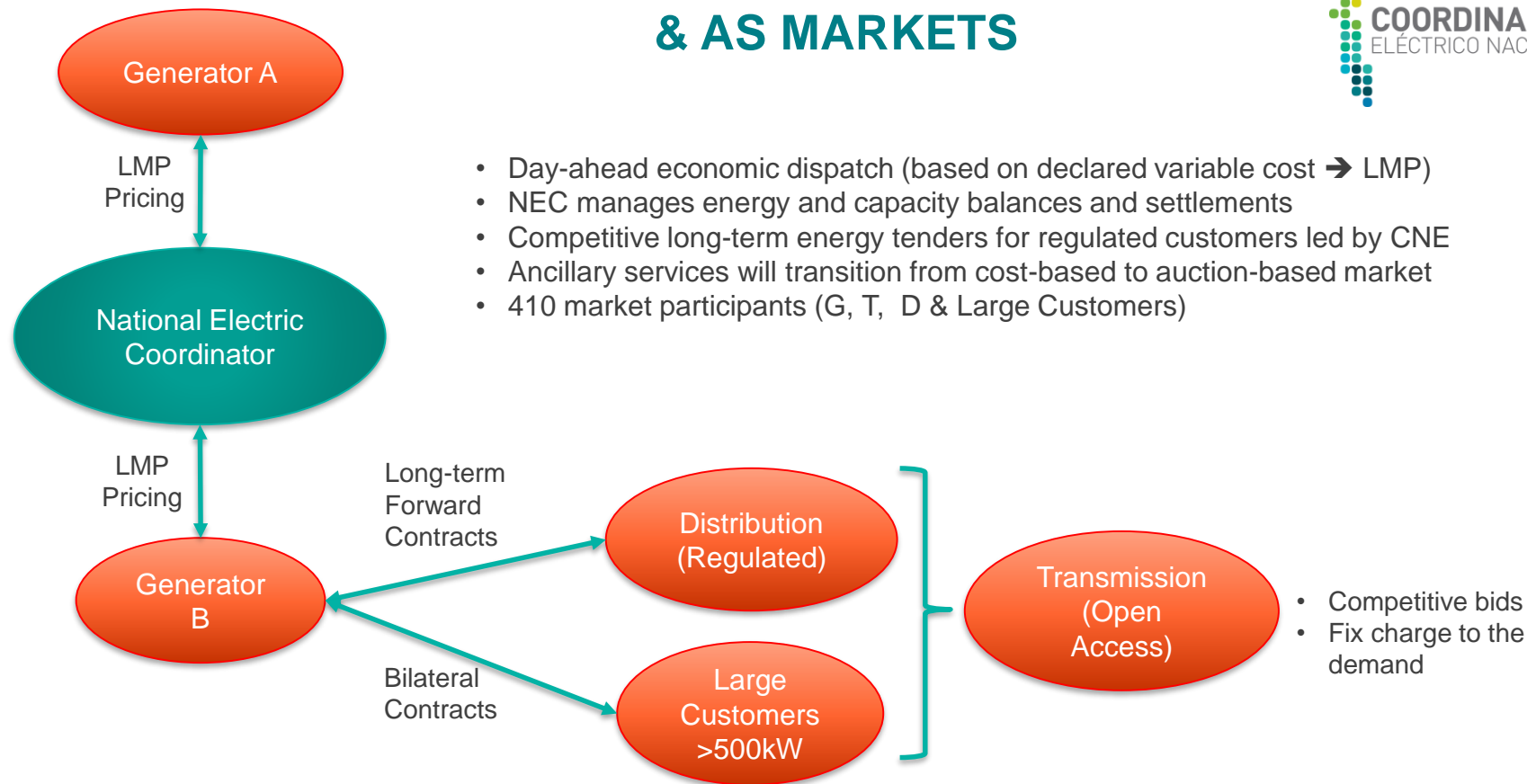
NATIONAL ELECTRIC COORDINATOR (Chilean ISO)



Independent technical organization in charge of the operation of the national grid and the energy market

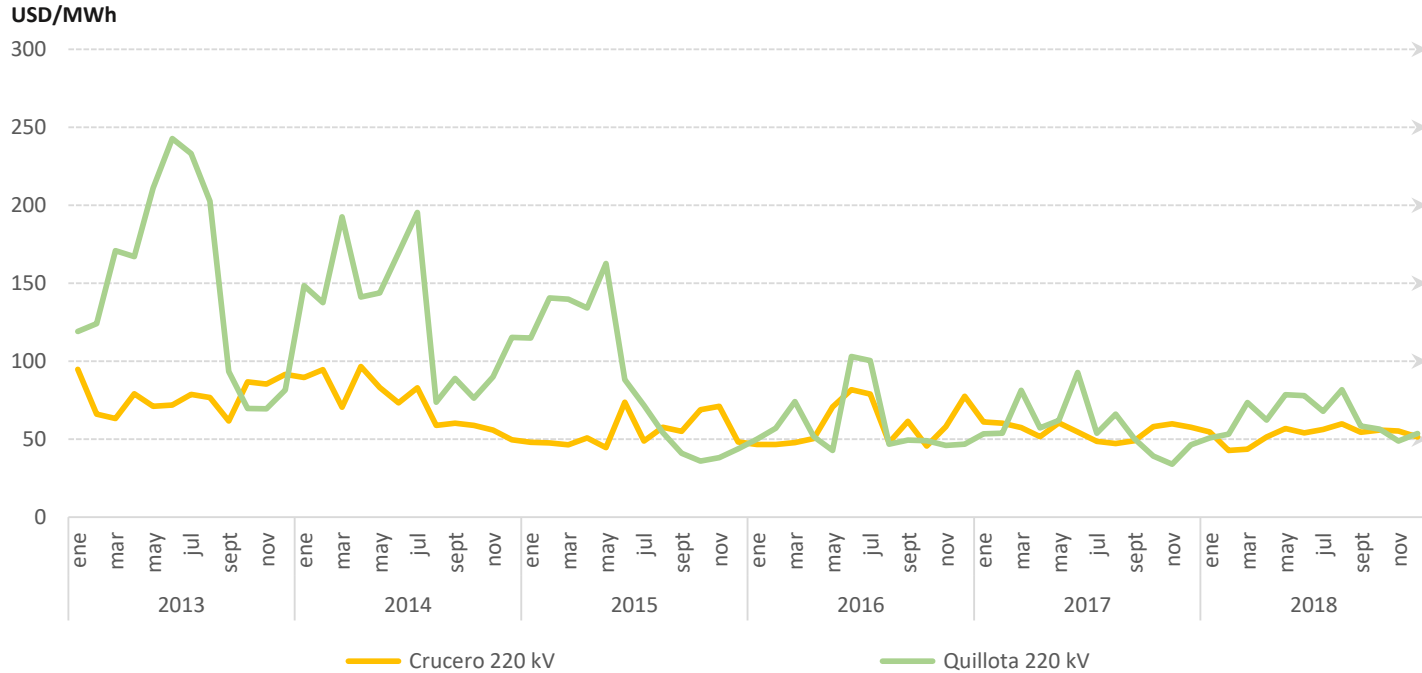
- ✓ Responsible for ensuring a secure, reliable and economic energy supply, and guaranteeing open access to the transmission systems
- ✓ Annual budget around US\$ 50 Million (US\$/MWh 0.65) and 300 employees
- ✓ Main functions:
 - ✓ Secure, reliable and economic system operation
 - ✓ Wholesale energy, capacity & ancillary service markets
 - ✓ Long-term planning for transmission expansions & International bidding process for transmission projects
 - ✓ Open access (project interconnection process)

WHOLESALE ENERGY, CAPACITY & AS MARKETS

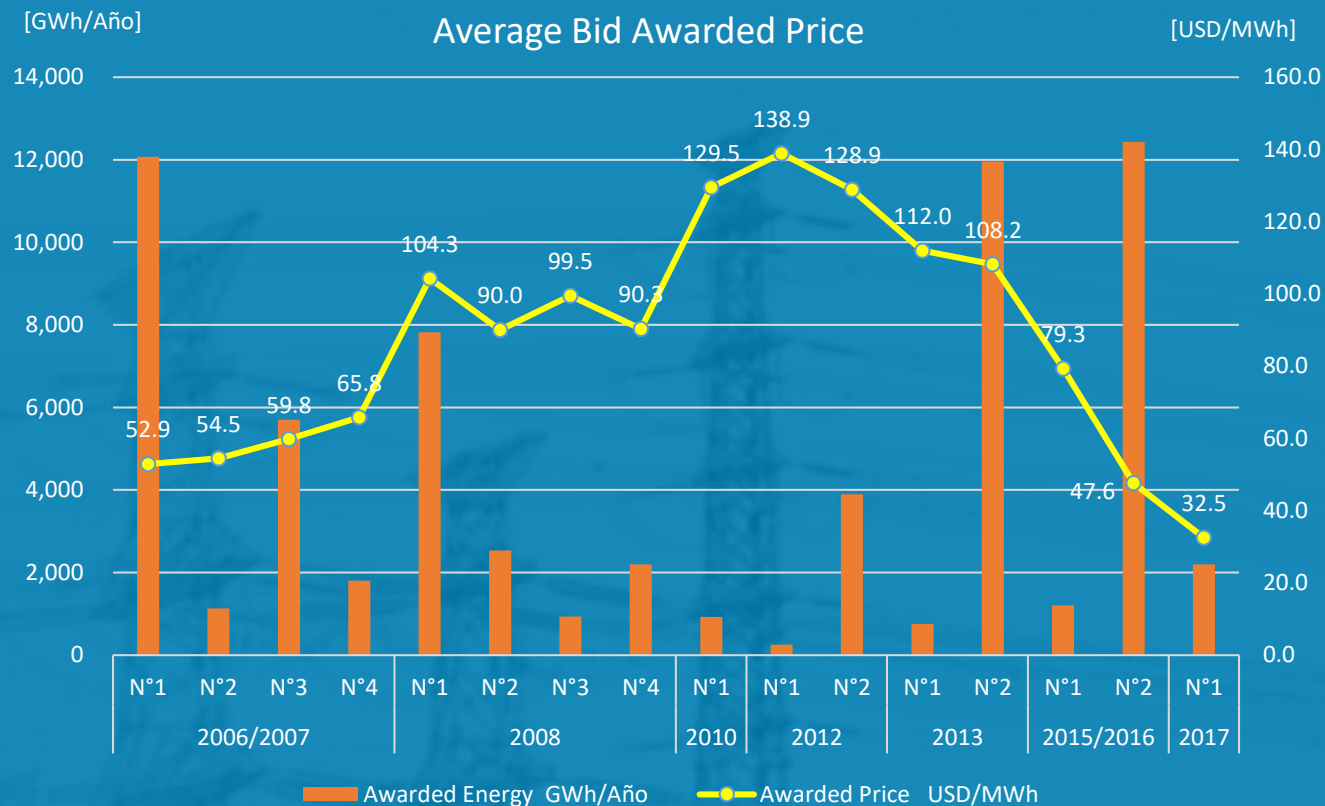


- Day-ahead economic dispatch (based on declared variable cost → LMP)
- NEC manages energy and capacity balances and settlements
- Competitive long-term energy tenders for regulated customers led by CNE
- Ancillary services will transition from cost-based to auction-based market
- 410 market participants (G, T, D & Large Customers)

MARGINAL COST (LMP) – Monthly Average



ENERGY TENDERS - Regulated Customers



RE Awarded:
2015/16 → 52%
2017 → 100%

PROJECTS UNDER CONSTRUCTION TO 2020



SMALL HYDRO
78 MW

3.6%



WIND
539 MW

24.7%



SOLAR
361 MW

16.5%

RENEWABLES
978 MW

44.8%

OTHERS
1,205 MW

55.2%

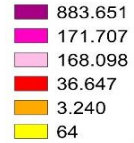
TOTAL 2,183 MW

Project: Cerro Dominador CSP
Technology: (First) Concentrated Solar
Region: Antofagasta
Capacity: 110 MW
ISD: 2020



RENEWABLE ENERGY POTENTIAL

Potencial
PV, MW
(con sistema
de seguimineto
en un eje)



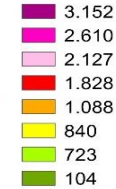
Potencial
CSP, MW



Potencial
EÓLICO, MW



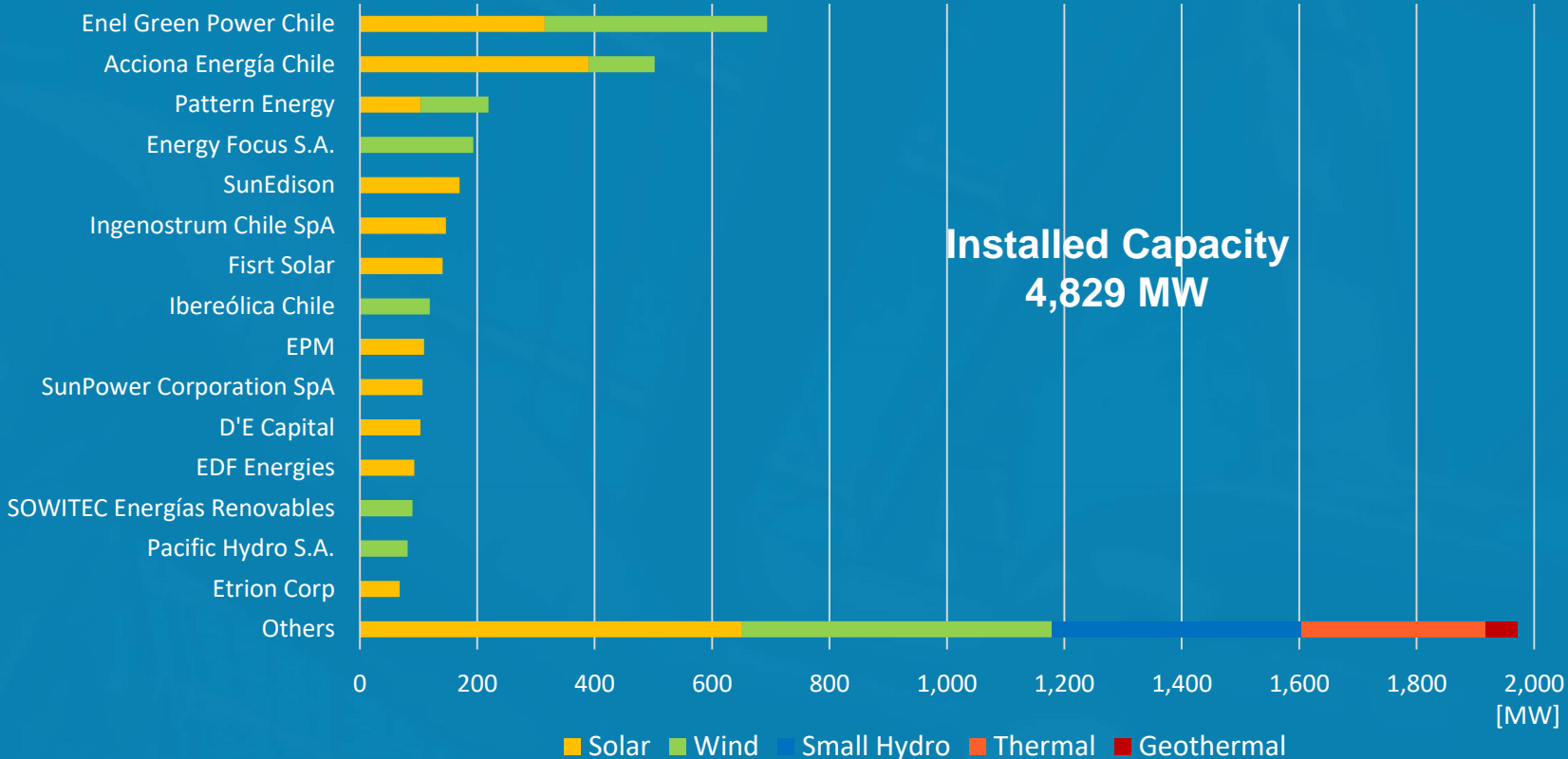
Potencial
HIDROELÉCTRICO,
MW



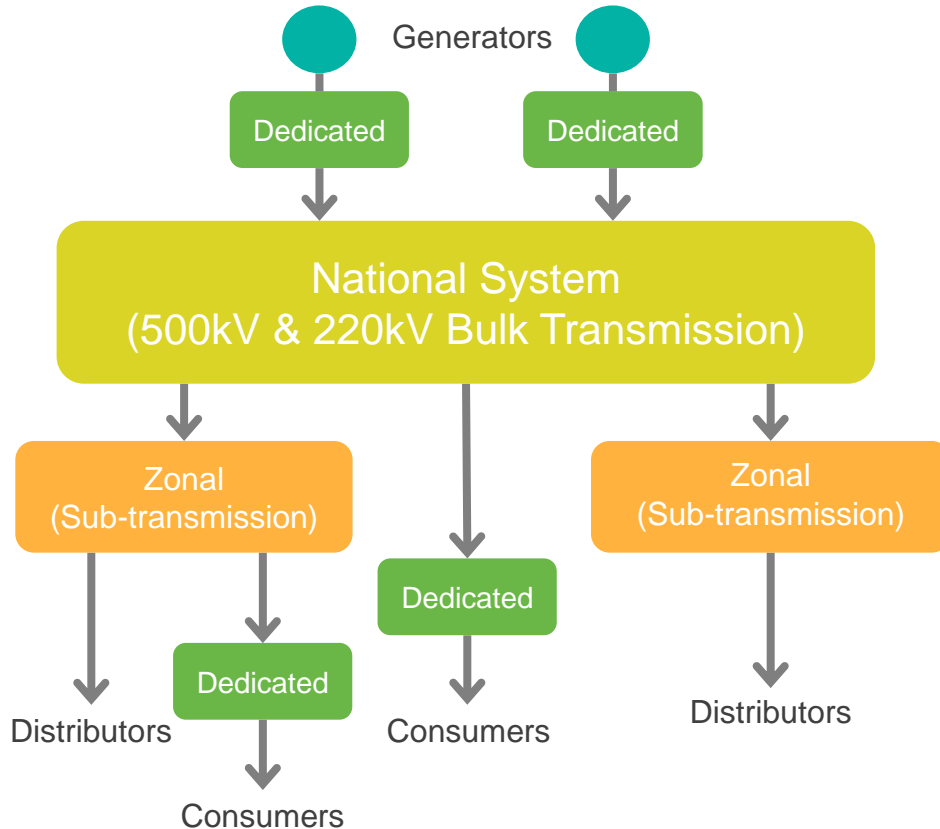
Chile has significant RE resources:

- 2,000 GW of wind, solar and hydro capacity.
- 4,000 MW of geothermal and biomass capacity.

MAIN ACTORS IN THE RE MARKET



TRANSMISSION SECTOR



- Three segments: National, Zonal and Dedicated
- Centralized planning for National/Zonal (by CNE)
- System expansions based on a competitive bidding process (by NEC)
- 2018 expansion plan → USD 1,400 million (First HVDC project)

SOME CHALLENGES...

- ✓ Integration of high levels of variable renewable energy (flexibility)
- ✓ New auction-based markets for ancillary services
- ✓ Develop RE workforce (4,000 jobs by 2030)
- ✓ Permitting, environmental, and social issues (PMO, ROW Studies, state land bids)
- ✓ Dry hydrology scenarios and voluntary decarbonization commitments
- ✓ Transmission congestion (First HVDC project)
- ✓ Natural disasters (earthquakes, tsunamis, volcanos, wildfires, flooding)

INVESTMENT OPPORTUNITIES

- ✓ **Renewable Energy Generation**
- ✓ **CSP Technology (Base capacity)**
- ✓ **Energy Storage Systems (BESS, Pump storage)**
- ✓ **Ancillary Services (New auction-based market)**
- ✓ **Transmission Expansions (Developers and EPC contractors)**
- ✓ **Regional Interconnections (Peru, Argentina)**



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**THANKS FOR
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