

Chile

# CHILE'S ACTION PLAN FOR POWER SECTOR DECARBONIZATION

Carlos Toro Ortiz and Belén Muñoz Zurita  
Ministry of Energy

Delivered for the 14<sup>th</sup> Clean Energy Ministerial (CEM14)

July 2023



## BACKGROUND

A collaborative report from the Clean Energy Ministerial (CEM) on [Lessons Learned for Rapid Decarbonization of Power Sectors](#) was delivered to energy ministers and presented at the 13<sup>th</sup> CEM (CEM13) in the United States in September 2022. In light of these lessons learned and discussed at CEM13, several jurisdictions signaled intent to develop Action Plans for power sector decarbonization, to be released at CEM14 in India in July 2023.

These Action Plans complement, but are differentiated from, other international power sector initiatives such as the Breakthrough Agenda (whose broad purpose is to raise collective ambition) and the Global Power System Transformation (G-PST) Consortium (whose goals are to convene power system operators to accelerate research innovations and foster peer learning). The Action Plans, supported by the [21st Century Power Partnership](#) and other CEM workstreams via direct technical assistance and capacity building, are intended to focus on select implementation actions given each country's existing power sector goals and activities, and are an opportunity for countries to display leadership in power sector decarbonization.

**These Action Plans are voluntary, developed by each country individually, not comprehensive of all activities within the jurisdiction, and are living documents that are subject to change.**



# OVERVIEW OF CHILE'S POWER SECTOR



## Electrification

Around 99% of the population



## Renewable Transition

Increasing RE instantaneous penetration of solar and wind power  
**67% Solar & Wind\***



## Coordinated companies

703 in 2023

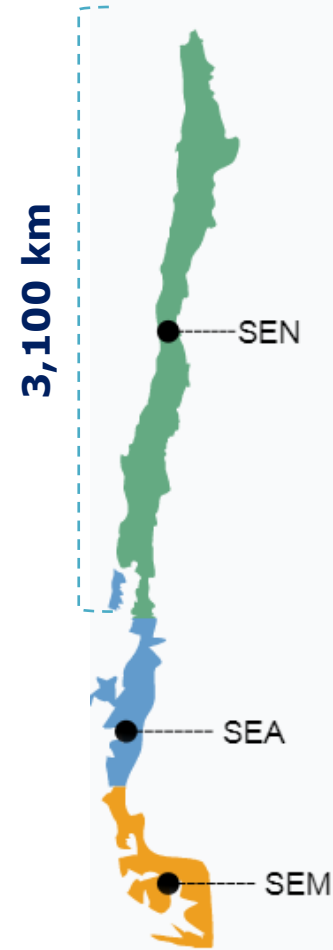


## Curtailement

5.3% RE generation curtailed during 2022

\* Maximum during 2022

Figure. Organization of Chile's Electric Grid



## Long System



One main system (Sistema Eléctrico Nacional - SEN)  
+  
Two isolated and smaller systems (Aysén - SEA and Magallanes - SEM)

Source: <http://energiabierta.cne.cl/>



## RELEVANT INSTITUTIONS



### Ministry of Energy

Responsible for **developing and coordinating the agenda, policies, and standards** for the proper operation and development of the energy sector, ensuring its compliance, and advising the Chilean government on related matters.



### National Energy Commission

Technical organization **responsible for defining the tariffs and technical standards** to which companies must adhere to produce, generate, transmit, and distribute energy. The National Energy Commission is responsible for regulating Chile's energy sector.



### Electricity and Fuels Superintendent

Monitor the proper operation of electricity, gas, and fuels, in terms of safety, quality, and price. Responsible for **overseeing the energy sector** in Chile.



### National Electrical Coordinator

The National Electrical Coordinator is an autonomous, technical, and independent body governed by public law, responsible for coordinating the operation of the national electricity system, **ensuring economical and secure electricity supplies**, and guaranteeing open access to transmission systems.

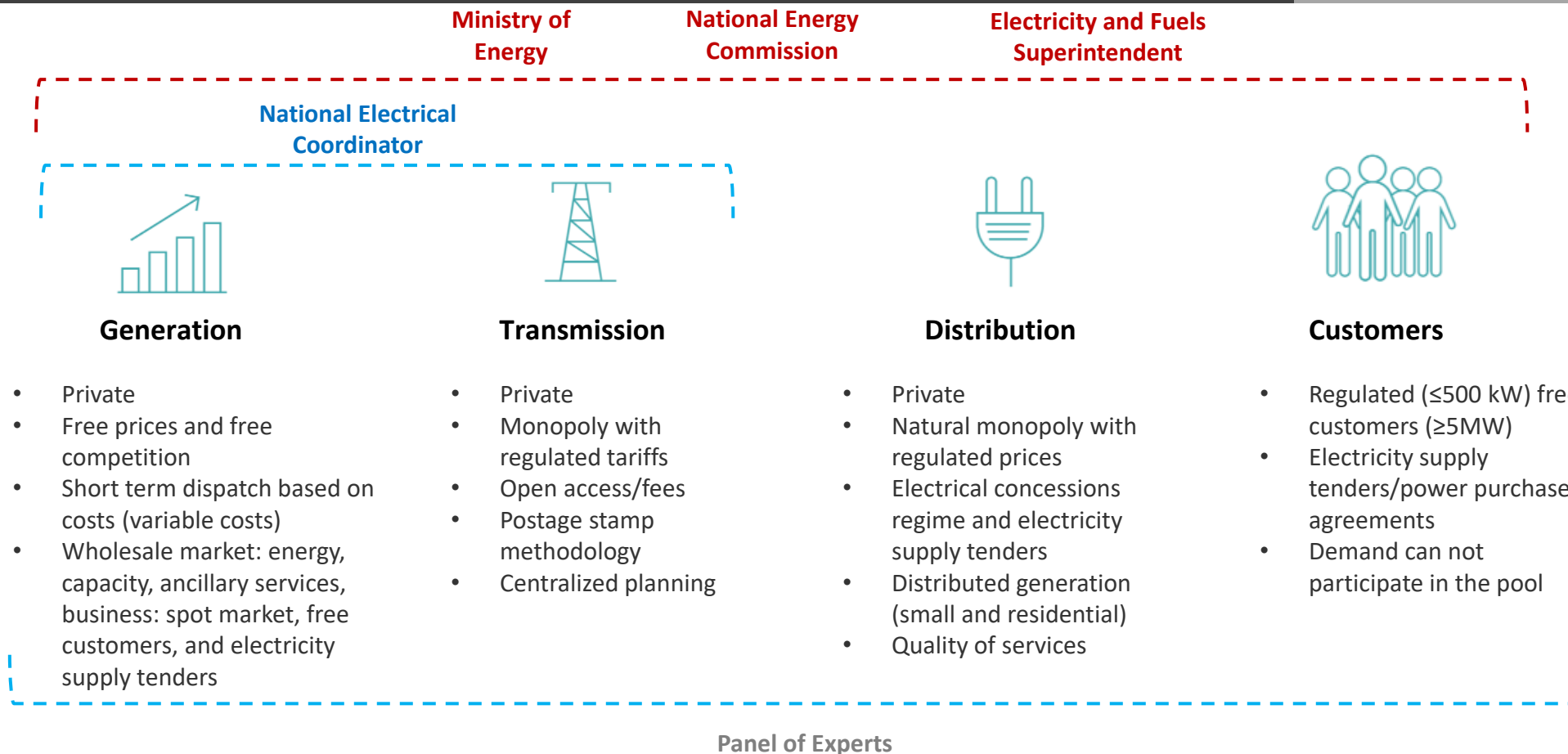


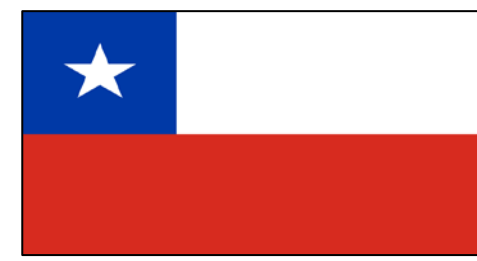
### Panel of Experts

Its function is to **solve, through opinions of binding effect, discrepancies and conflicts** that, according to the law, arise due to the application of the electricity and gas services legislation that the electricity, gas services, and other companies submit for their review.



## KEY PLAYERS





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# I. PLANNING

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## Action Plan for Rapid Power Sector Decarbonization



# DECARBONIZATION HISTORY AND PLAN

## 2018 - 2019

Coal Phase Out by 2040 Agreement  
NDC and Carbon Neutrality Target



## 2020 - 2021

Long Term Climate Strategy  
and Carbon Budgets



## 2022 - 2023

Long Term Energy Planning 2023-2027  
Climate Change Law

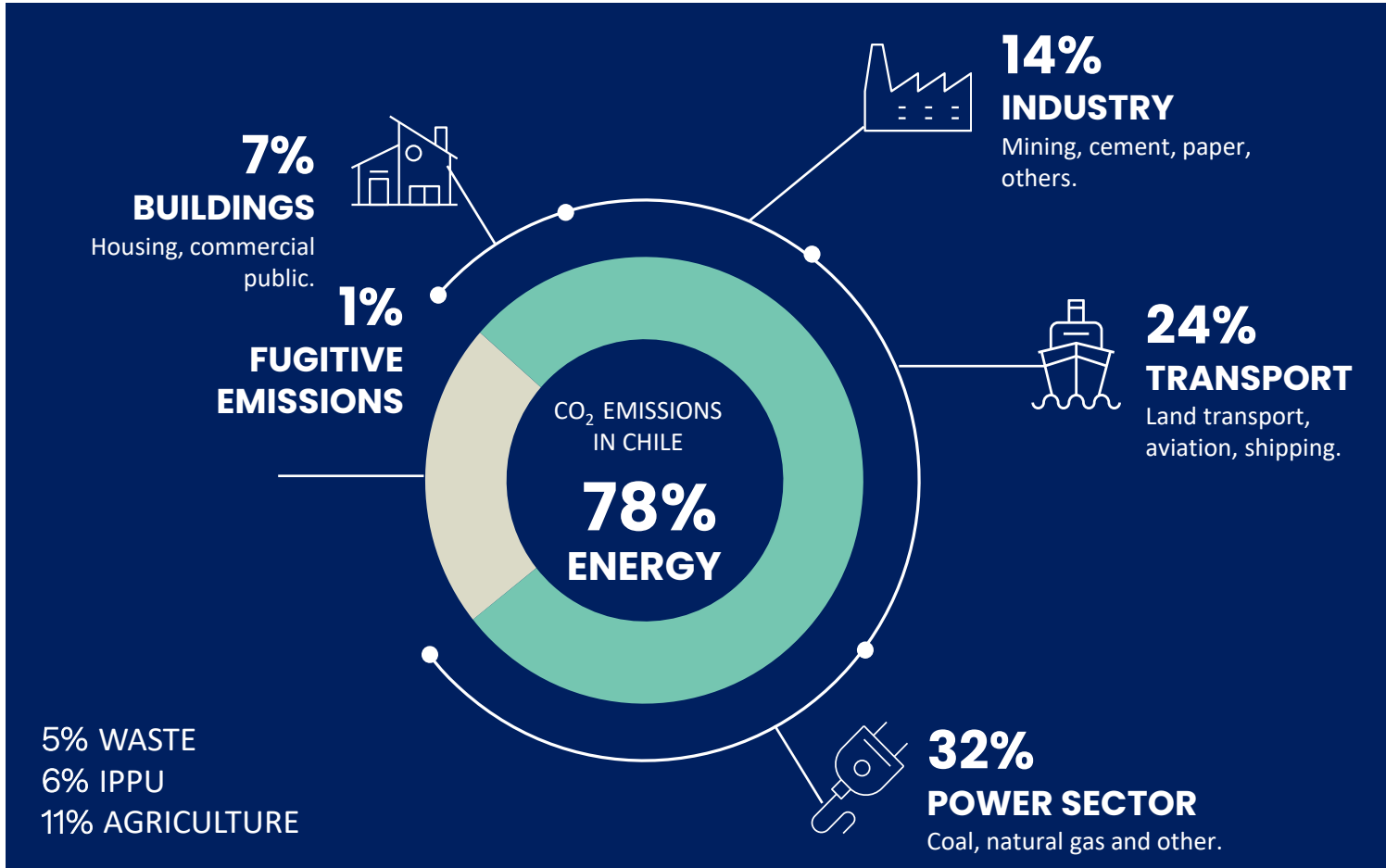
**Decarbonization Plan Rountable  
(April-Nov)**





# CHILE GREENHOUSE GAS EMISSIONS

Figure. Sources of Greenhouse Gas Emissions in Chile



**Energy**  
as a solution for  
the climate  
change crisis  
and air  
pollution.



Inventario Nacional de Emisiones GEI Chile 2020  
**Ministry of Environment**

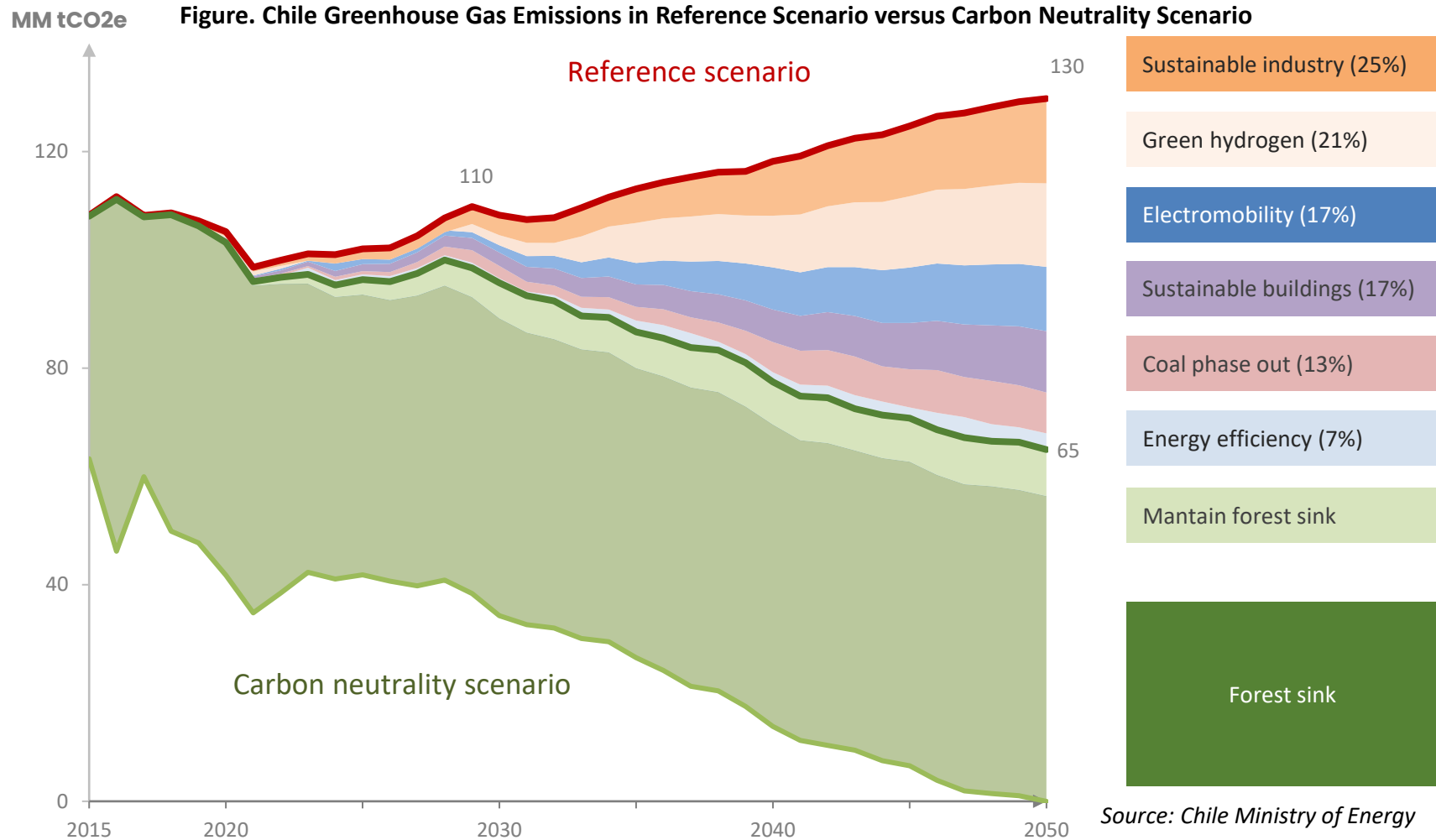
Source: Chile Ministry of Environment





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# CHILEAN CARBON NEUTRALITY PATHWAY



**6 important mitigation actions towards net zero: a country commitment.**



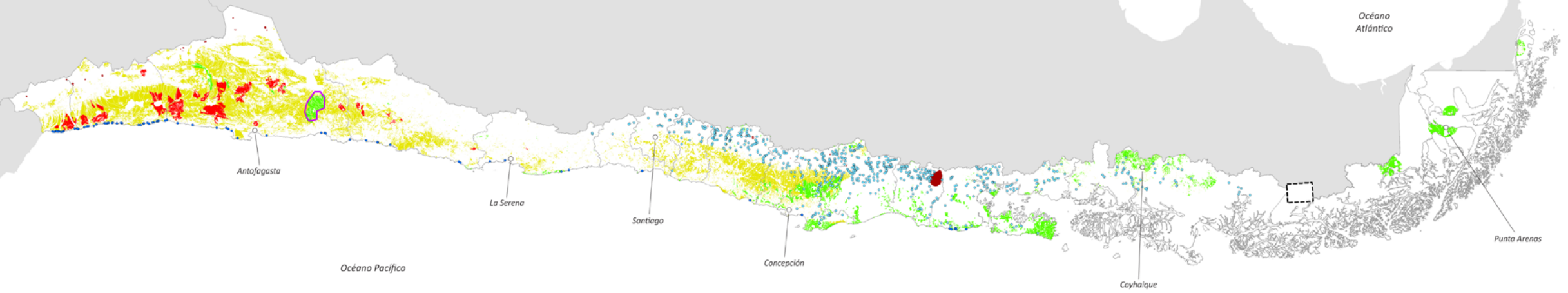
Carbon Neutrality for the Energy Sector  
**Ministry of Energy**



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# CHILEAN RENEWABLE ENERGY RESOURCES

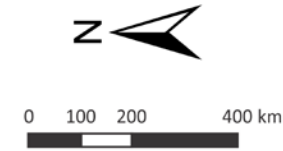
Figure. Renewable Energy Resources in Chile




**Potenciales de Energías Renovables PELP 2023-2027**

**Leyenda**

- Eólico
- Geotérmico
- Solar CSP
- Solar Fotovoltaico
- Potenciales Centrales Hidroeléctricas
- Potenciales Centrales de Bombeo Costeras
- Área de Reserva de Taltal



*Potenciales con descuento de áreas superpuestas entre tecnologías. Para la provincia de Palena y las regiones de Aysén y Magallanes, el potencial se limita hasta 20 km desde los sistemas medianos. Fuente: División Energías Sostenibles (agosto, 2021)*

**+80** times greater technical potential than actual installed capacity

Tecnología	Potencial (GW)
Solar PV	2,086
Wind	81
Solar CSP	152
Geothermal	4
Hydro	10
Pumped Hydro	42
<b>Total</b>	<b>2,375</b>



Renewable Potential **Ministry of Energy**

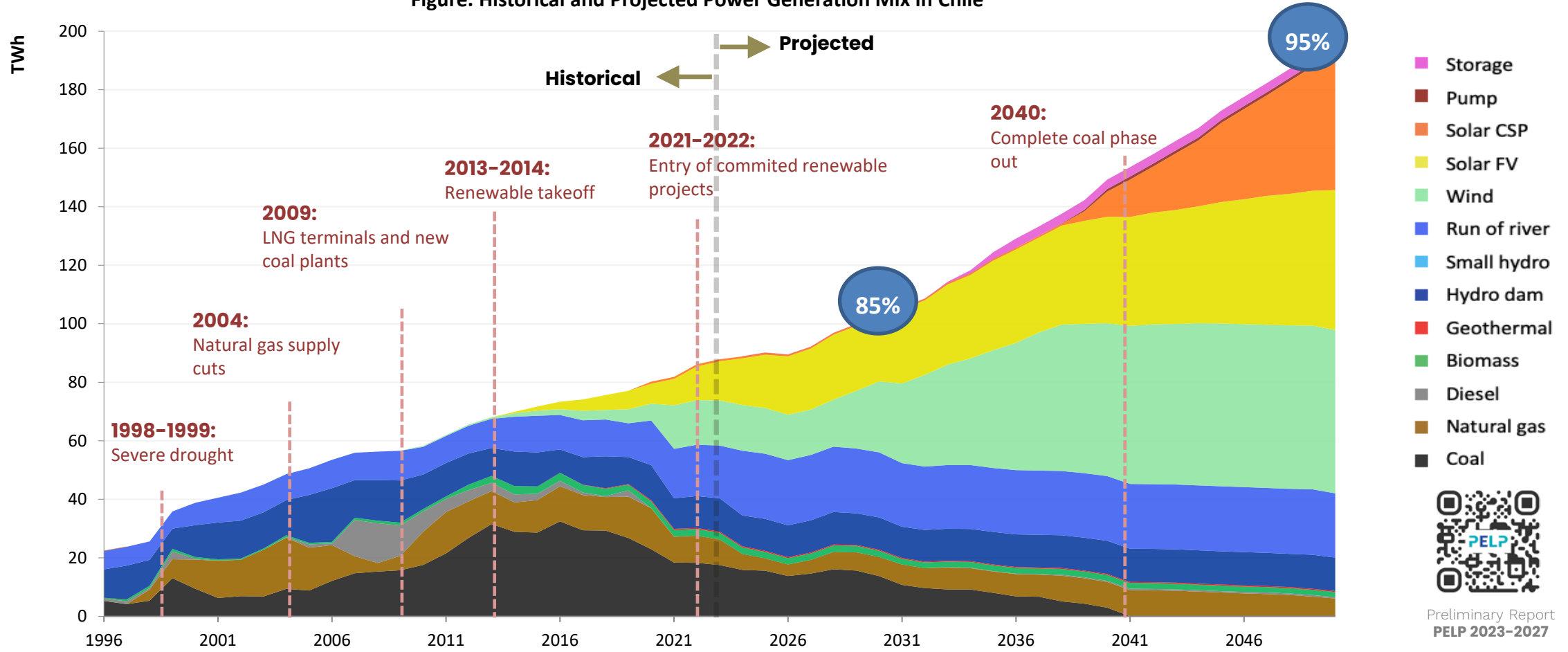
Source: Chile Ministry of Energy



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# HISTORY AND FUTURE OF THE CHILEAN ELECTRICAL SYSTEM

Figure. Historical and Projected Power Generation Mix in Chile



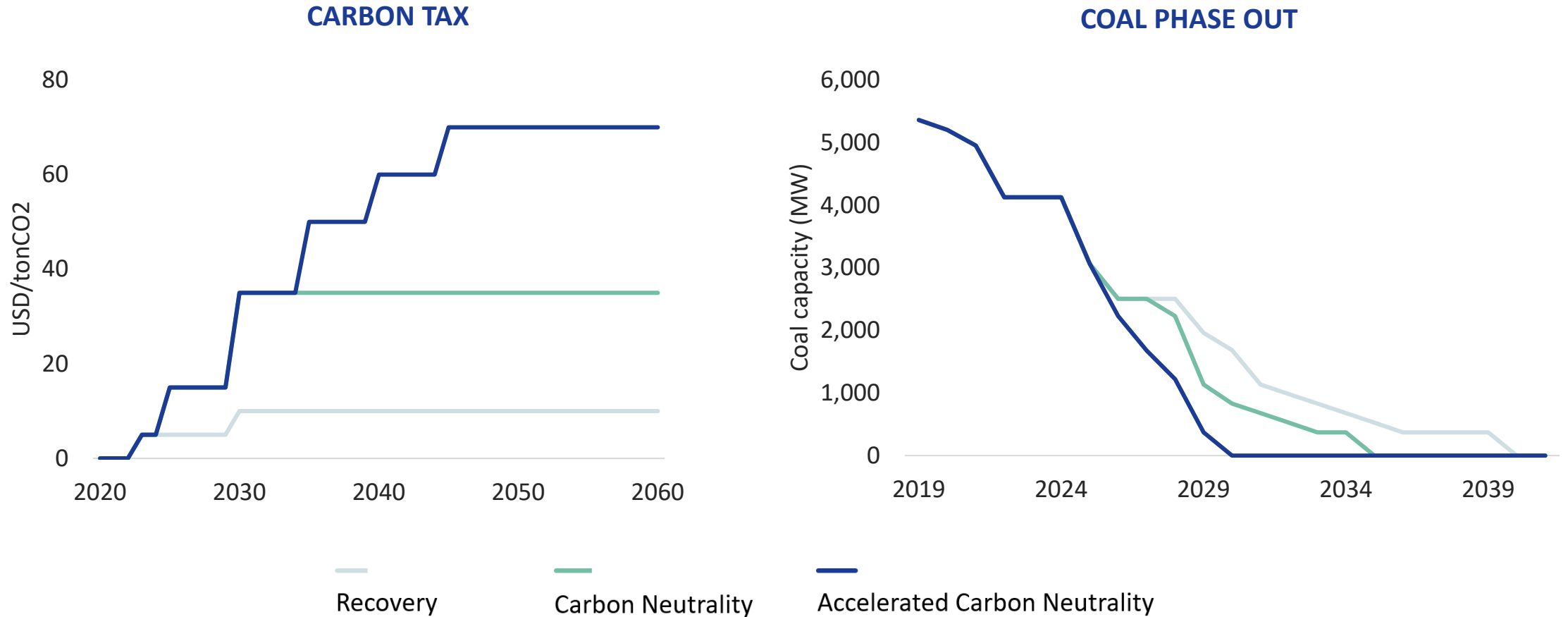
Preliminary Report  
PELP 2023-2027

Source: Chile Ministry of Energy



# LONG TERM ENERGY PLANNING – PRELIMINARY RESULTS (1/2)

Figure. Carbon Tax and Coal Phase Out in Chile Long Term Energy Planning



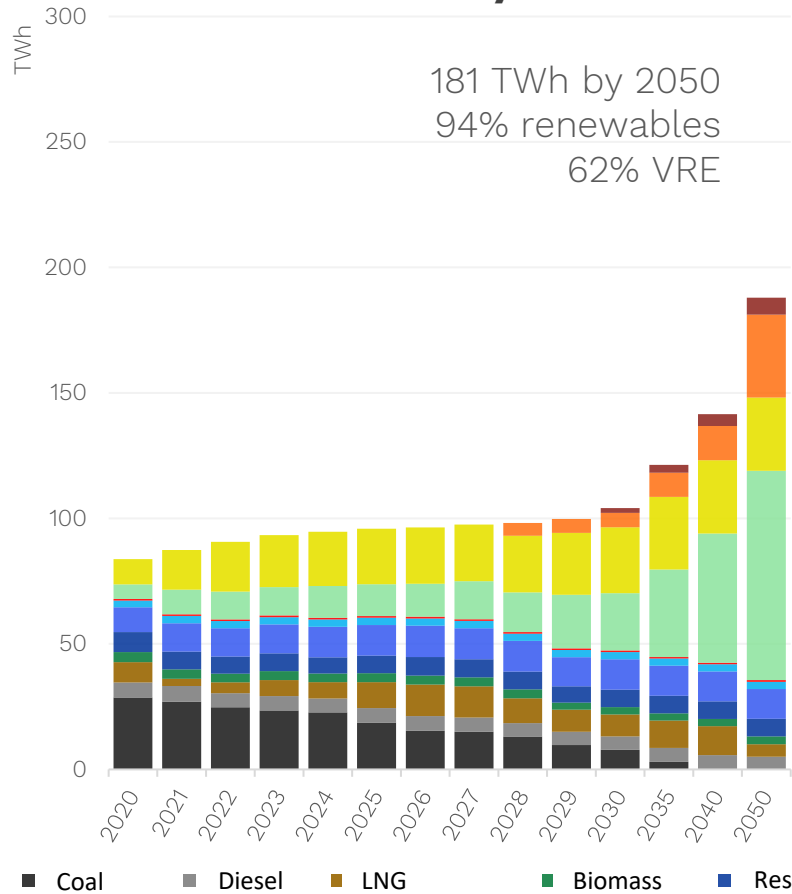
Source: Chile Ministry of Energy



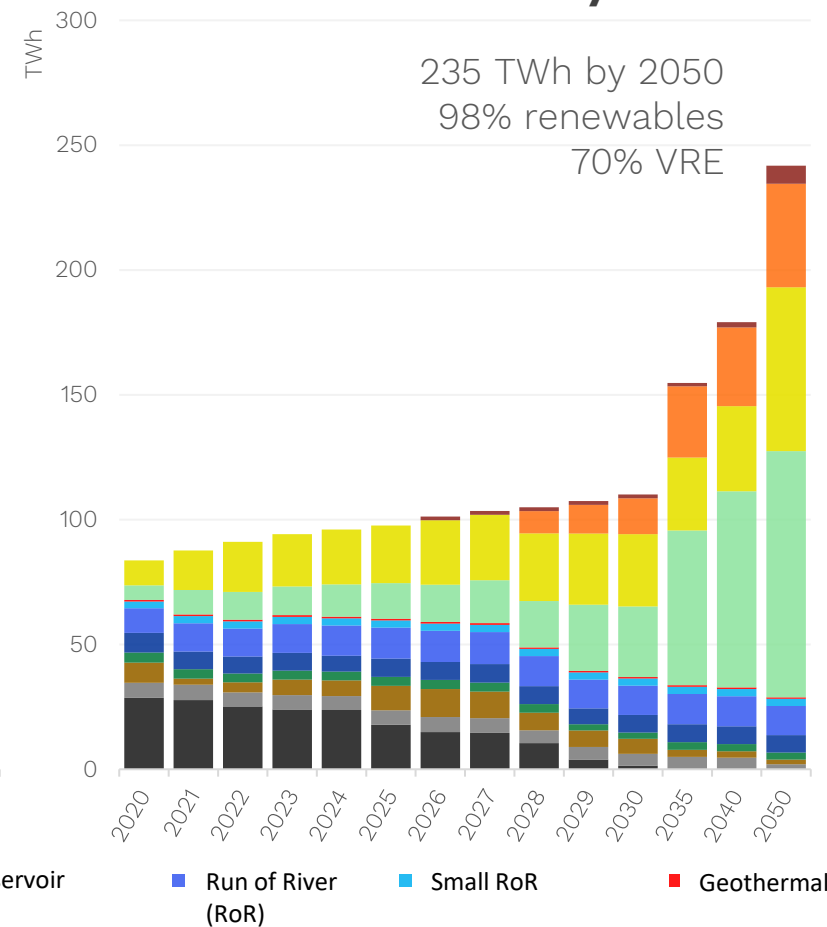
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# LONG TERM ENERGY PLANNING – PRELIMINARY RESULTS (2/2)

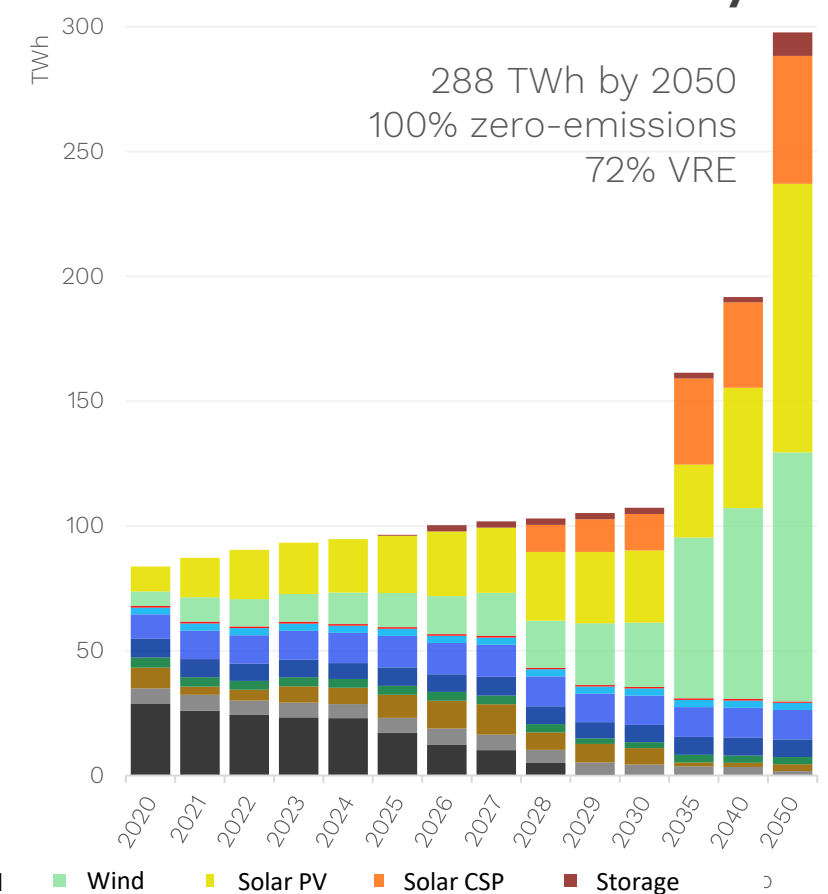
### Recovery



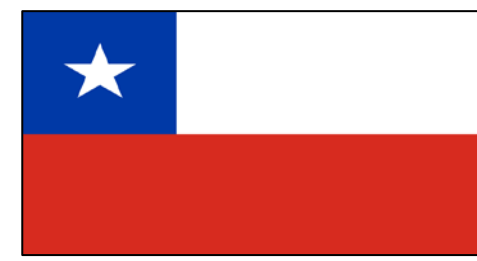
### Carbon Neutrality



### Accelerated Carbon Neutrality



VRE: Variable Renewable Energy (Solar PV and Wind)



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## II. BUILDING

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### Action Plan for Rapid Power Sector Decarbonization



# POWER SECTOR INFRASTRUCTURE SNAPSHOT



**34,083 MW**  
Installed capacity until January 2023



**83,375 GWh**  
Annual energy generation in 2022

Wind + Solar = 32.7% of Installed Capacity

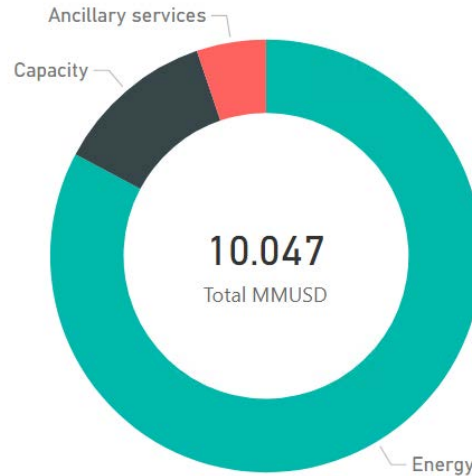


**1,193 MW**  
Total coal capacity phased out from 2018 to 2022: 22% of total; 64% of total by 2025

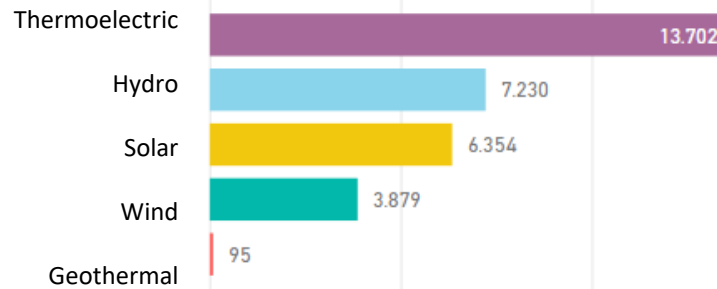


**27,920 GWh**  
Annual NCRE (non-conventional renewable energy) generation during 2022: 33.5% of total

## Electricity Market



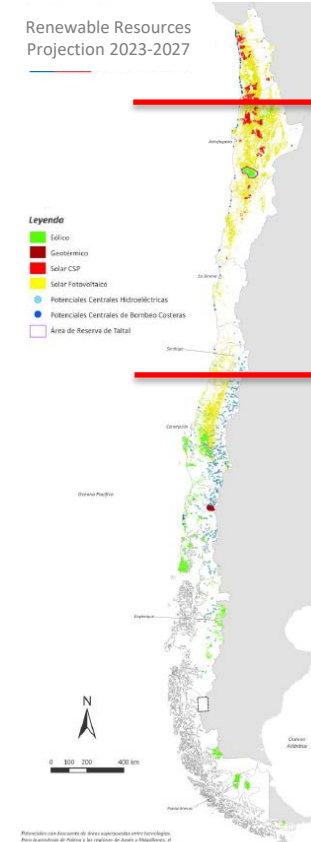
### Installed Capacity [MW] 2023



37% of installed capacity is NCRE

## Projections for the Future

Renewable Resources Projection 2023-2027



**Kimal**  
HVDC - LCC  
+600 kV  
2000 MW  
CAPEX ref: 1176 MMUSD  
1500 km  
Expected operation: 2029

**Lo Aguirre**

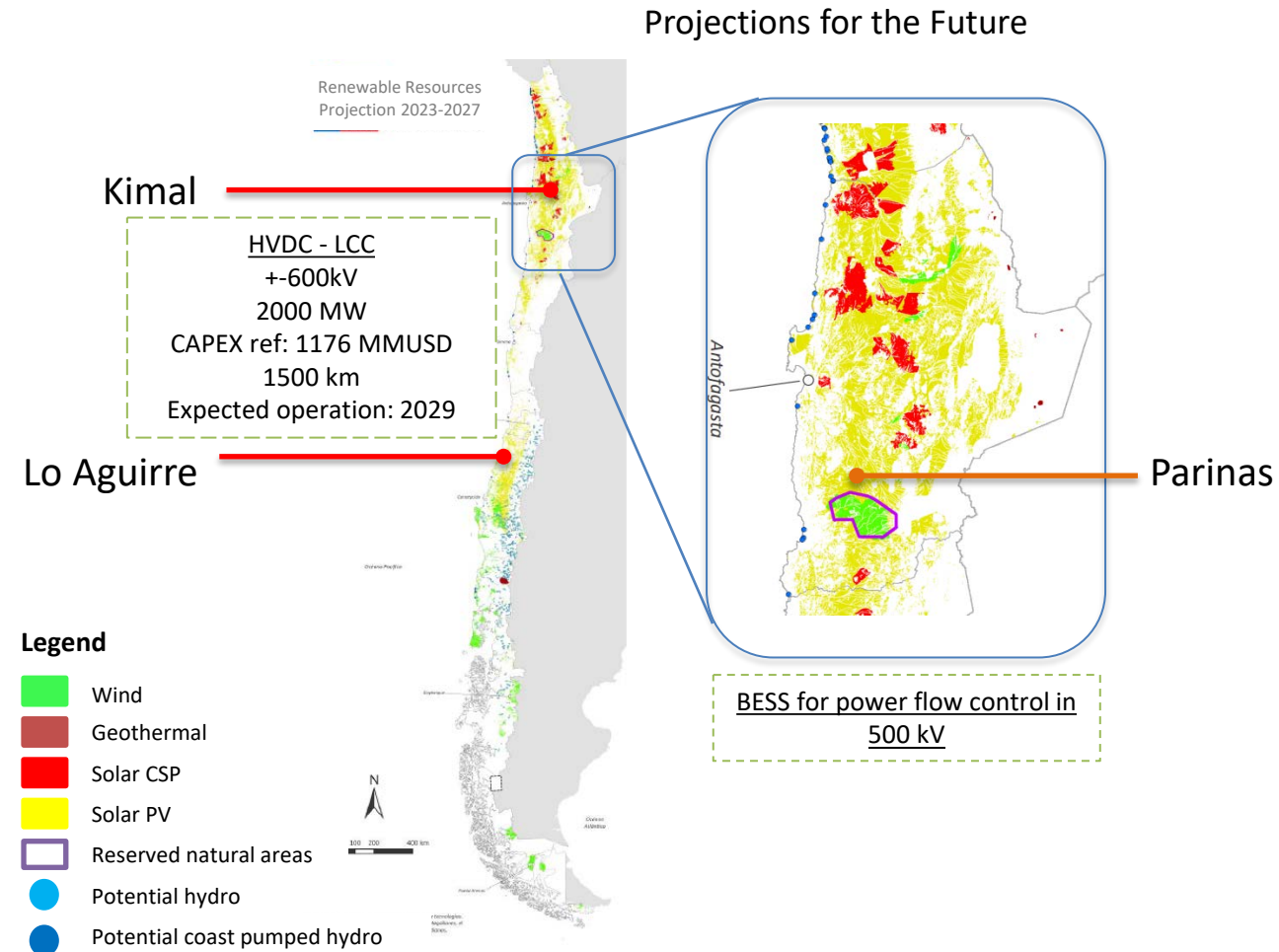




# TRANSMISSION EXPANSION

## Plans to overcome the transmission challenges:

1. Law project for the promotion of urgent and broad consensus matters in terms of Transmission:
  - a) Efficient development of transmission
  - b) Promotion of competition and storage
  - c) Climate change and electric sector: enabling infrastructure for the energy transition, territorial planning and ordering, emissions-free power grid operation
  
2. Transmission expansion plan: includes battery storage for flow control in 500 kV at S/E Parinas.







# PROMOTION OF RENEWABLE ENERGY

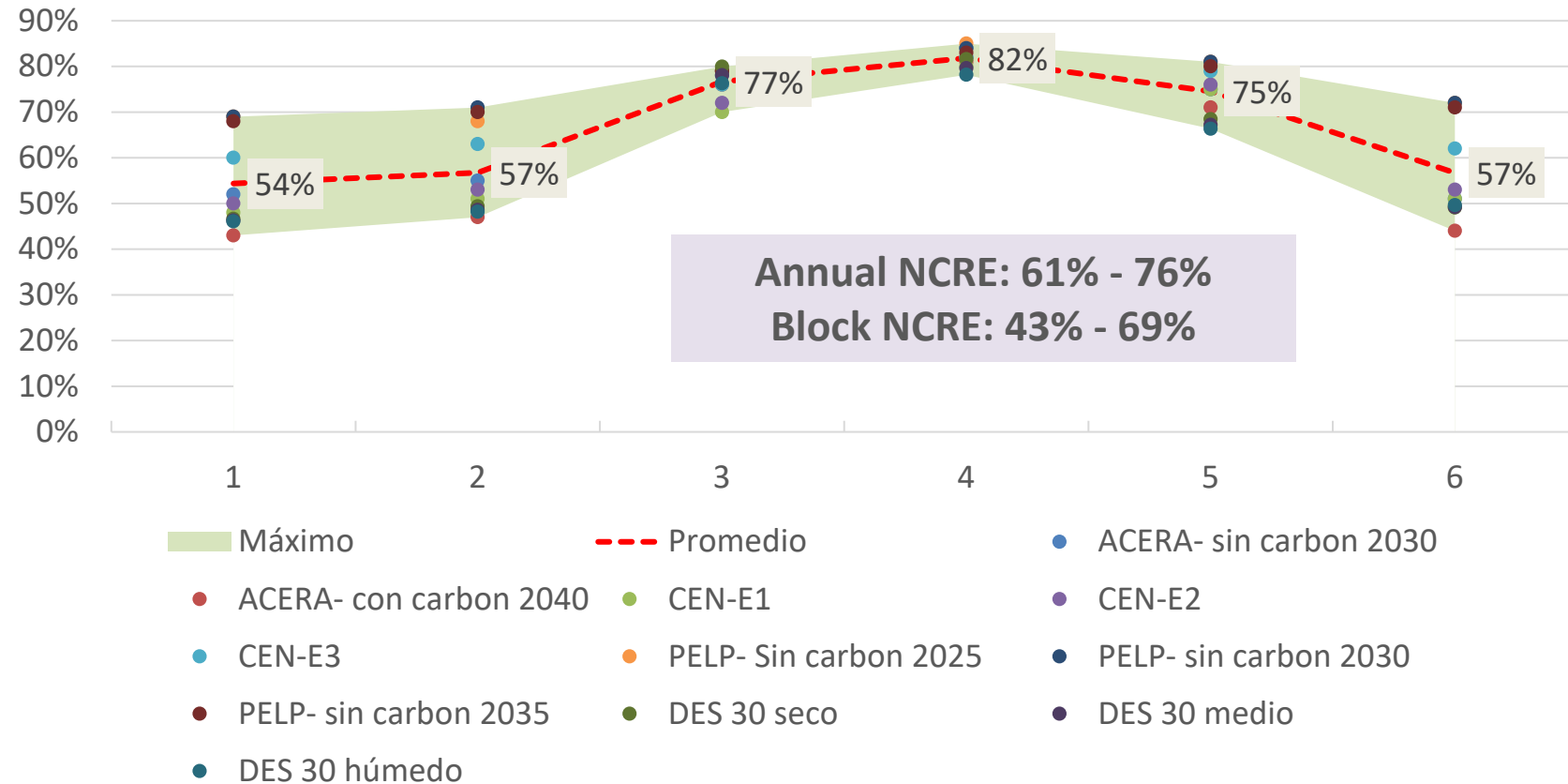
Law project for the promotion of renewable energy:

Annual participation: 60%

Block Participation: 40%

2030 objective.

Average NCRE participation in the different scenarios





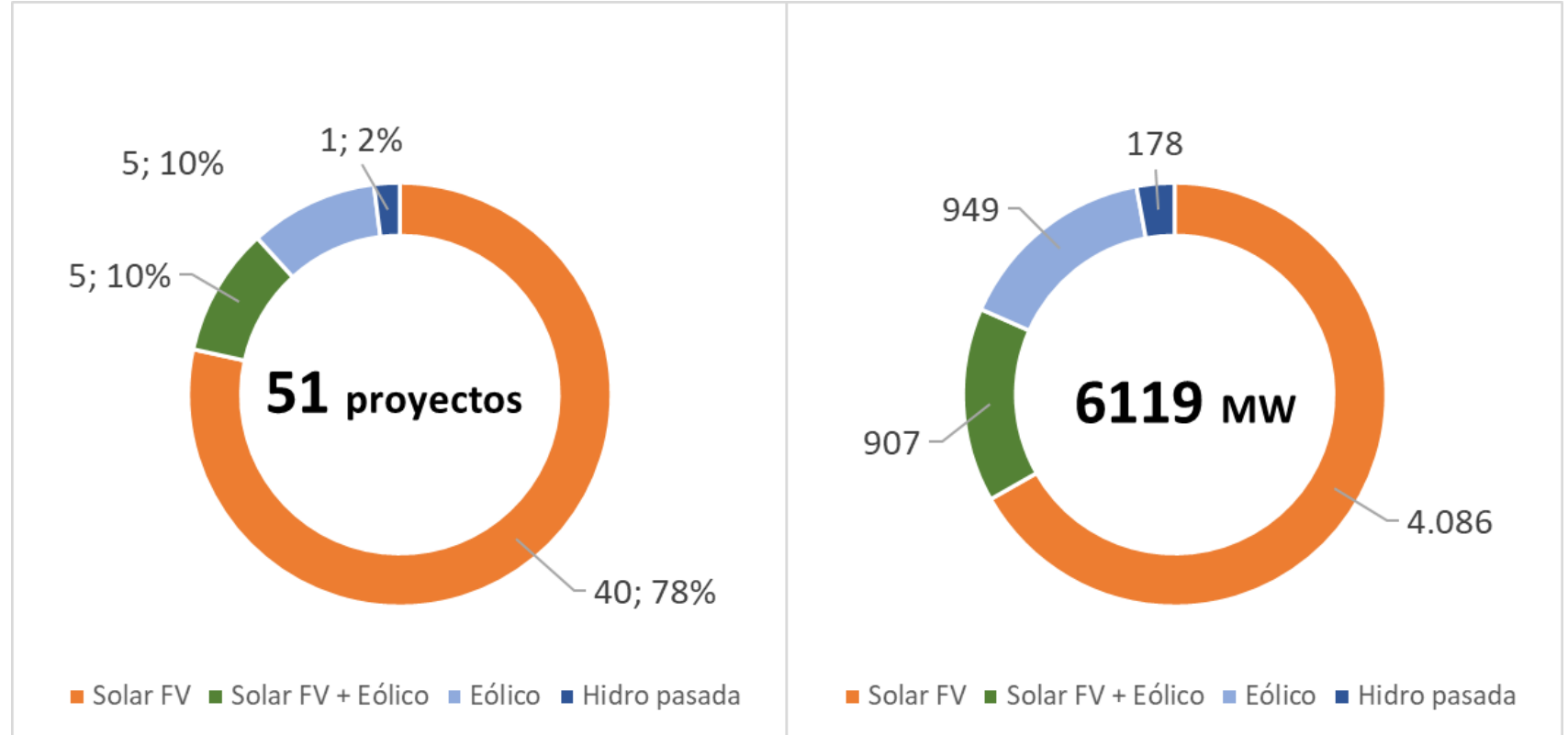
# ENERGY STORAGE PROMOTION

## Law modification for the promotion of storage:

- Stand alone projects
- Payment in energy and power markets

Plans to invest \$USD 2 billion in large-scale energy storage by 2026 in the northern Atacama desert, in addition to 5.4 GWh of storage already in the procurement pipeline for 2027-2028.

Projects with storage are growing in Chile.



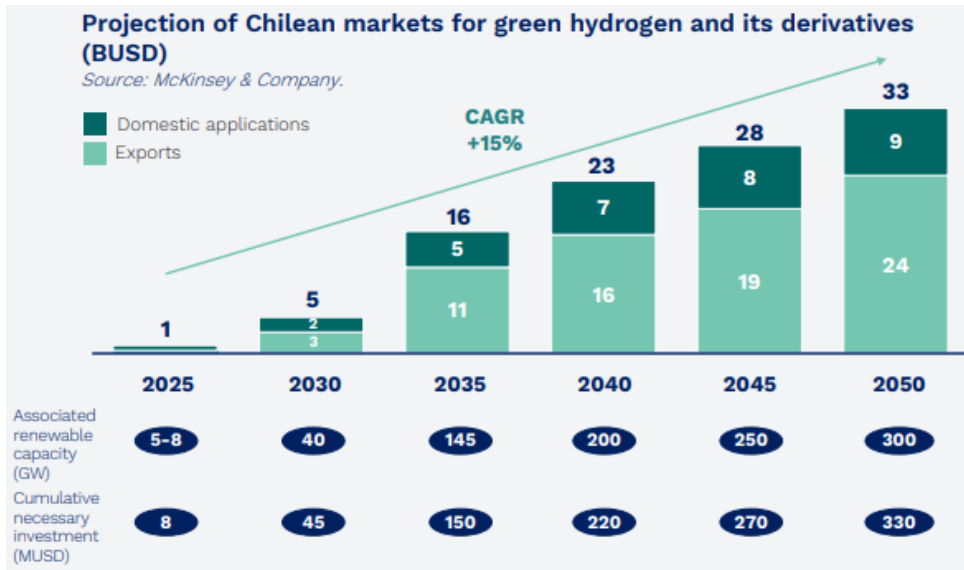


# GREEN HYDROGEN AND LITHIUM NATIONAL STRATEGIES

## Green Hydrogen

The National Green Hydrogen Strategy seeks to position Chile as one of the largest producers and exporters of green hydrogen in the world.

- This due to the great VRE potential that would produce low-cost hydrogen, with zero emissions.

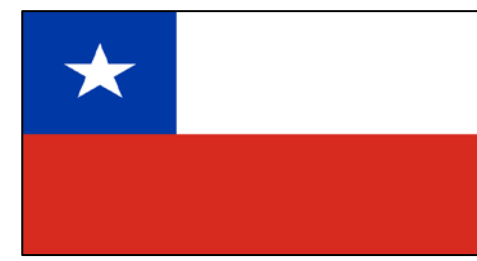


## Lithium (announced)

The National Lithium Strategy is a set of measures that seek to develop the Chilean lithium sector in a sustainable way. Some of the most relevant actions that are possible are:

- Create the National Lithium Company.
- Create a Network of Protected Salt Flats and ensure the use of technologies with low environmental impact in the Salt Flats already under exploitation.
- Create a Technological and Public Research Institute for Lithium and Salt Flats.
- Incorporate the Chilean State in the productive activity of the Atacama's Salt Flat.

Source: Chile Ministry of Energy



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## III. OPERATING

### Action Plan for Rapid Power Sector Decarbonization



# CHILEAN ELECTRICAL GRID OPERATION

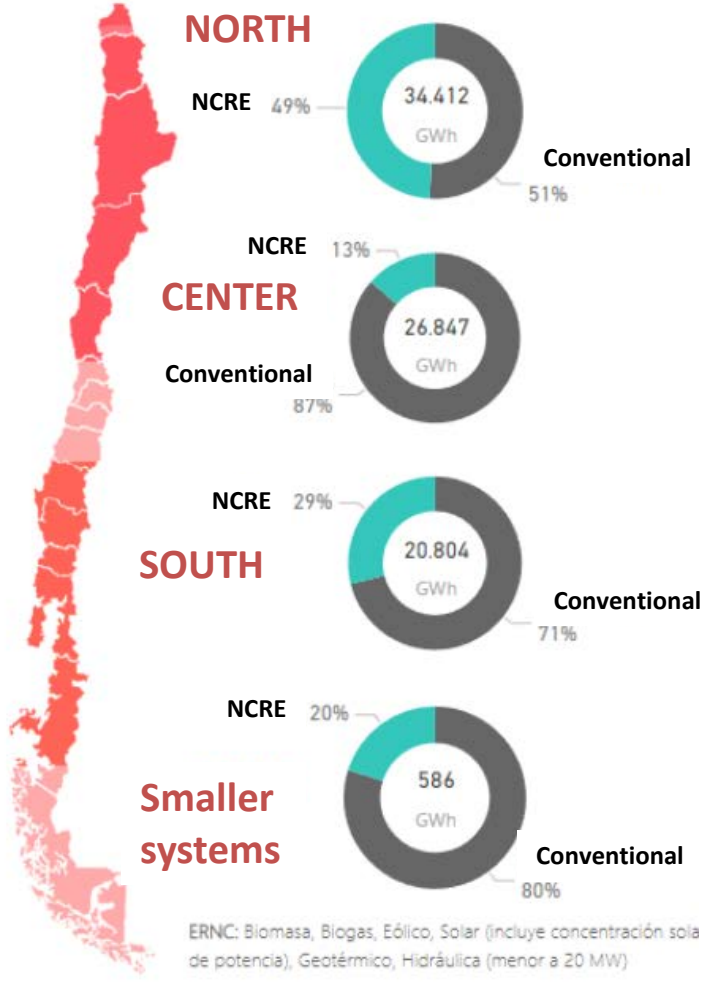
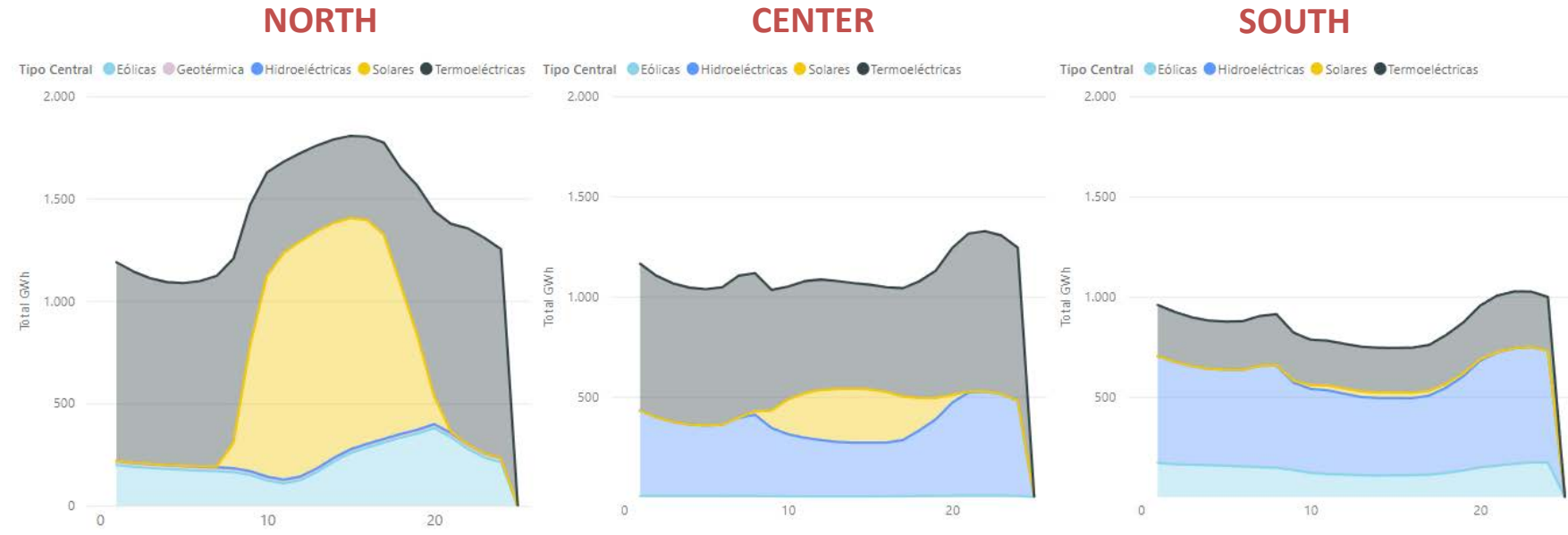


Figure. Total Generation per Hour (2022)



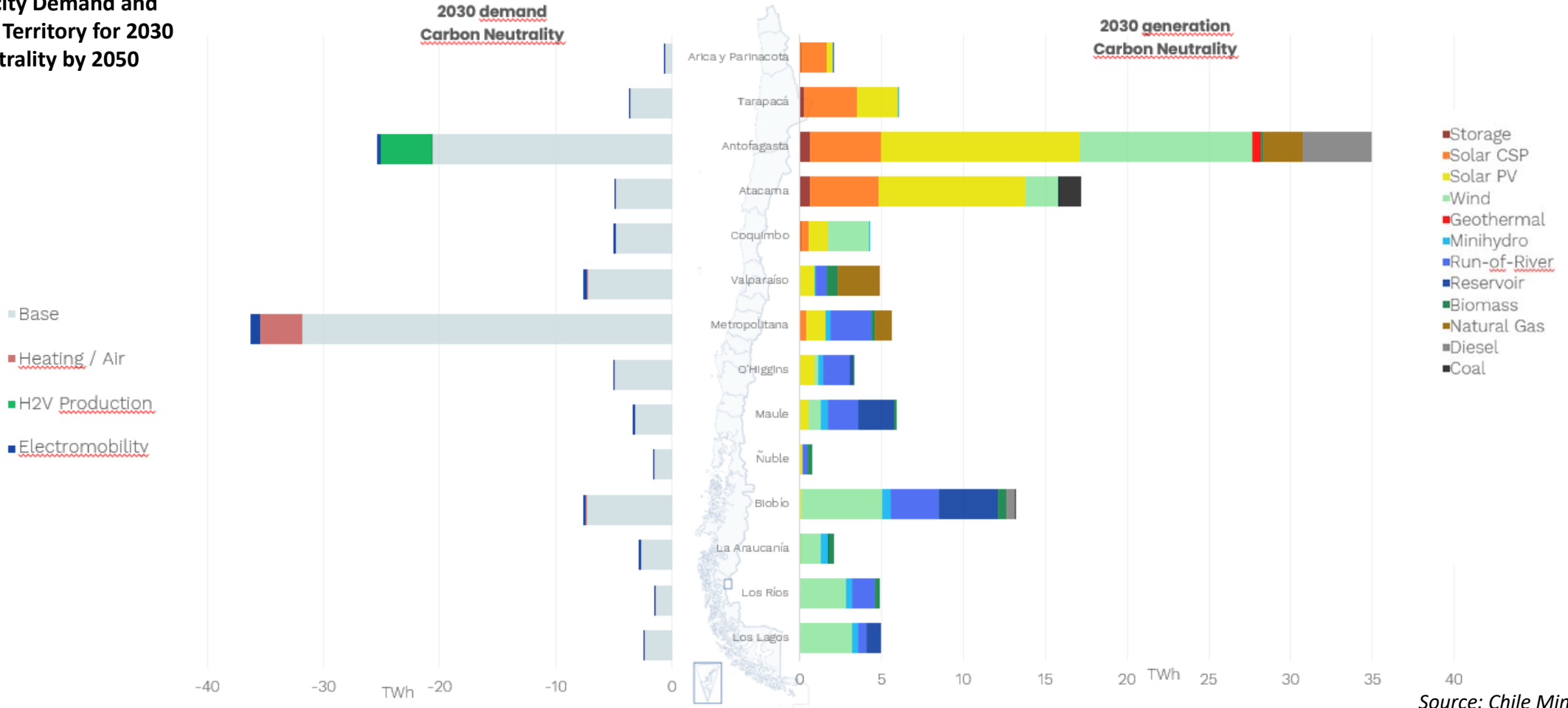
The National Electrical Coordinator (Grid Operator of Chile) has also developed a [roadmap](#) to achieve a 100% renewable, secure, and reliable grid by 2030.

Source: Chile Ministry of Energy



# PROJECTED ELECTRICITY SYSTEM DEMAND AND GENERATION

Figure. Electricity Demand and Generation by Territory for 2030 in Carbon Neutrality by 2050 Scenario



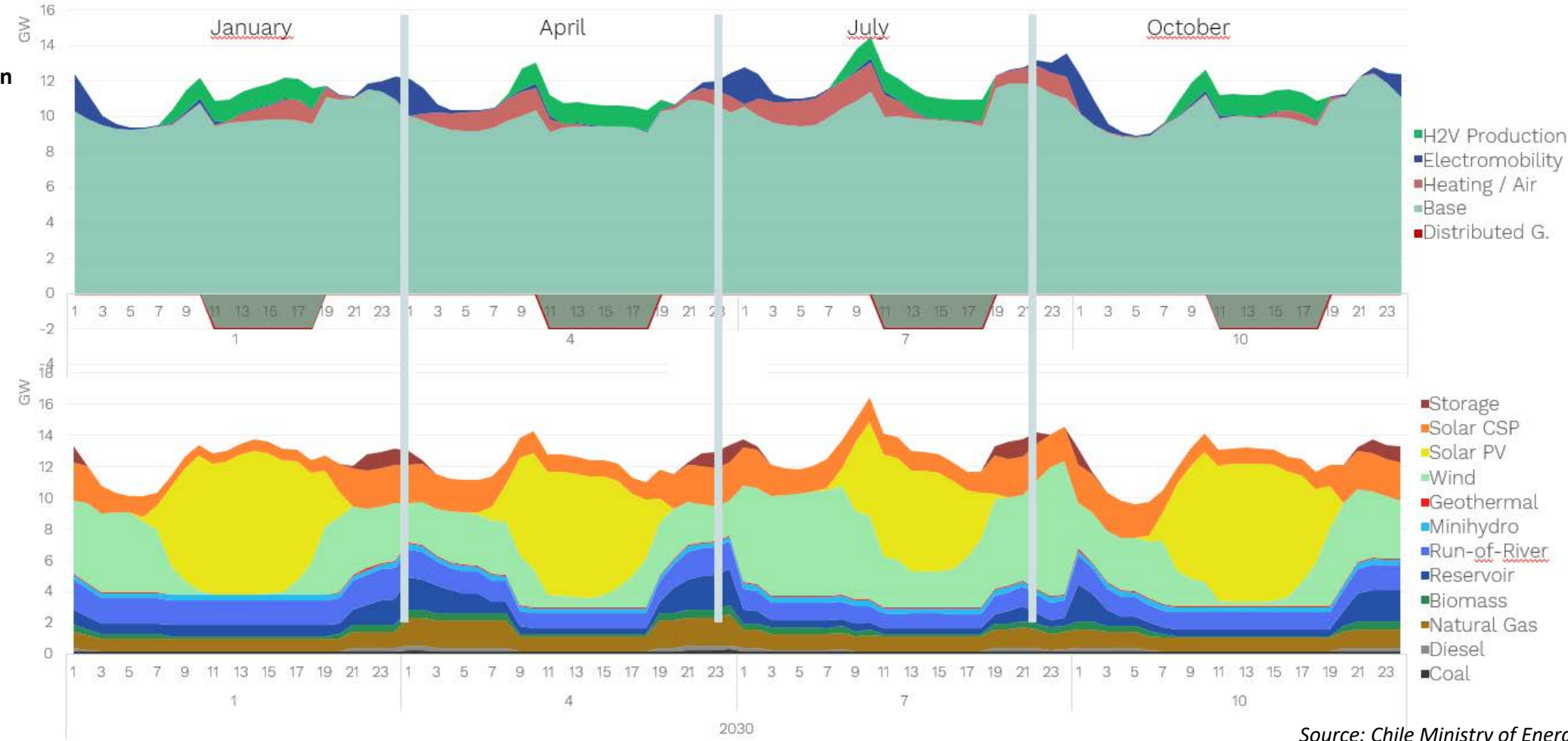
Source: Chile Ministry of Energy



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# PROJECTED ELECTRICITY SYSTEM OPERATION

**Figure. Electricity System Operation (Demand and Generation) for 2030 in Carbon Neutrality by 2050 Scenario**



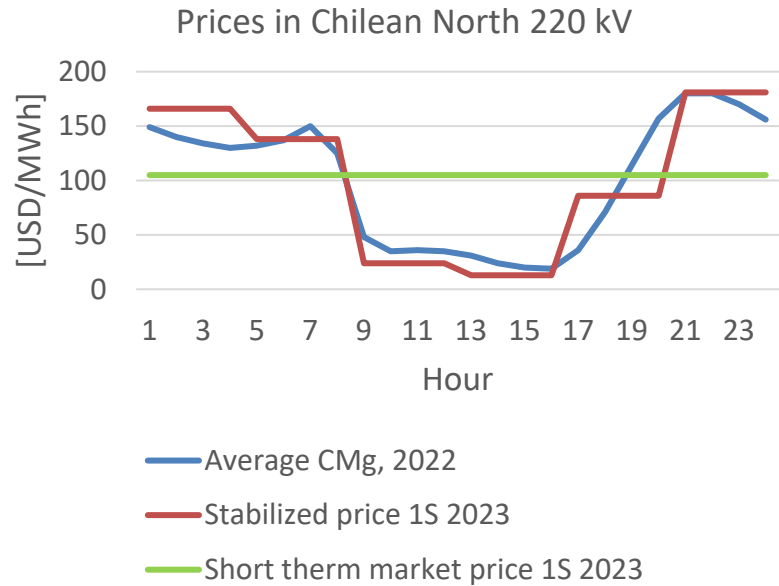
Source: Chile Ministry of Energy





# AGGRESSIVE PENETRATION OF DISTRIBUTED ENERGY RESOURCES (DERs)

## 1) Update in the competition conditions: 1 to 6 hour blocks



Taken from electrical substation "Crucero 200 [kV]"

## 2) New regulations in the interconnection process

Setting new rules for DERs with storage systems

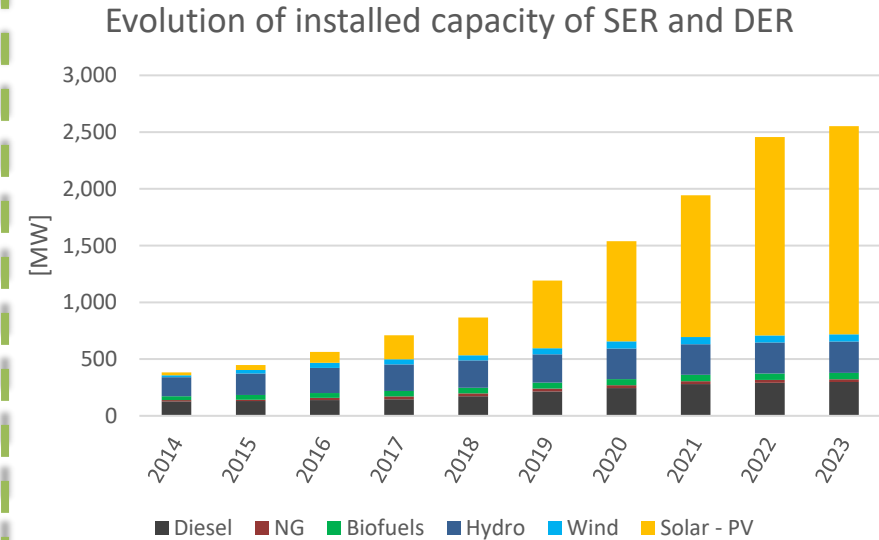
New rules for the development of a public information platform

Technical studies to determine the capacity of some DERs to prevent congestion

Standards in construction contracts (schedules, deadlines, etc)

And others...

## 3) Increase participation of DERs



SER: Small Energy Resources (< 9 [MW])

DER: Distributed Energy Resources (< 9 [MW] and connected to the distribution grid)

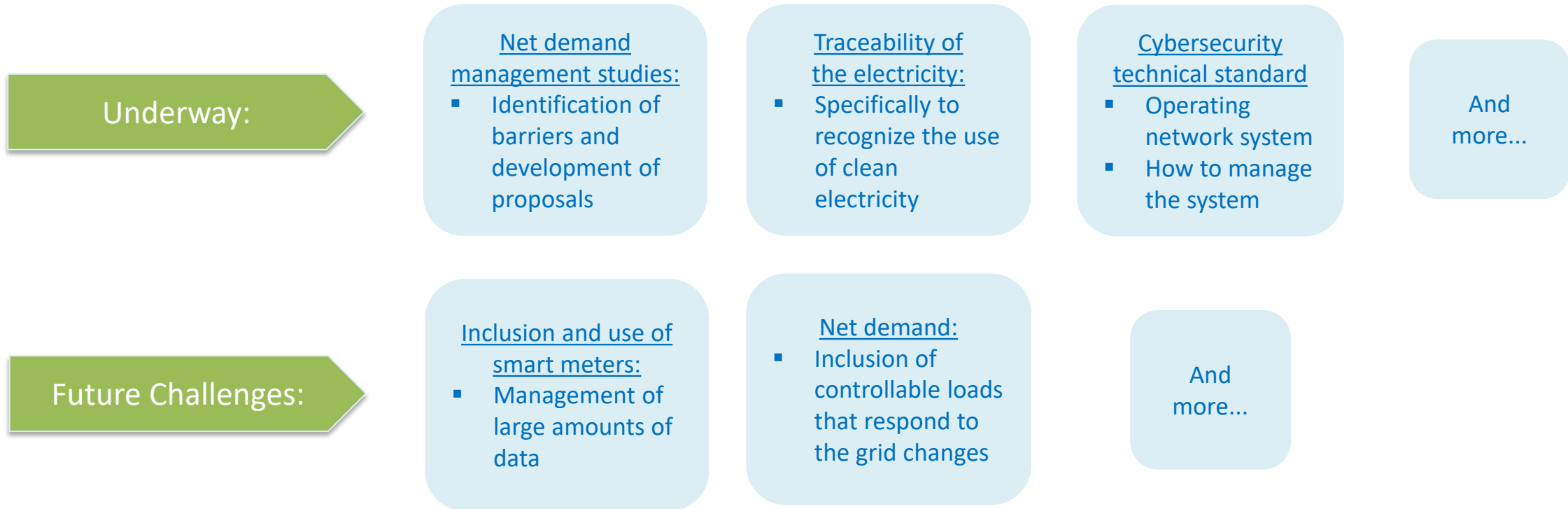
Source: National Commission of Energy





## GRID DIGITALIZATION

Chile is working on different topics to digitalize the information of the entire electric system.





# JUST ENERGY TRANSITION





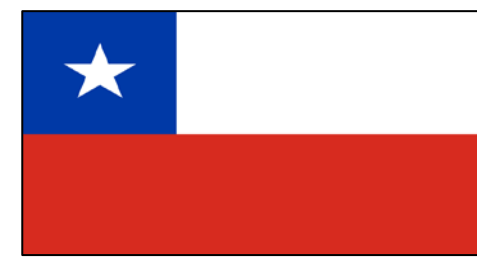
## BIBLIOGRAPHY

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- [\[2019-MinE\] NDC Mitigation Proposal Link](#)
- [\[2021-MinE\] Long Term Energy Planning 2023-2027 \[English\]](#)
- <http://energiaabierta.cne.cl/>
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- [https://energia.gob.cl/sites/default/files/national\\_green\\_hydrogen\\_strategy\\_-\\_chile.pdf](https://energia.gob.cl/sites/default/files/national_green_hydrogen_strategy_-_chile.pdf)
- <https://www.energypolicy.columbia.edu/chiles-new-lithium-strategy-why-it-matters-and-what-to-watch-for/>
- [https://energia.gob.cl/sites/default/files/documentos/pelp2023-2027\\_informe\\_preliminar\\_ingles.pdf](https://energia.gob.cl/sites/default/files/documentos/pelp2023-2027_informe_preliminar_ingles.pdf)



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