



Accelerating the Energy Transition in Chile

(Acelerando la Transición Energética en Chile)

WORKSHOP
MOVILIDAD ELÉCTRICA EN EL PROCESO DE TRANSICIÓN ENERGÉTICA

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May 3, 2021



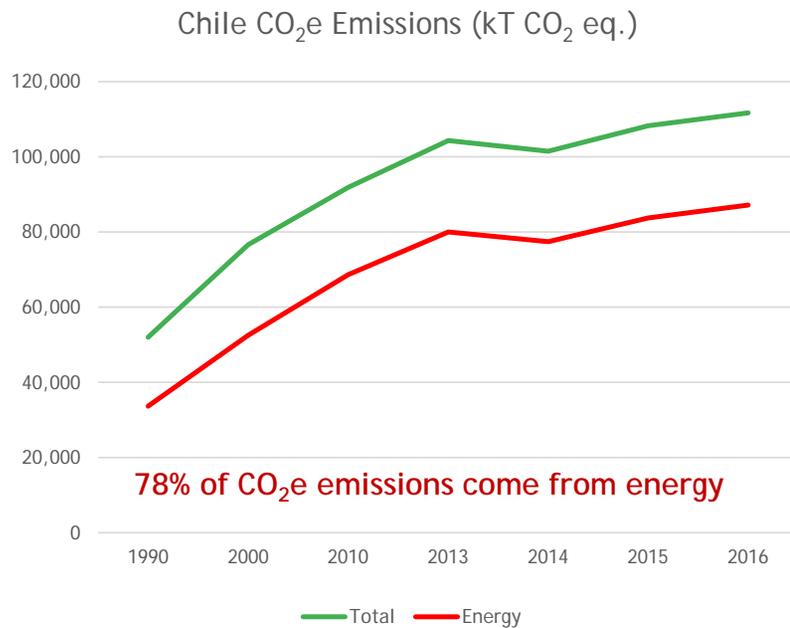
PONTIFICIA
UNIVERSIDAD
CATÓLICA
DE CHILE

Chile

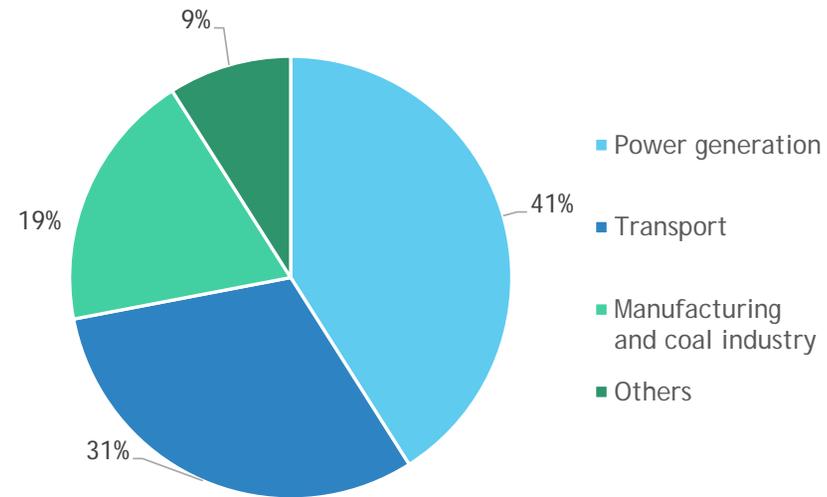


Chile Emissions CO₂eq.

Since 1990 CO₂e emissions have more than doubled



Energy Emissions 2016



Transport accounts for 31% of CO₂ eq emissions

Mining industry accounts for 17.6% of CO₂ eq emissions

- ▶ 8% in the mining industry
- ▶ ~ 9.6% from electricity generation consumption



Source: Tercer Informe Bienal de Actualización de Chile sobre Cambio Climático 2018, MMA

Chile

2020 NDC

▶ Mitigation Component

- ▶ Commits to a GHG emission budget not exceeding 1,100 MtCO₂eq between 2020 and 2030, with a GHG emissions maximum (peak) by 2025, and a GHG emissions level of 95 MtCO₂eq by 2030.
- ▶ Reduce total black carbon emissions by at least 25% by 2030, with respect to 2016 levels.

▶ Adaptation Component

- ▶ Sustainable management and **recovery of 200,000 hectares of native forests**, representing GHG captures of around 0.9 to 1.2 MtCO₂eq annually by 2030.
- ▶ **Afforest 200,000 hectares**, of which at least 100,000 hectares will comprise permanent forest cover, with at least 70,000 hectares of native species. Recovery and afforestation will be undertaken primarily in land suitable for forest growth and/or priority areas for conservation and will represent captures of between 3.0 and 3.4 MtCO₂eq annually by 2030.

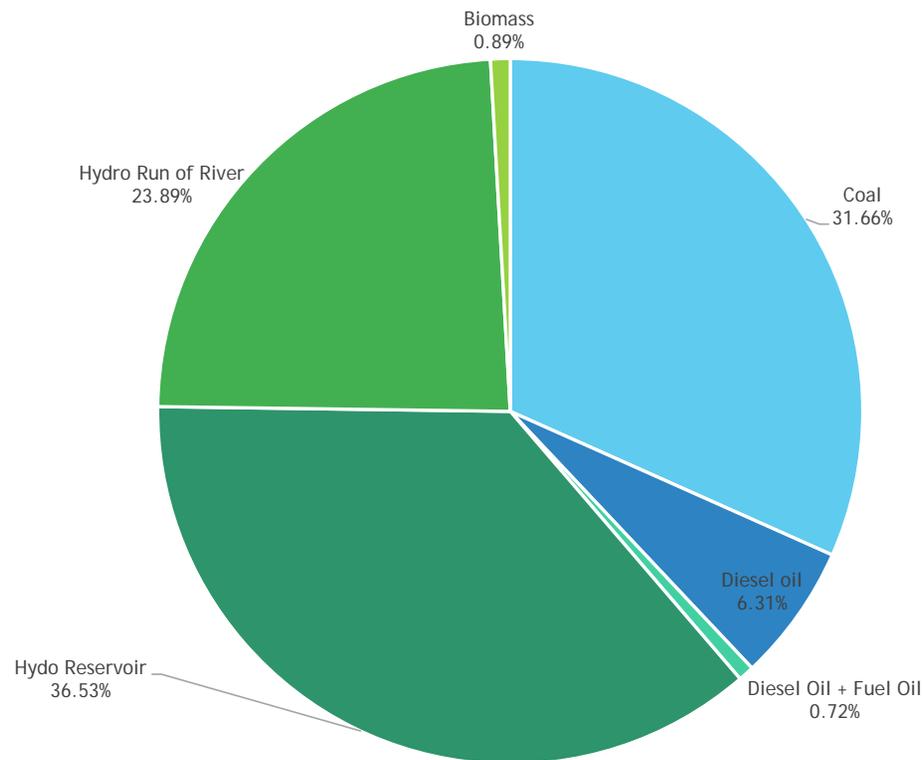


Chile

- ▶ Chile's new NDC is complemented by other positive climate actions.
 - ▶ A [proposed Climate Change Law](#) (in the Congress) will institutionalize the country's commitment to achieve carbon neutrality by 2050.
 - ▶ Commitment to [close all coal plants by 2040](#). In some cases, it is even moving forward with plant shutdowns ahead of schedule.
 - ▶ [EE law](#)
 - ▶ [Electromobility National Strategy, electrify all public transport by 2040](#)
 - ▶ [Green H₂ National Strategy \(\)](#)
 - ▶ At COP 25 in Madrid, [10 countries in LAC agree to reaching an average of 70% of installed capacity in the renewable energy matrix by 2030](#). The agreement led by Colombia includes Chile, Costa Rica, the Dominican Republic, Ecuador, Guatemala, Haiti, Honduras, Paraguay and Peru, and is open to the participation of other countries in the region.
 - ▶ [70% of renewable energies in the matrix by 2030, including under this parameter the largest hydroelectric plants.](#)
 - ▶ [Science and innovation as drivers of change](#) and policy guidance
 - ▶ Solar Platform of the Atacama Desert and Solar Energy Research Center
 - ▶ Circular Economy Center
 - ▶ Electromobility Center
 - ▶ Clean Technologies Institute

Chile Power Sector 1996

SIC + SING Generation by Fuel 1996, 27,334 GWh
(Source: CNE)



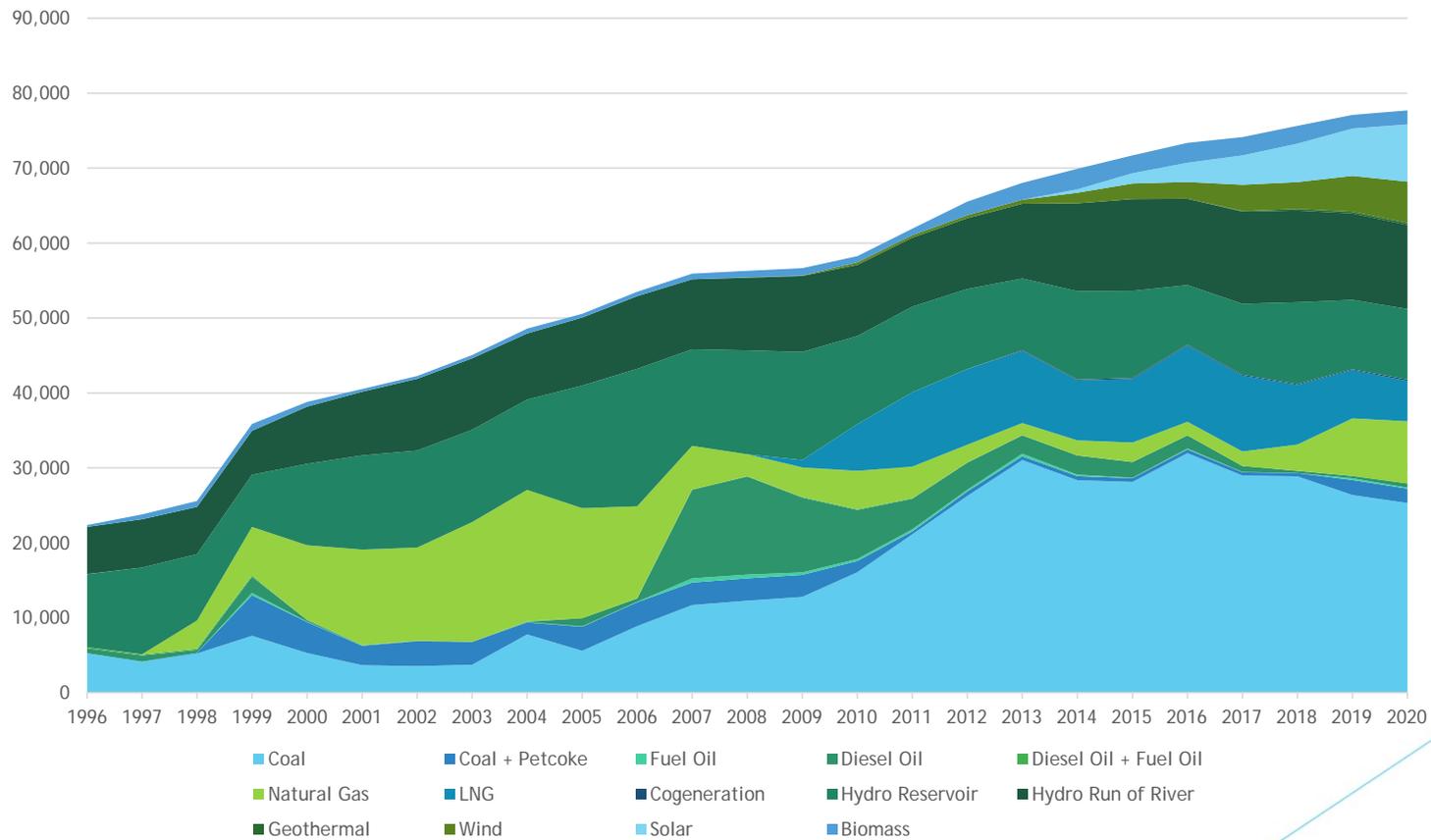
39% FF
1% NCRE
60% Hydro

SEN
(98.5%
population)



Chile Generation

Generation SIC + SING & SEN by Fuel, 1996-2020 GWh
(Source: CNE, GWh)

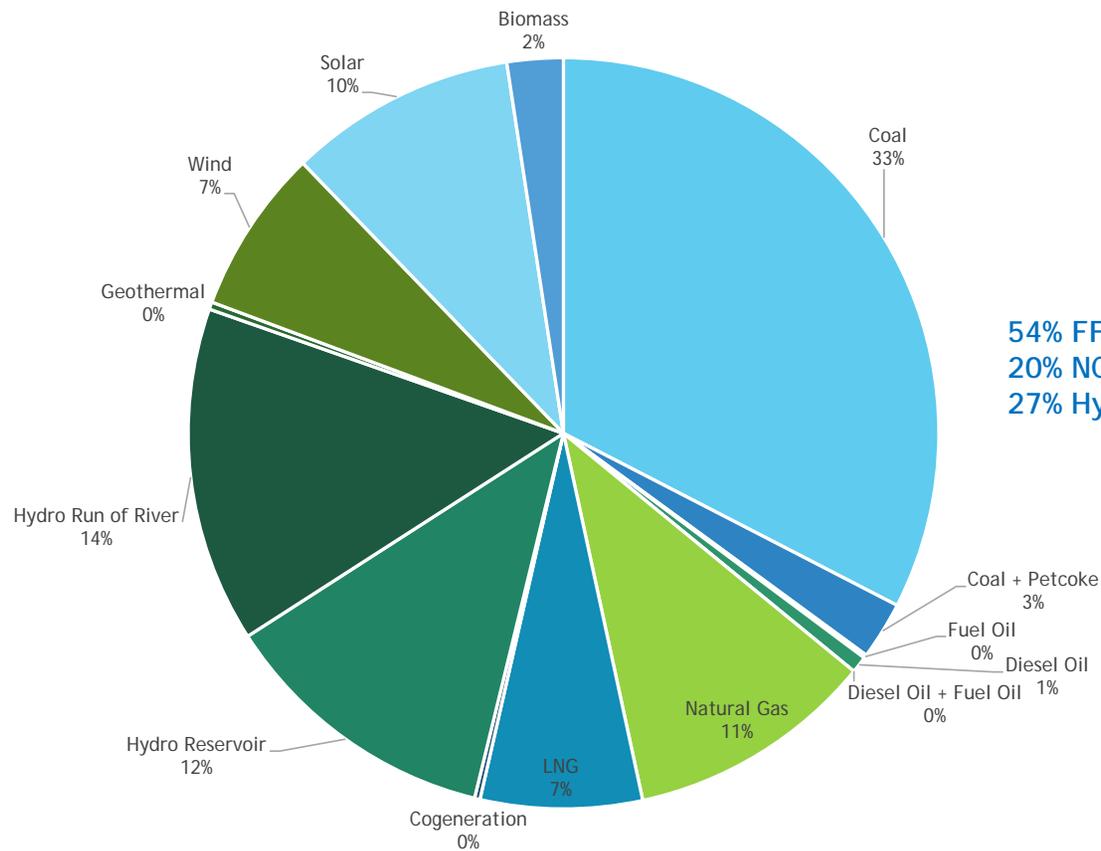


Generation
SIC+SING &
SEN 1996-
2020



Chile Power Sector 2020

Generation SEN by Fuel 2020, 77.696 GWh
(Source: CNE)



54% FF
20% NCRE
27% Hydro

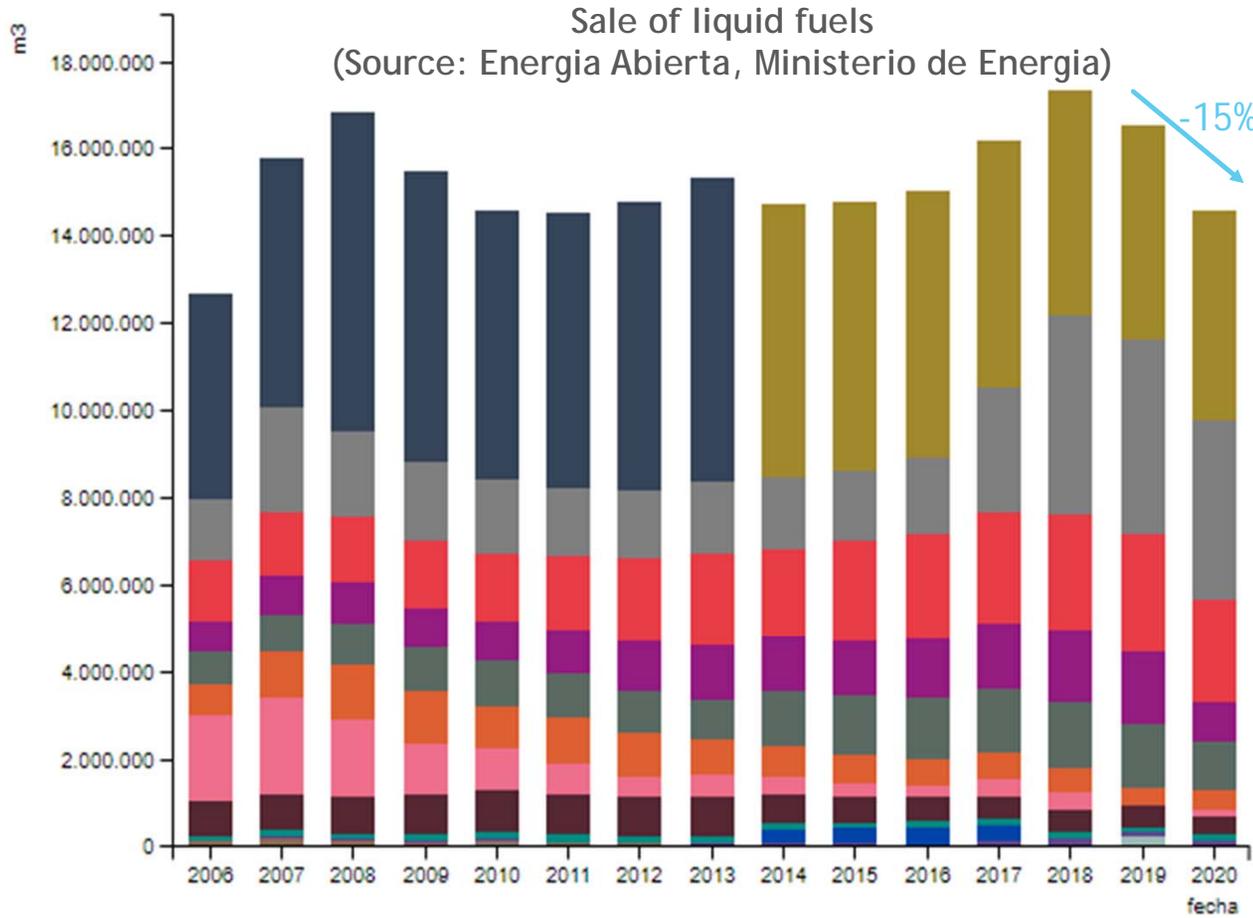
SEN
(98.5%
population)

Generation
SEN 2020,
77,641
GWh, en %

- 2021
- Length 2060 miles
 - 26.8 GW capacity
 - 77,696 GWh (2020)
 - > 22,320 miles of lines
 - > 667 power units
 - 24.8% NCRE (GWh)



Chile FF



- Petróleo Diesel B1
- Petróleo Diesel A1
- Petróleo Combustible 180
- Kerosene de Aviación
- Gasolina de Aviación
- Gasolina 97
- Gasolina 95
- Gasolina 93
- Kerosene Doméstico
- Petróleo Combustible 6
- Petróleo Combustible 5
- Petróleo Diesel Invernal
- Petróleo Diesel Marino
- Petróleo Diesel B2
- Petróleo Diesel B
- Petróleo Diesel
- Gasolina 81



Sale of Liquid Fuels
2006-2020

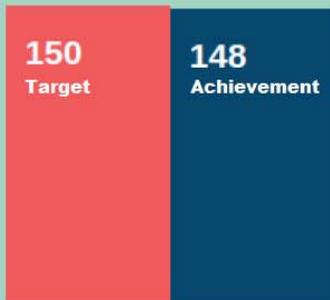
Chile Electromobility Strategy Targets

GOALS AND ACHIEVEMENTS IN ELECTROMOBILITY IN CHILE



Achievements as of July 2020

EV charge stations



EV Car Fleet



Achievement



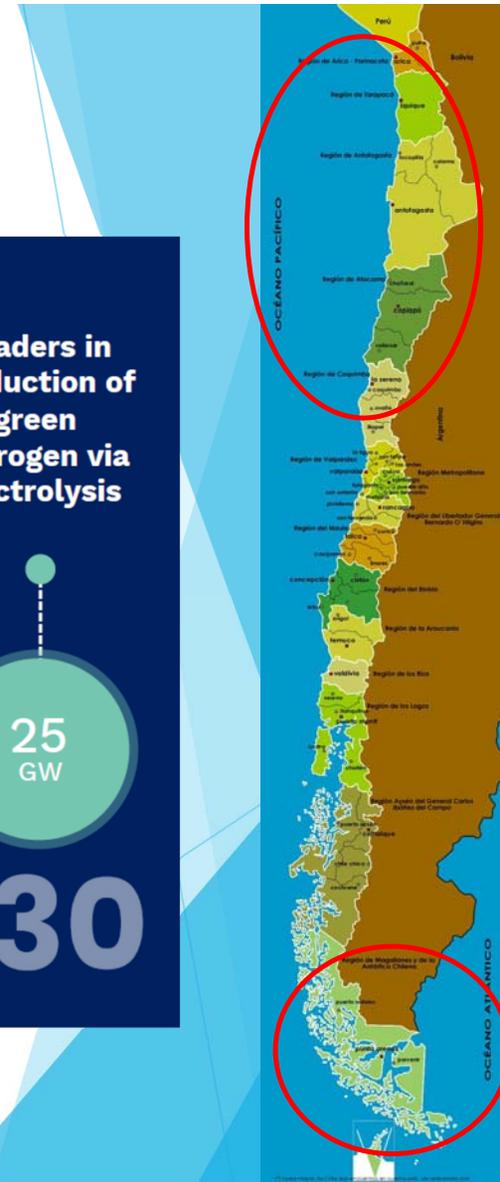
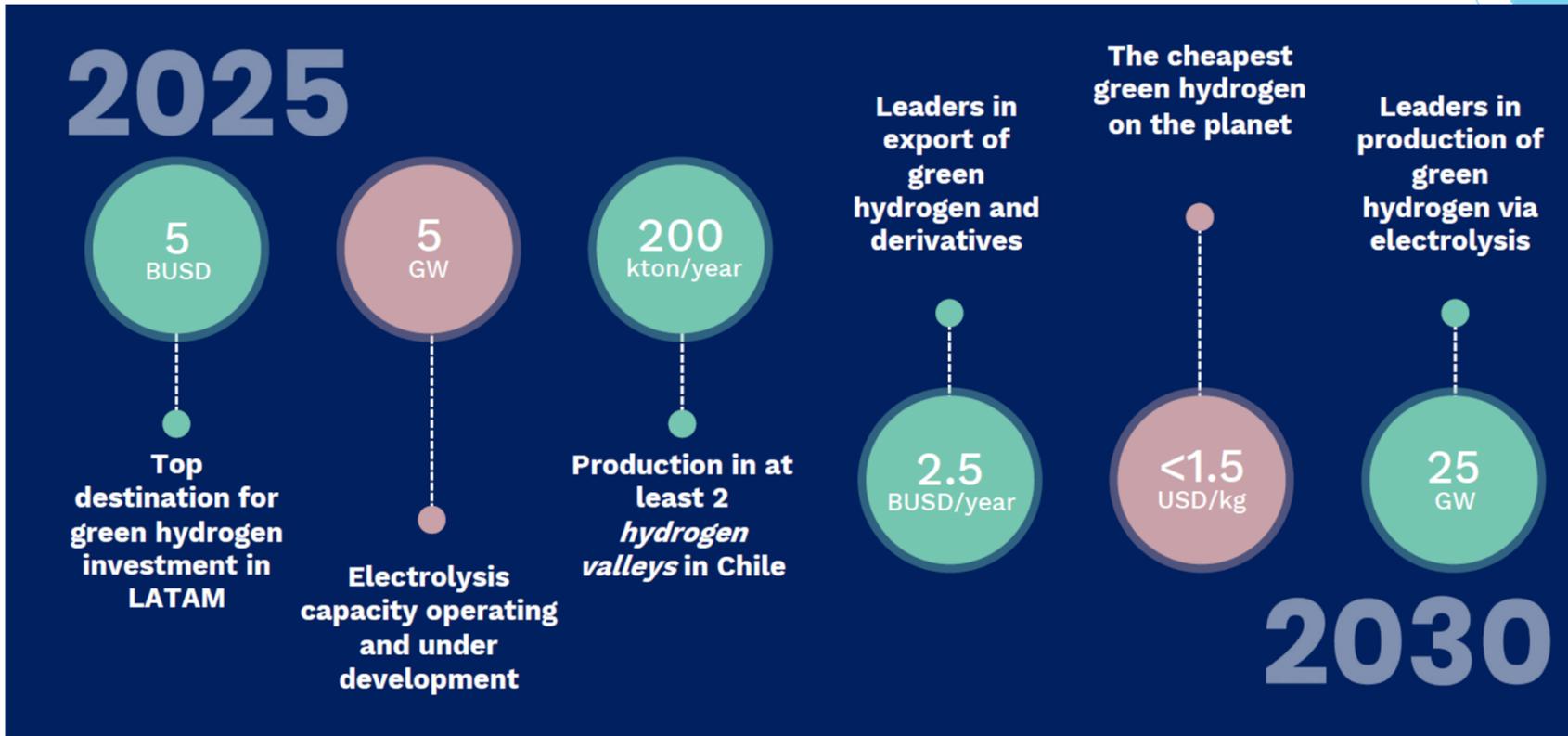
Source: Plataforma de Electromovilidad, ME Chile

100% Public Transport Electric in 2040



Chile National Green H₂ Strategy

► The Ambition

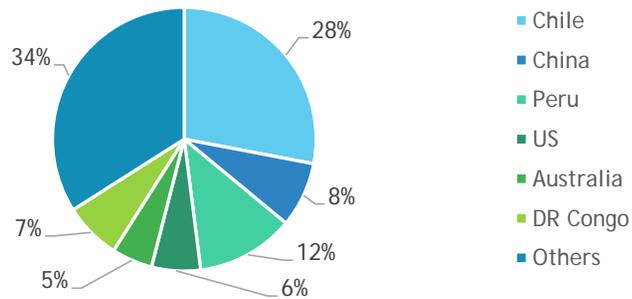


Leveraging Innovation for the Transition

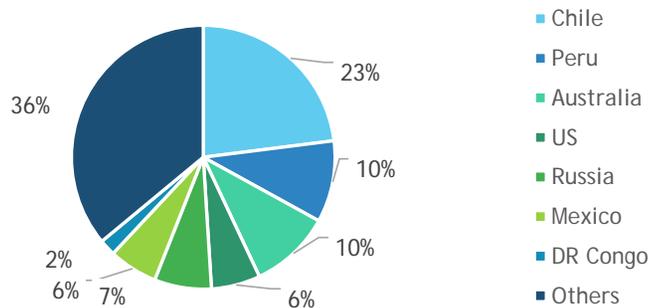


Chile Copper

Share in world production 2019
World Production 20,000 thousands of fine metric tons



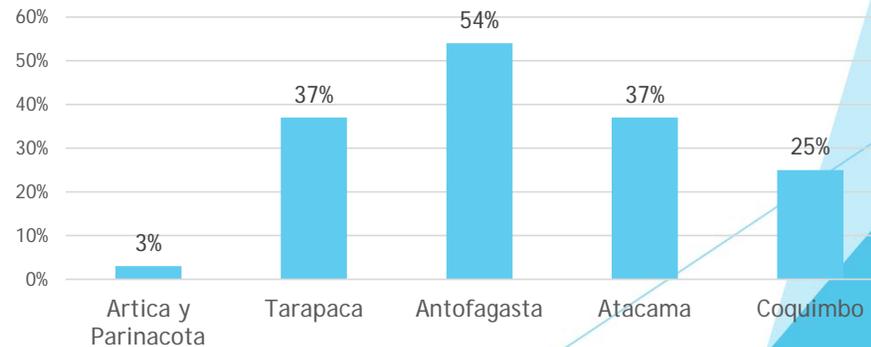
Share in world reserves 2019
World reserves 870,000 thousands of fine metric tons



- ▶ The mining sector accounts for 10% of GDP
- ▶ 51% of the country's exports
- ▶ 91% of mining exports are copper
- ▶ Mining industry contributes with 7% of government revenues
- ▶ Invested more than US\$ 90 billion in the 2010 decade, ~22% of total investment

World Cu demand to increase ~30% in this decade

Mining as % of regional GDP (Macro Zona Norte)

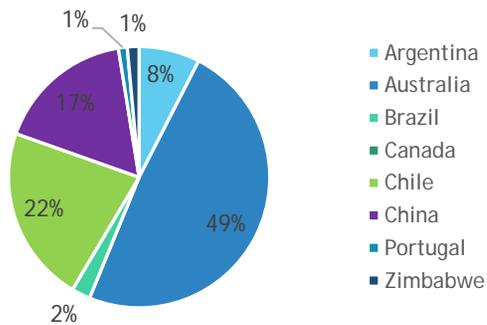


Source: Consejo Minero and Cochilco

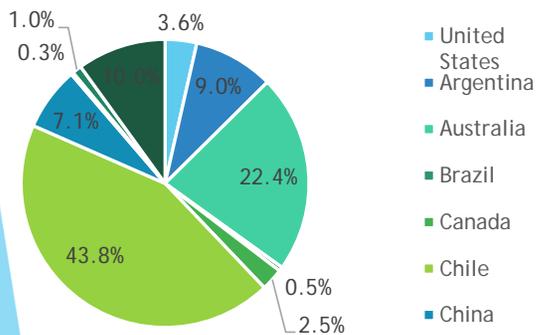


Chile Lithium

Lithium: Share in world production 2020



Lithium: Share in world reserves 2020



Source: USGS



- Key component for electromobility and energy transformation
- Li projected demand to double by 2025

Northern Macrozone



Challenges

- ▶ Decreasing ore law
- ▶ Increasing mining costs
- ▶ CO₂ emissions
- ▶ Tailings and waste
- ▶ Water use and evaporation ponds
- ▶ Aspiration to enhance value added of raw materials
- ▶ Aspiration to harness vast renewable/solar resources
- ▶ Cope with growing minerals demand in a sustainable way
- ▶ Job creations, education and innovation



Chile: A Natural Lab

- ▶ Macro Zona Norte a **hub of world class mining companies**, with great appetite for cleaning up their energy mix.
- ▶ **World class renewable energy companies**, where more than 20% of generation comes from renewables (\neq large hydro), up from ~3% in 2010.
- ▶ **Largest solar radiation**
- ▶ **Robust roads and ports** infrastructure
- ▶ **Leading business environment** in the south and an appetite to increase the value added of natural resources, creating new industries and harness the great potential of solar radiation.



The Opportunity

- ▶ **Extractive industries** are the **starting point in the supply chain** for much of the **global economy and energy transformation**.
- ▶ Globally, **mining is responsible for 4% - 7% of global GHGE**, emissions directly from own or controlled sources + emissions from the generation from purchased energy (S&P).
- ▶ **Between 1/3 and 1/2 of the cumulative emissions reductions needed to achieve net-zero emissions stem from technologies that are not commercially available today (IEA).**



International Bid for a Clean Technology Institute

- Solar Energy - Solar Fuels (Green H₂)
- Sustainable Mining
- Advance Materials - Lithium

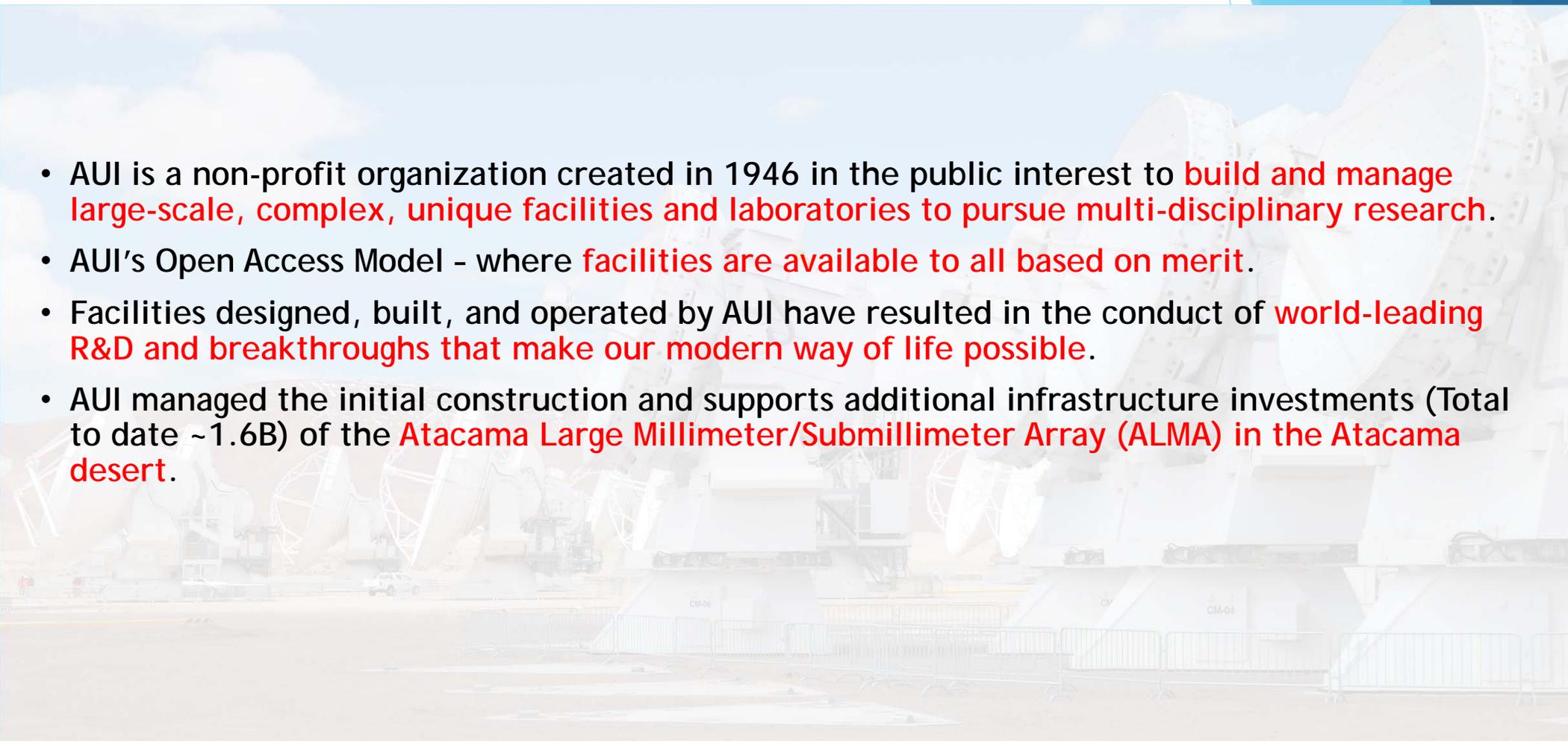


November 2018	May 2019	June 2019	October 2019	March 2020	January 2021
Corfo Launch RFI Stage	RFI Submissions	RFI Results	Corfo Launch RFP Stage	RFP Submission	RFP Results that award to consortium leaded by AUI



AUI - Associated Universities, Inc.

- AUI is a non-profit organization created in 1946 in the public interest to **build and manage large-scale, complex, unique facilities and laboratories to pursue multi-disciplinary research.**
- AUI's Open Access Model - where **facilities are available to all based on merit.**
- Facilities designed, built, and operated by AUI have resulted in the conduct of **world-leading R&D and breakthroughs that make our modern way of life possible.**
- AUI managed the initial construction and supports additional infrastructure investments (Total to date ~1.6B) of the **Atacama Large Millimeter/Submillimeter Array (ALMA) in the Atacama desert.**



ICTL Overview



The Research & Development Program -

Develop an interdisciplinary and interconnected R&D ecosystem that promotes energy research and advanced mining, and that moves technology from raw materials production across the value chain to pilot clean energy technology

Solar Energy

- Solar electricity (photovoltaics)
- Solar fuels (green hydrogen)
- Solar heat (concentrated solar power)

Sustainable Mining

- Advancing environmental sustainability in the extraction of mineral resources underpinning expanded mining operations
- Reduced emissions, water use, and waste

Advanced Materials of Lithium and Other Minerals

- Sustainably produced lithium raw materials and developing downstream industry to produce battery cathodes and other value-added intermediate products

Institute Functions Span the Technology Areas

Research & Technology Development

- Community based strategic planning and Open Access calls

Infrastructure & Technological Services

- Provide lasting technological capability in the Macrozona Norte

Entrepreneurs & Innovation

- Incubate new ventures and networks for entrepreneurs

Technology Transfer and IP

- Provide agile IP protection processes that help drive technologies to market

Human Capital

- Programs for academic, vocational and professional workers that also enhance diversity

Public Policy

- Develop focus groups for each Technology Area as a resource for information

Partnerships Underpin Institute's Success

Research & Development Program

The R&D program aims to accelerate the development and deployment of commercial technology through innovation and partnerships

The Chilean Clean Energy
Technology Institute:
Targets

	Technology Readiness Level		Manufacturing Readiness Level
TRL 1	Basic principles observed and reported	MRL 1	Basic manufacturing implications identified
TRL 2	Technology concept and/or application formulation	MRL 2	Manufacturing concepts identified
TRL 3	Analytical and experimental critical function and/or characteristic	MRL 3	Manufacturing proof of concept developed
TRL 4	Component and/or breadboard validation in a laboratory environment	MRL 4	Capability to produce the technology in a laboratory environment
TRL 5	Component of breadboard validation in a relevant environment	MRL 5	Capability to produce prototype components in a production relevant environment
TRL 6	System/subsystem model or prototype demonstration in a relevant environment	MRL 6	Capability to produce a prototype system or subsystem in a production relevant environment
TRL 7	System prototype demonstration in an operational environment	MRL 7	Capability to produce systems, subsystems or components in a production representative environment
TRL 8	Actual system completed and qualified through test and demonstration	MRL 8	Pilot line capability demonstrated, Ready to begin low rate production
TRL 9	Actual system proven through successful mission operations	MRL 9	Low rate production demonstrated, Capability in place to begin Full Rate Production



Final Comments

- ▶ Chile is committed with SDG, COP 21 Paris Agreement - NDC, and has adopted strategies that taking advantage of the country resources, his business environment, has accelerated its energy transition.
- ▶ The country`s next step is to use Science and Innovation to harness the advantage of Chile as a Natural lab for the advancements of Clean Technologies
 - ▶ [Make renewables sustainable](#)



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