



Chile

Investments in the Energy Sector

Embajada de Canadá y Cámara
Chileno Canadiense de Comercio
Septiembre 2020



Summary



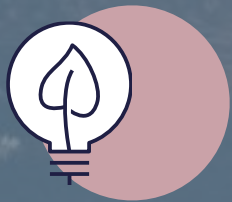
Why Chile?

- Chile is a country open to foreign investment, that has had sustained economic growth, with unprecedented reduction in poverty and inequality.
- Chile has one of the highest potentials to produce low cost renewable energy in the world , with broad political agreement on regulatory and environmental matters.
- International markets and regulations will increasingly demand sustainable products.



Opportunities

- Chile has a carbon neutrality goal with multiple opportunities to take advantage of renewable energy in a variety of industries (transportation, industry, heating).
- Chile is going to be able to provide the world with green products: mining, food and wood pulp.



Green Hydrogen Strategy

- Market is estimated to be USD 2.5 trillion in 2050, half the size of the current oil market.
- Chile has the potential to supply 20% of global demand for green hydrogen.
- Ministry of Energy is developing a strong strategy to boost the development of green hydrogen.

Contents

- About Chile
- Why Chile?
- Opportunities



About Chile

Basic figures

GDP 2019	US \$294 bn
Exports	US \$69.7 bn
Imports	US \$65.5 bn
Population	18 million
GDP p/capita (PPP)	US \$22,975 (#1 in LATAM)
CB Interest rate	1.75%
Inflation 2019	3.0% (2000-2018: 3.2% average)
Foreign Direct Investment	US \$18 bn (annual average past ten years)
VAT	19%

Robust Foreign Direct Investment Regime

Non-Discrimination: Foreign companies based in Chile enjoy the same rights and responsibilities as Chilean companies in the country (national treatment).

Free flow of capital and profits: National legislation allows the entry and repatriation of capital without cost or constraints beyond procedural formalities.

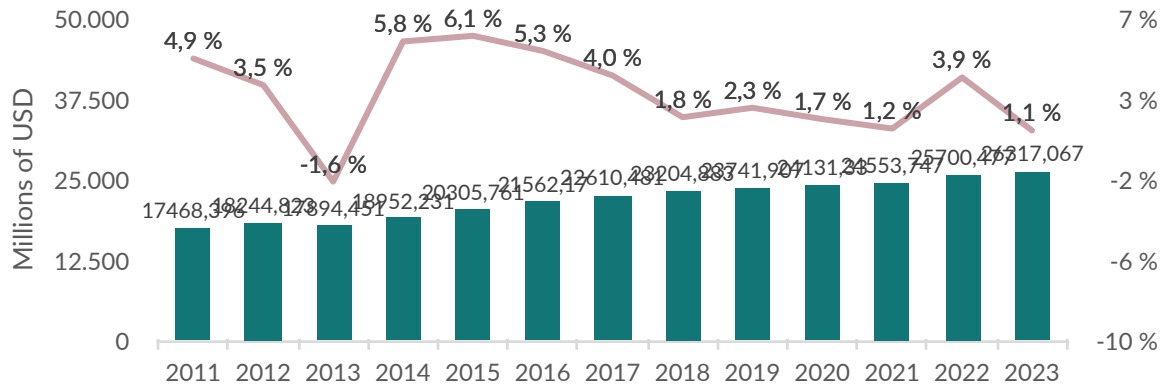
Pro-business environment: Simple tax structure / Ease to set up companies.

Committed to boost investment: Pro-Investment agenda of the Government.

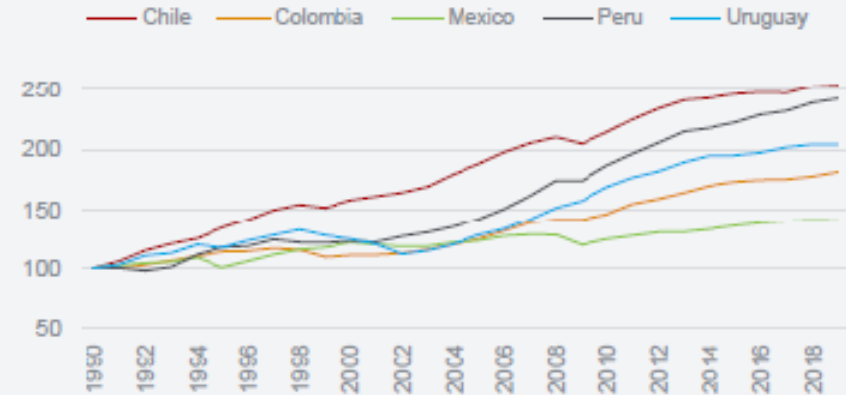


In past decades Chile has experienced significant economic growth and reduction in income inequality and poverty

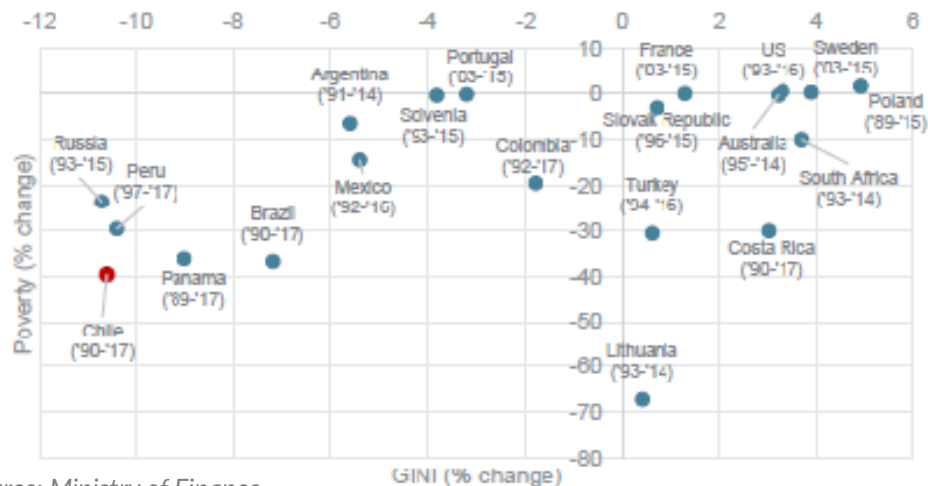
GDP per capita consistent growth



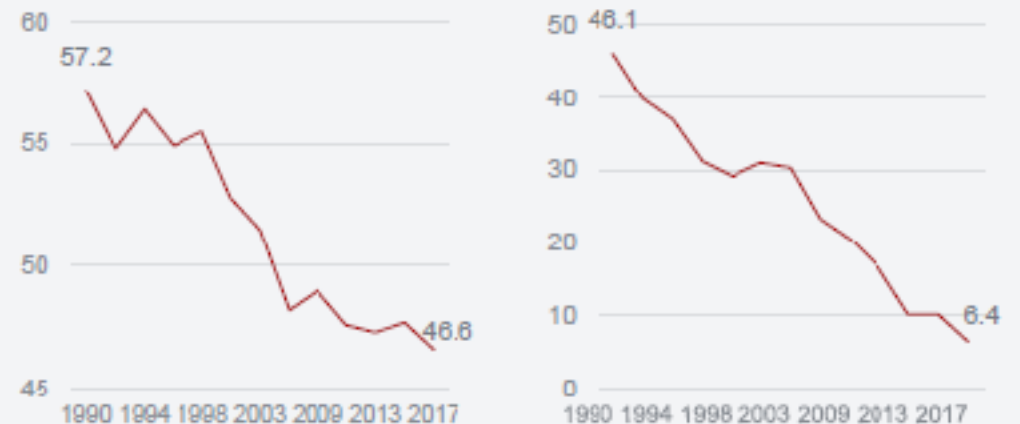
GDP per capita (PPP) in select American Economies (1990=100)



Changes in Gini Index & poverty rate across economies



Chile's Gini Index & poverty rate



Source: Ministry of Finance

Chile is open to foreign investments

Free trade agreements with 86% of world's GDP

- First South American country to join the OECD (2010).
- Chile is among the main exporters of copper, lithium, steel grinding balls, wood pulp, salmon, cherries, blueberries and grapes in the world.

Main national exports (billion USD)

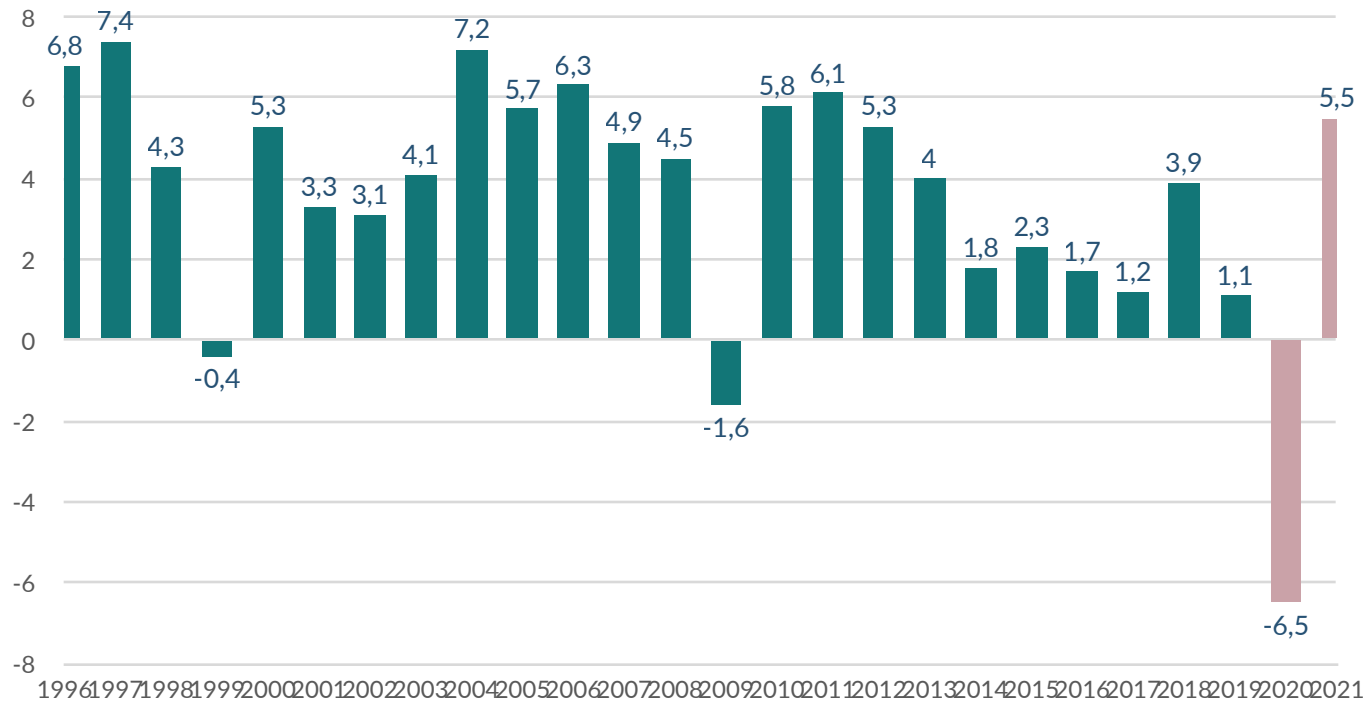


Chile has the fiscal capacity to support the economic shock

due to the pandemic and social unrest of October 2019

Chile's Real GDP: Actual & Forecast

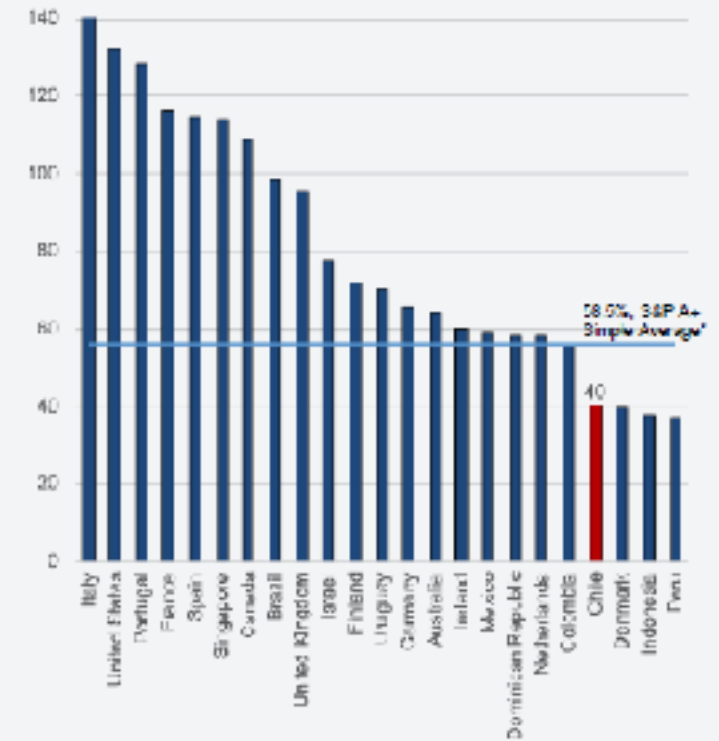
Percent year-on-year



Source: Ministry of Finance. Public Finance Report 2020, Q2.

Gross Public Debt Forecast for Selected Economies

Percent of GDP, 2021



*Includes Chile, China and Slovak Republic.

Source: All forecasts are from the IMF's Fiscal Monitor April 2020, except from Chile which was taken from IFP 2Q, 2020; Dipres.

Efforts are now focused on strengthening the economic recovery



1. Investment push

Tax reform:

- Instant depreciation of 100% fixed assets until Dec 2022*.

Facilitating private investment projects:

- 138 private projects totaling USD 24.5 billion over 2020-2022 have been identified and will be streamlined.
- Bidding and construction of 31 public works projects under concessions for ~USD 8.6 billion, including hospitals, airports, highways, among others.
- Tendering of 114 fiscal properties.

Public investment: 2,544 public investment projects totaling ~USD 34 billion in 2020-2022 (12% of 2019 GDP).

Ministry	2020	2021	2022	2020-2022
Public Works	2,862	4,239	3,861	10,962
Housing	2,512	3,274	2,969	8,755
Transport & Telecommunications	140	128	181	449
Local governments	1,882	2,101	1,783	5,766
Sports	40	84	136	260
Agriculture	112	187	154	453
Other Ministries	2,502	2,273	2,341	7,116
TOTAL (USD million)	10,050	12,286	11,425	33,761

Source: Ministry of Finance. *Preliminary pipeline subject to review.



2. Promoting jobs

- Wage subsidy schemes in the order of USD 2 billion.
- Job training & reversion programs.



3. Support for Small and Medium Enterprises

- Special financing instruments and subsidies.
- Technical assistance.
- Promotion of national tourism.
- Roundtables with relevant parties.



4. Facilitating & simplifying permits

- Agenda that includes 28 measures to reduce red-tape in the preparation processes of private investment projects, following the recommendations of the National Productivity Commission.
- Special focus on reducing bureaucracy for SMEs.

and providing a democratic resolution to the social unrest

Social crisis

In October 19, after a 3,7% increase in the subway fare, Chile witnessed a social uprising ranging from peaceful protest demanding a fairer and less unequal society to violent riots attacking public and private infrastructure.

Government efforts focused in:

Broad social agenda

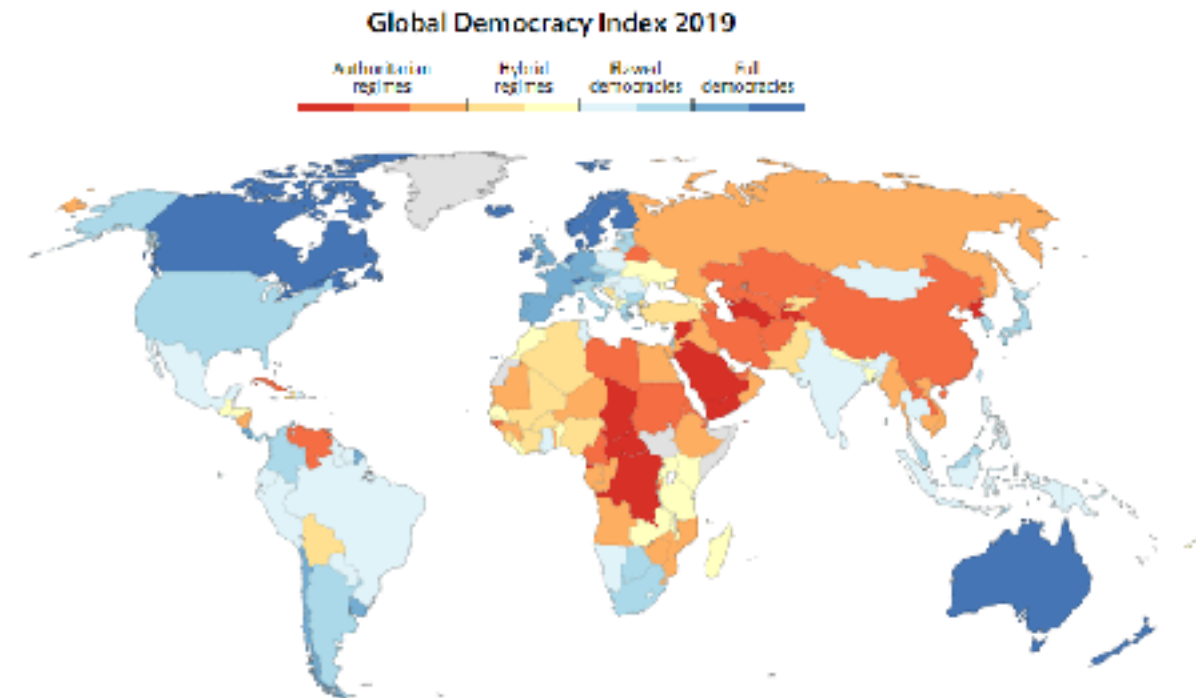
- Increase in minimum guaranteed pensions paid by the State.
- Creation of catastrophic health insurance.
- Increase in minimum guaranteed wage (complemented by the State).
- Reduction in property taxes for the elderly and disabled.
- Reduction in subway and electricity price.
- New payment plan for outstanding fines in highway tolls.

Constitutional process

- Plebiscite in October 2020 to define if a new constitution must be drafted and the structure of the commission that would write it.
- If a new constitution is written, it must then be ratified in a plebiscite.

In The Economist Democracy Index, Chile improved its score after the social unrest

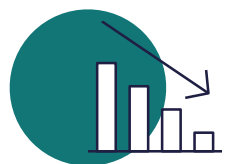
- “Owing to the willingness of the people to take to the streets, Chile improved its score in the political participation category and moved from a “flawed democracy” to a “full democracy”.



Contents

- About Chile
- **Why Chile?**
- Green hydrogen

Drivers to invest in Chile Energy Sector



Renewable
Energy
potential

70x

Chile's potential in renewable energies is more than 70 times its current installed capacity.

-80%

Reduction of solar energy costs since 2010.



Broad political
and environmental
agreement

2040

Phase out of coal-fired power plants agreement.

2050

Carbon neutrality goal.



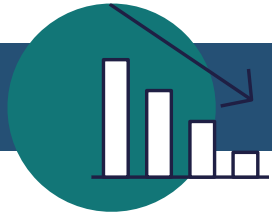
International
market
requirements

\$30 USD

Per metric ton of CO2 of import tax in European border scenarios.

100%

Renewable energy contracts are gaining traction among industries.

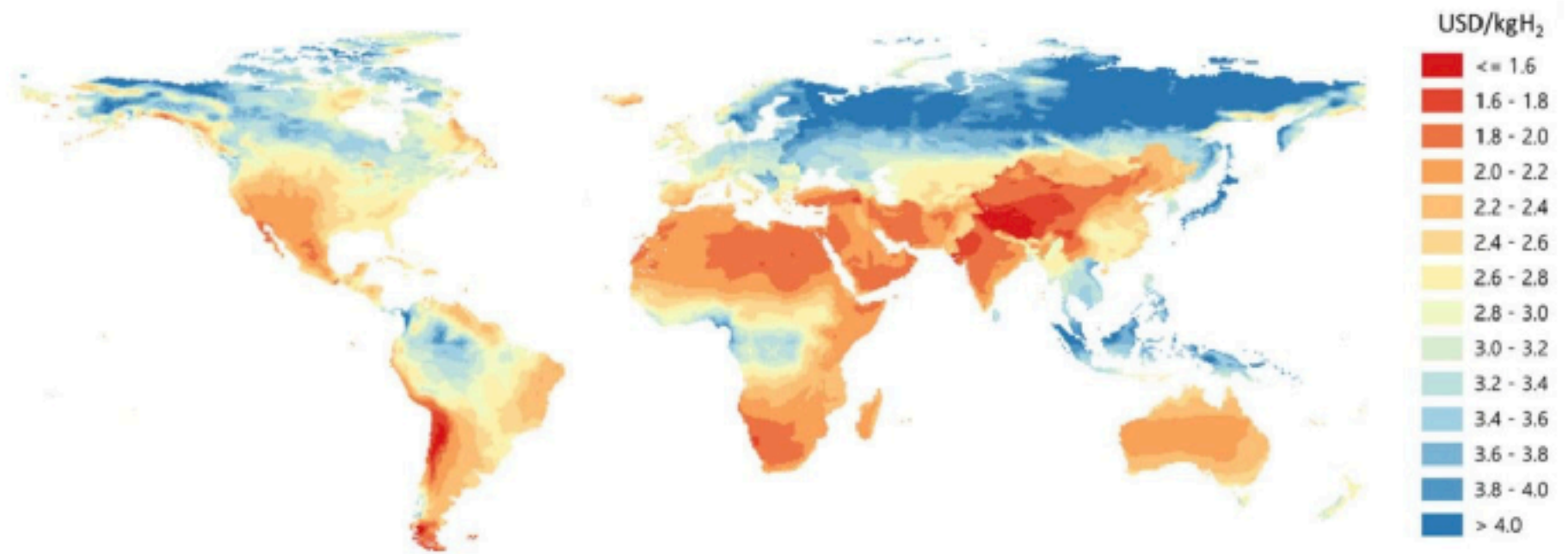


Best renewable energy potential in the world

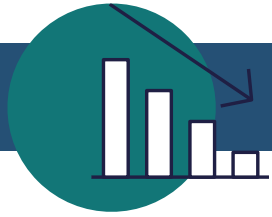
70x

Chile's renewable potential v/s installed electricity capacity

Hydrogen estimated cost based on wind and solar potential



(Source: IEA, *The Future of Hydrogen*, 2019)

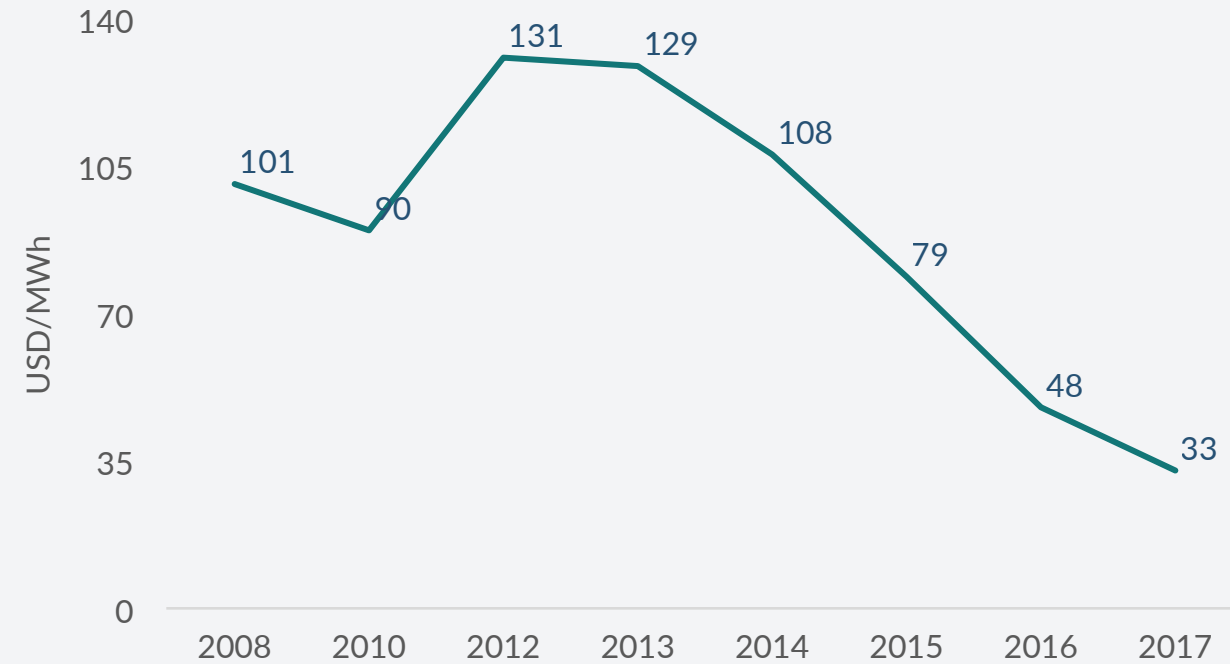


Regulated clients tenders resulted in price reduction due to renewable energy potential + cost decreases

80%

Reduction of solar energy costs since 2010

Tenders average price (USD / MWh)

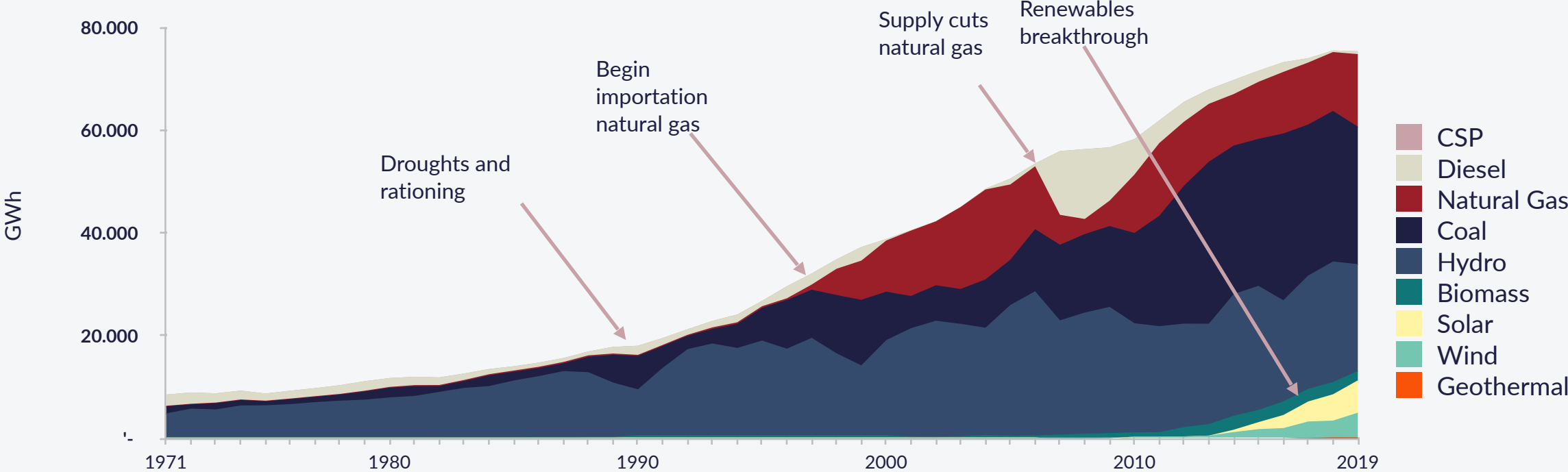


Renewable potential allows for change from a thermo & hydraulic matrix



Renewable electricity generation

→ 44%
2019

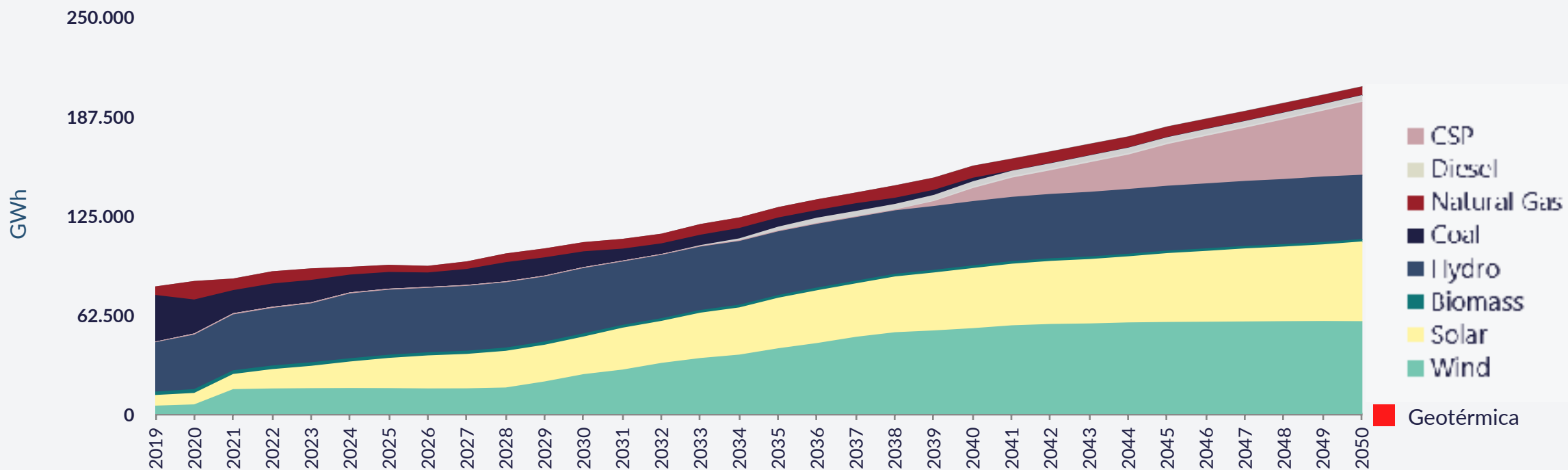


... to a renewable matrix



Renewable electricity generation

→ 44%
2019 → 70%
2030 → 95%
2050



Fuente: PELP / Análisis de Carbono Neutralidad, 2019

Drivers to invest in Chile Energy Sector



Renewable
Energy
potential

70x

Chile's potential in renewable energies is more than 70 times its current installed capacity.

-80%

Reduction of solar energy costs since 2010.



Broad political
and environmental
agreement

2040

Phase out of coal-fired power plants agreement.

2050

Carbon neutrality goal.



International
market
requirements

\$30 USD

Per metric ton of CO2 of import tax in European border scenarios.

100%

Renewable energy contracts are gaining traction among industries.



Coal-fired power plant closure agreement, an enabling measure

By 2040 Chile will close all coal power plants.

In 2019, coal represented 44% of the total gross generation of the electric system.

Three plants have been withdrawn since June 2019, and today there are 25 plants with 5200 MW.

By 2024, 1731 MW will be withdrawn, 31% of the country's coal-fired generation capacity.

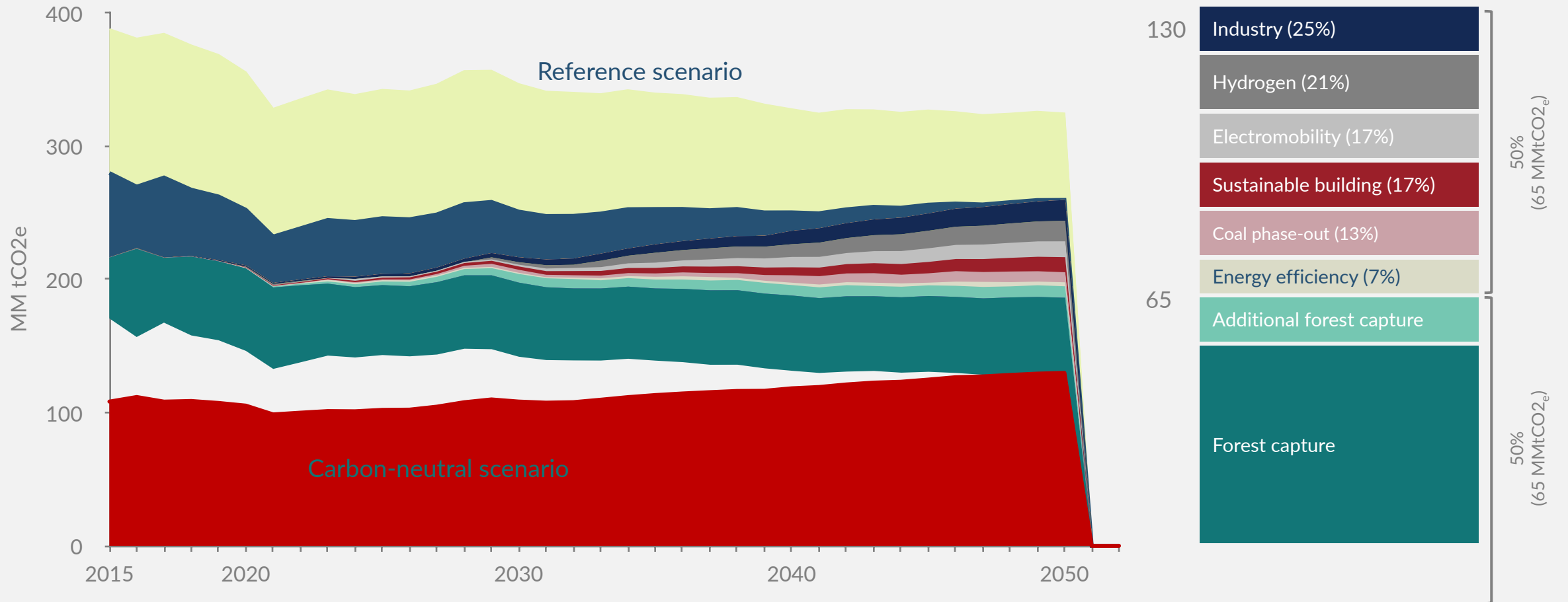


Transversal political agreement to reach Carbon neutrality 2050



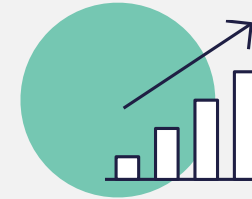
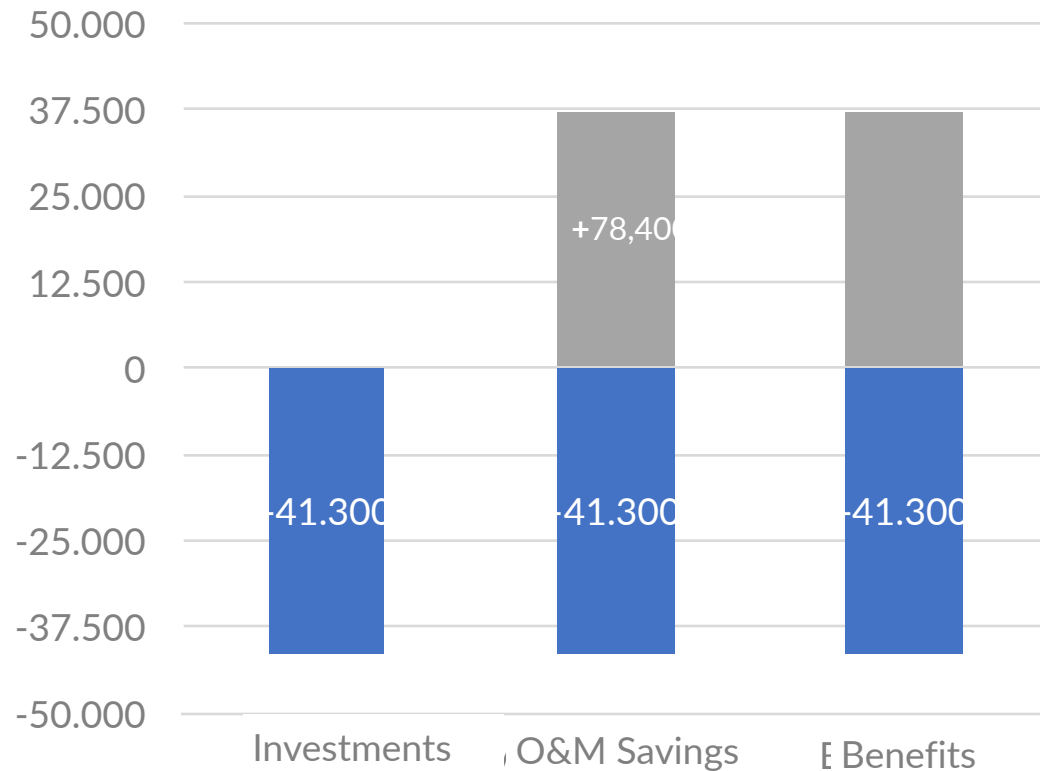
Carbon Neutrality plan

Energy sector at the heart of the mitigation



With economic benefits for the country

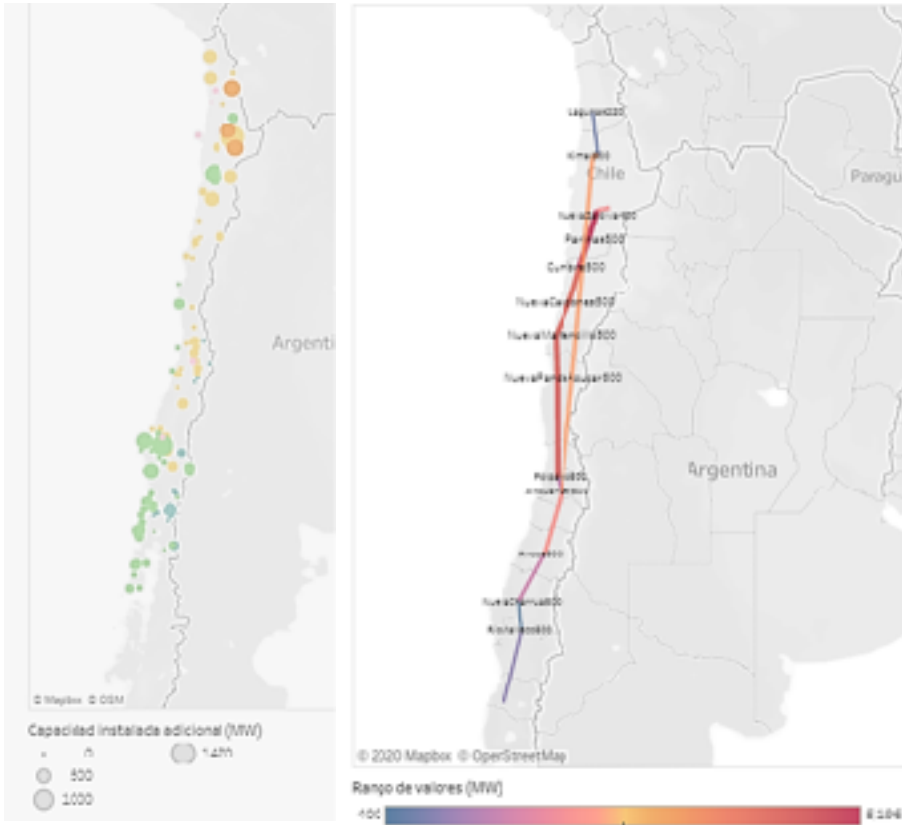
Investment and benefits of carbon neutrality (NPV)
[Million USD]



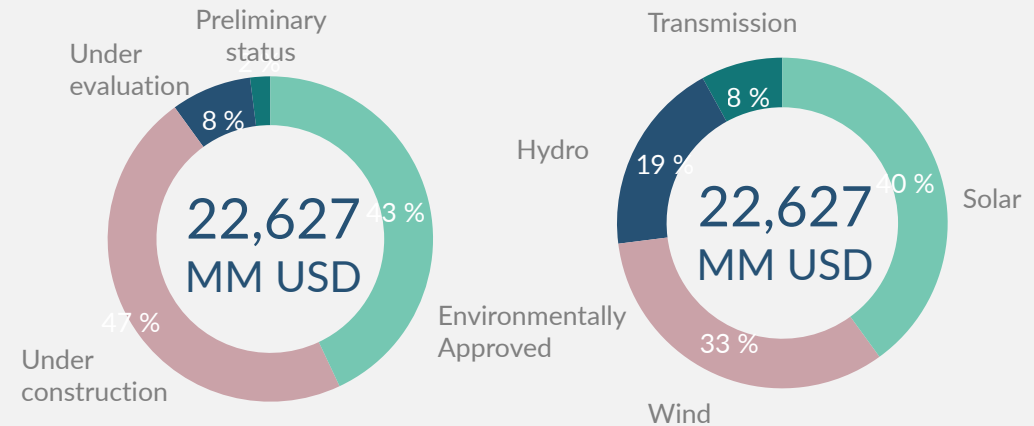
- Net values correspond to the difference between reference scenario and carbon-neutral scenario.
- Does not include offsetting or emissions trading market.
- Does not include co-benefits for local emission reductions and health improvement effects.
- A discount rate of USD + 6% was used.

Opportunities in generation, transmission and storage

New generation and transmission to 2050



More than 20 billion USD of renewable projects under development



Transmission expansion projects

	Expansion plan	Expansion projects
	2017	60
	2018	68
	2019	67

Estimated investment of over 4,500 Million USD in expansion projects

Source: Long Term Energy Planification, Ministry of Energy 2019

Low cost of electricity will fuel the penetration of electric vehicles

Electromobility growth in Chile



1509 electric vehicles

(june 2020)

Electric buses

Plug-in hybrid

Electric vehicles

Opportunities in intensive use transport

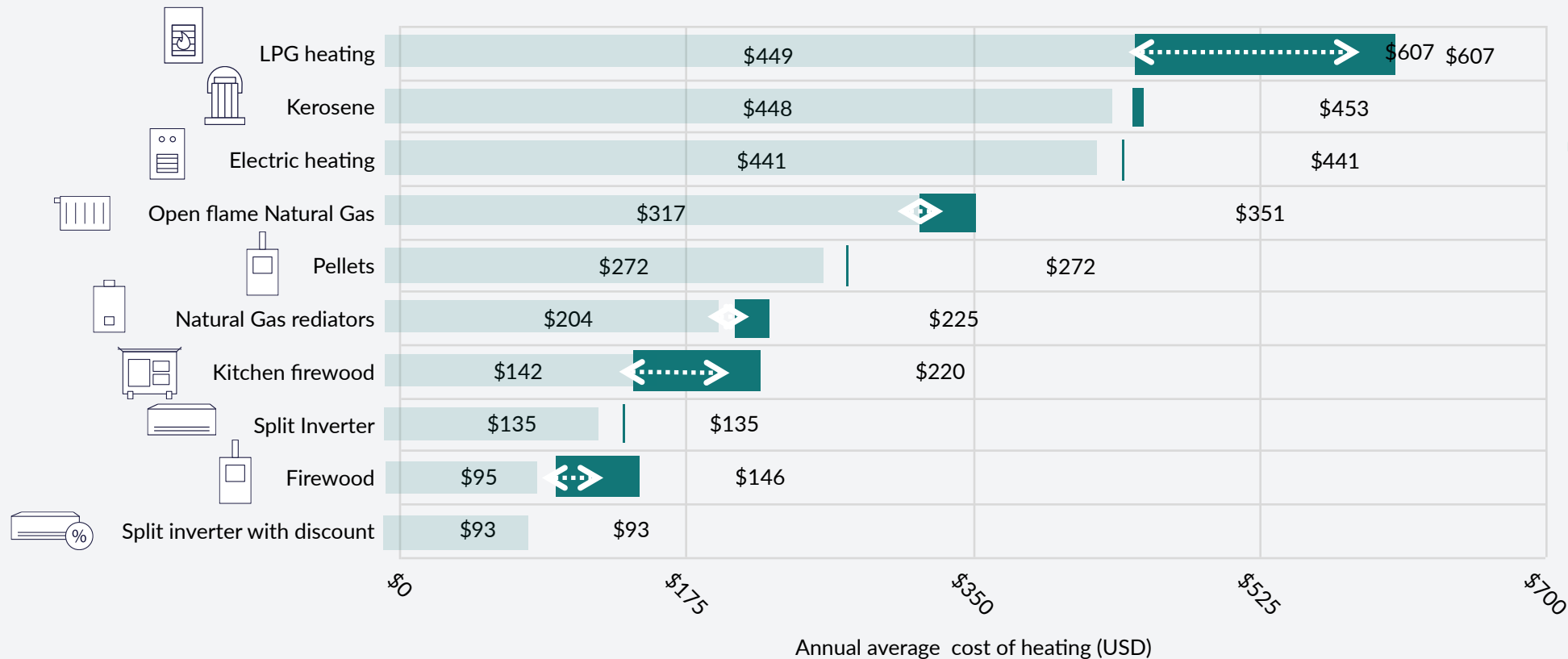
Chile has the second largest number of electric buses in the world.



Auctions for public transport network
Electric bus fletes | Loading terminals

Also residential electric heating is competitive with firewood

Rancagua urban area



House size:
81m²

Price of firewood
\$45 - \$70 m³

Discounted rate:
0,151 USD/kWh

Drivers to invest in Chile Energy Sector



Renewable
Energy
potential

70x

Chile's potential in renewable energies is more than 70 times its current installed capacity.

-80%

Reduction of solar energy costs since 2010.



Broad political
and environmental
agreement

2040

Phase out of coal-fired power plants agreement.

2050

Carbon neutrality goal.



International
market
requirements

\$30 USD

Per metric ton of CO₂ of import tax in European border scenarios.

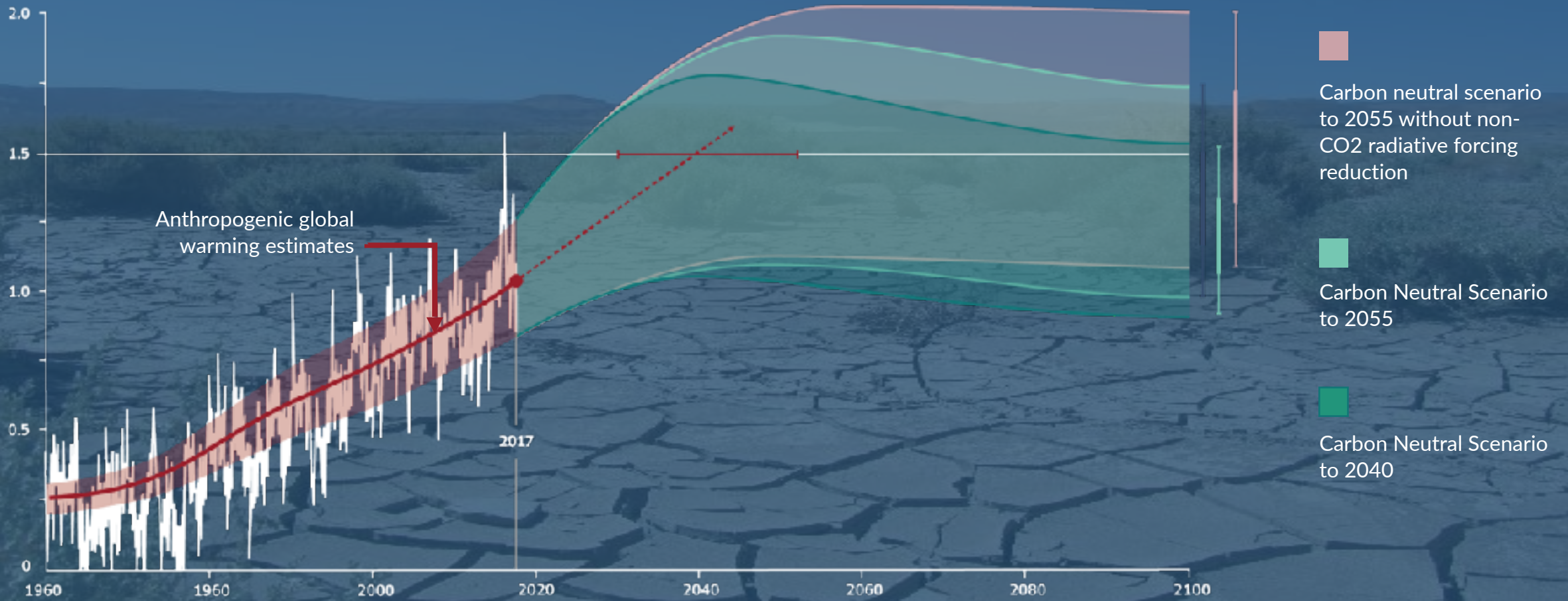
100%

Renewable energy contracts are gaining traction among industries.



International market demands greener products

Change of observed and modelled temperatures (°C)

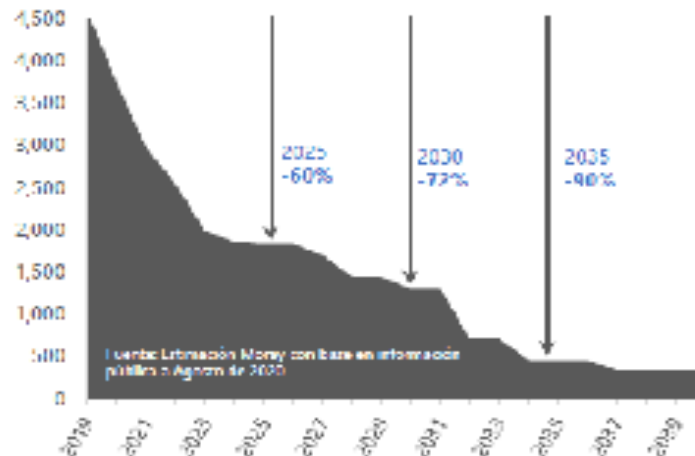




100% renewable PPA contracts are gaining traction

- Since 2017, PPA contracts are being renegotiated to shift supply from coal to renewable generation. This is a growing trend throughout the industry.
- BHP recently announced they will prepay \$840 million to terminate a coal PPA with AES early.
- The reduction of coal-fired PPA contracts is expected to be 60% by 2025 and 90% by 2035.

Coal PPA volume in MW

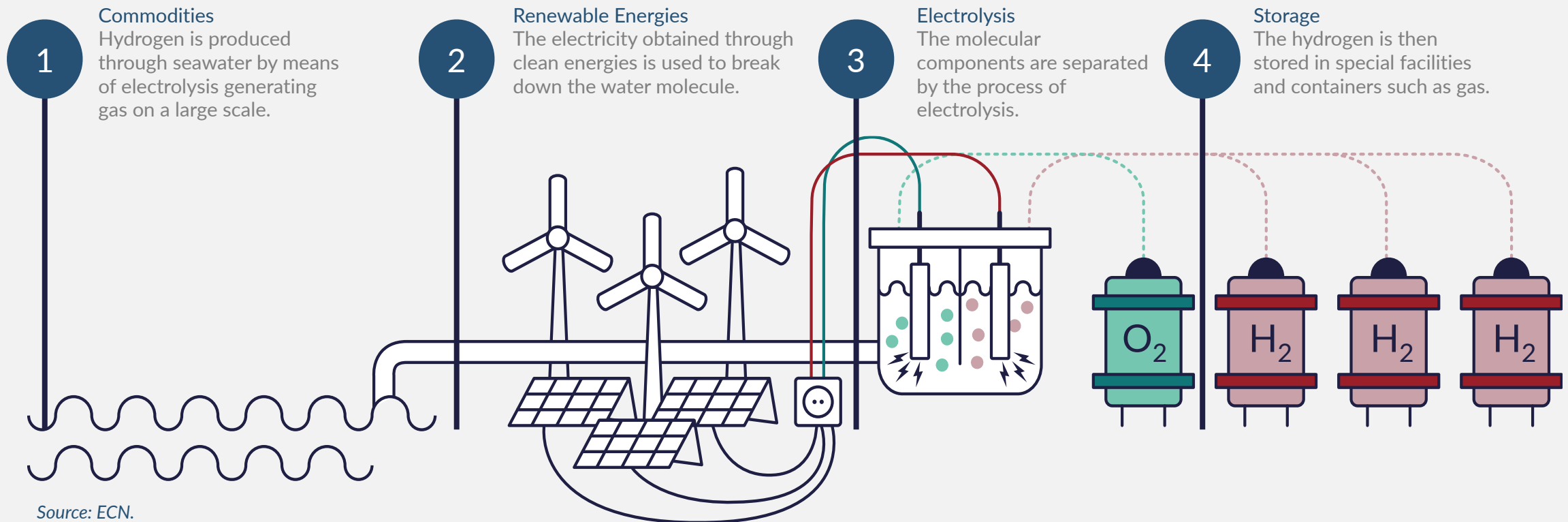


Contents

- About Chile
- Why Chile?
- Green hydrogen

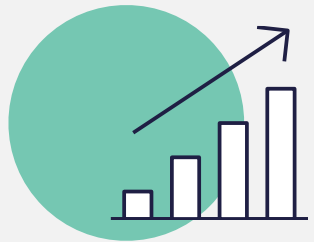
Green Hydrogen

- Hydrogen is the most abundant element in nature.
- Hydrogen can be obtained from natural gas (called gray and blue hydrogen) or from water (green hydrogen).
- The H₂ molecule has a high energy density per unit mass (3 times more than gasoline and 120 times more than lithium batteries).



Source: ECN.

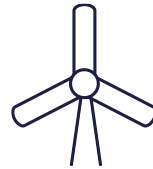
Key concepts of Green H₂



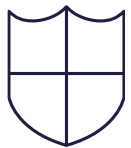
It would mean up to US\$ 500 billion in global investment by 2030
Imports are replaced by local production



Does not need much water
Less than 1% of the water used by mining could replace all its diesel consumption



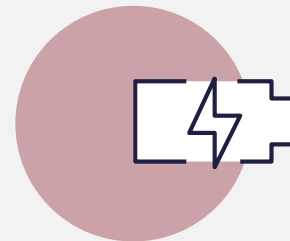
Cost depends mainly on renewable energy
Between 50 and 80% of the cost of hydrogen corresponds to electricity supply



Same or safer than other currently used fuels



Only emits water vapour when used

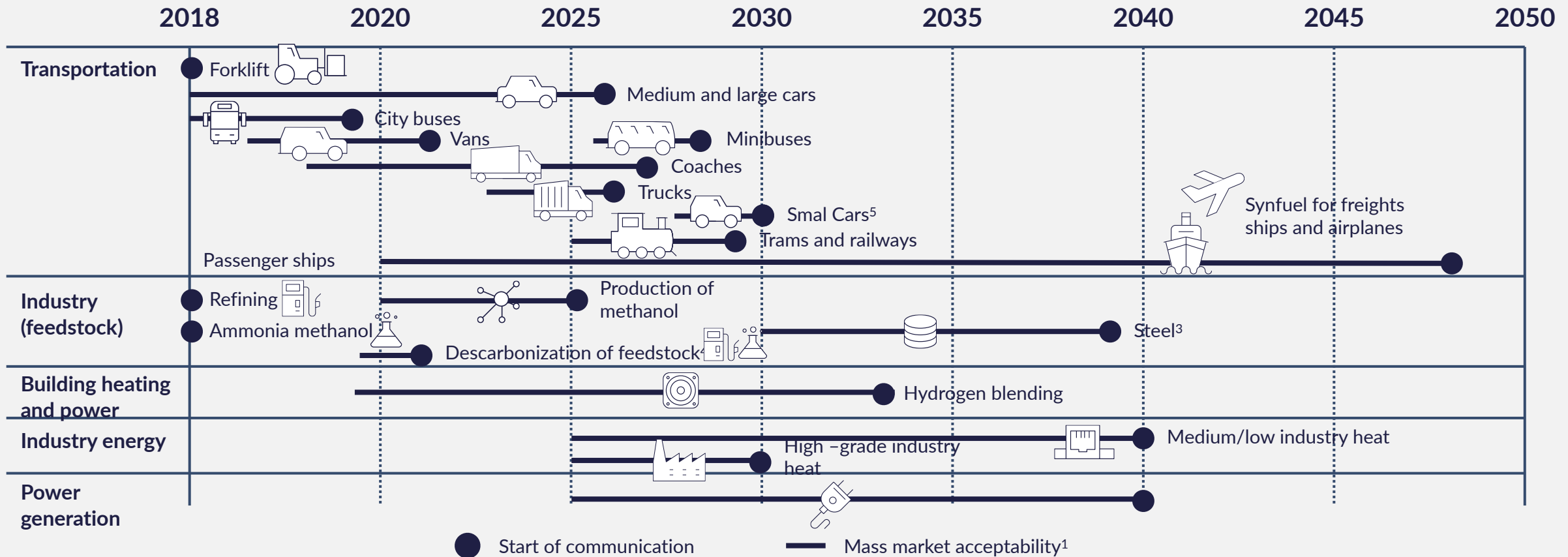


Higher energy density than lithium batteries
Complementarity for other clean solutions

Hydrogen applications are close to mass development

transport will be the next wave

(Source: McKinsey & Co)



1. Defined as sales >1% within segment

2. Market share refers to amount of production that uses hydrogen and captured carbon to replace feedstock.

3. DRI with green H2, iron reduction in blast furnaces and other low-carbon steel making process using H2.

4. Market share refers to the amount of feedstock that is produced from low-carbon sources.

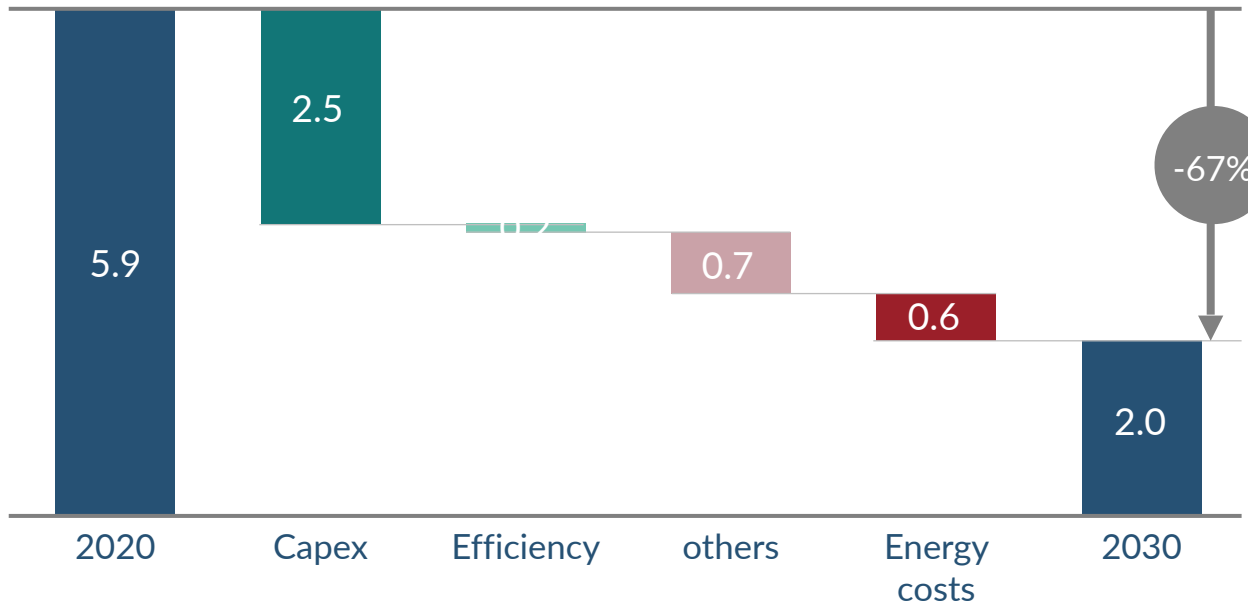
5. Commercialization data for France adjusted from global roadmap in accordance with ramp-up date.

The cost of green hydrogen will fall by 2030

due to reduction in Capex

Cost reduction for H2 with electrolysis connected directly to a solar or wind power plant in Chile

(Source: McKinsey & Co)



Capex decreases 76% for electrolyzers, due to scaling, learning curve and technical improvements.

Efficient size is increased from 2 MW to 80-90 MW.

Plant factor of 28% for generation.

Efficiency improvement from 64% to 70% in 2030 results in lower electricity consumption and less capacity required.

O&M costs are reduced by following equipment and learning costs to operate.

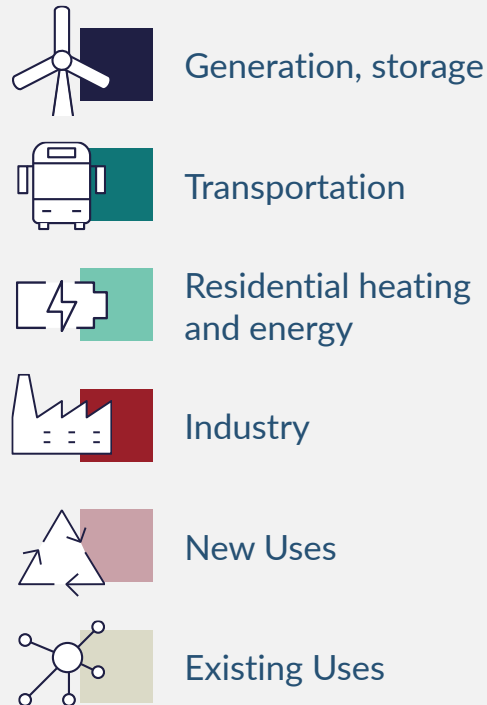
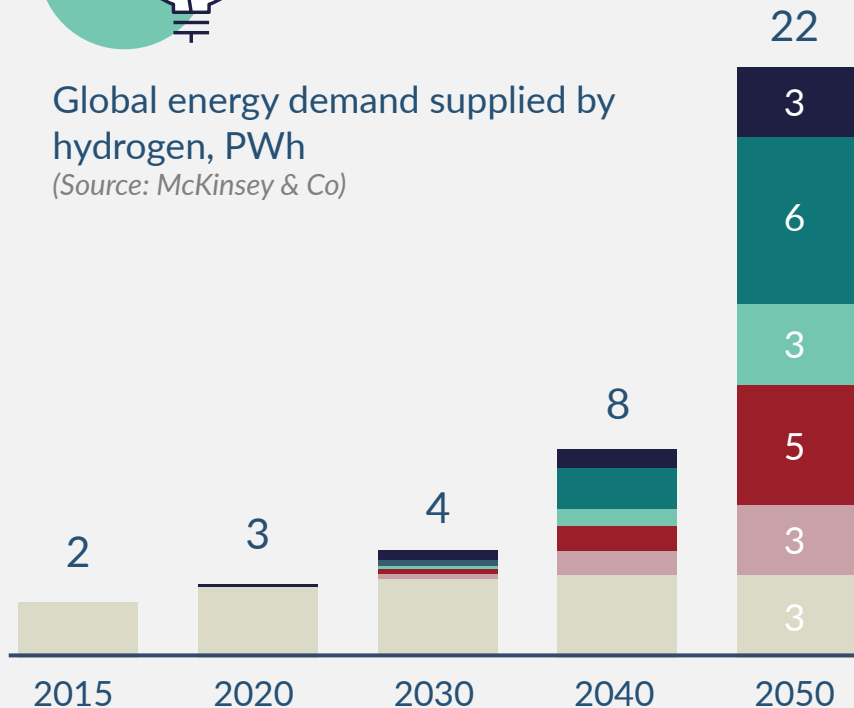
PV solar energy cost falls from 31 to 19 USD/MWh assuming direct connection to H2 production. No transmission cost.

By 2050 it is projected to be half the size of the current oil market



Global energy demand supplied by hydrogen, PWh

(Source: McKinsey & Co)



2050:

18%

final energy demand

6 Gt

annual CO2 abatement

\$2.5tn

annual sales (hydrogen and equipment)

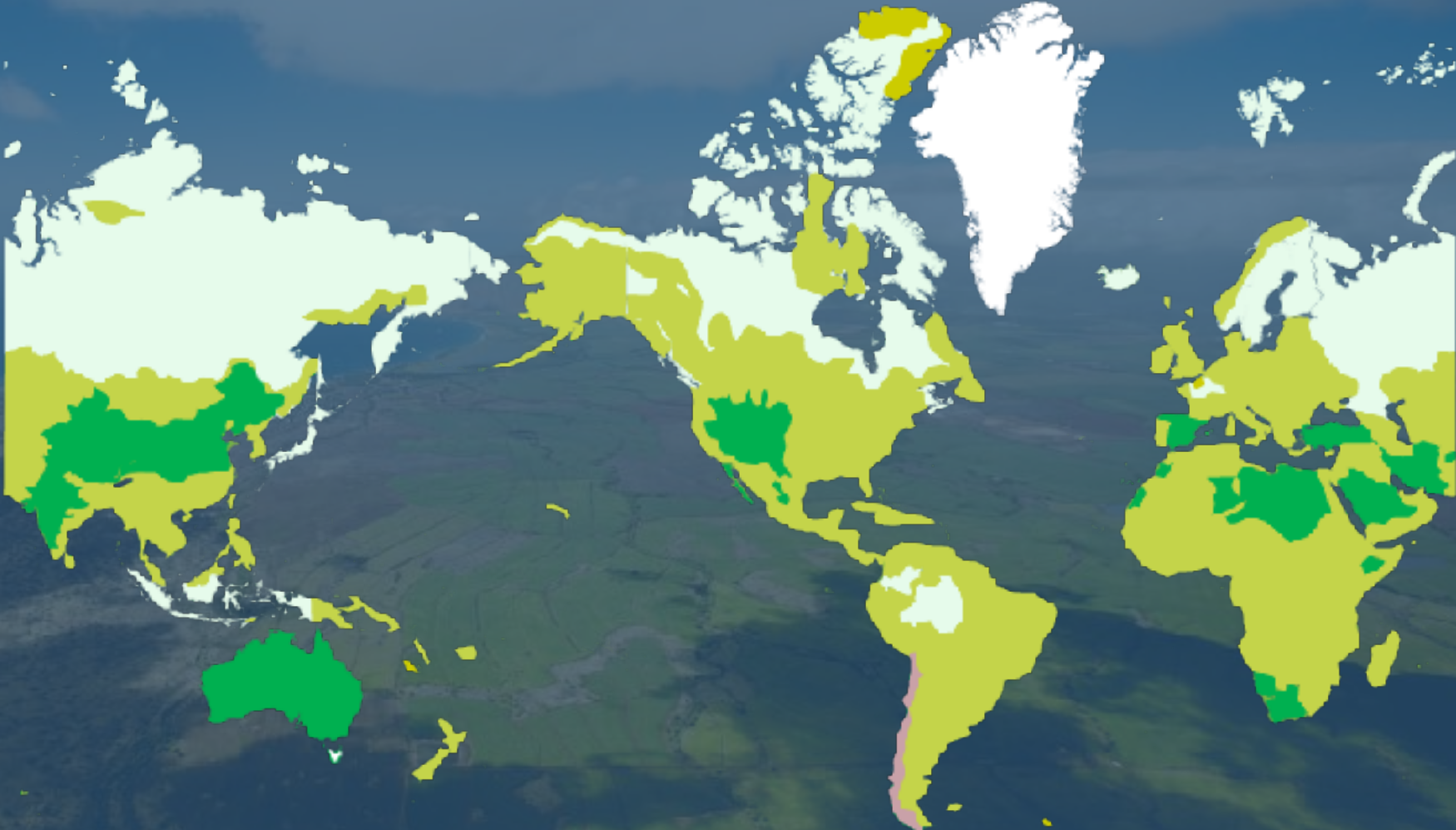
30 m

job creation

Chile appears as the most competitive producer in the world

Cost of green hydrogen in different regions, in USD/kg in 2030:

- USD < 1.5/kg
- USD 1.5-2/kg
- USD 2-3/kg
- USD > 3/kg



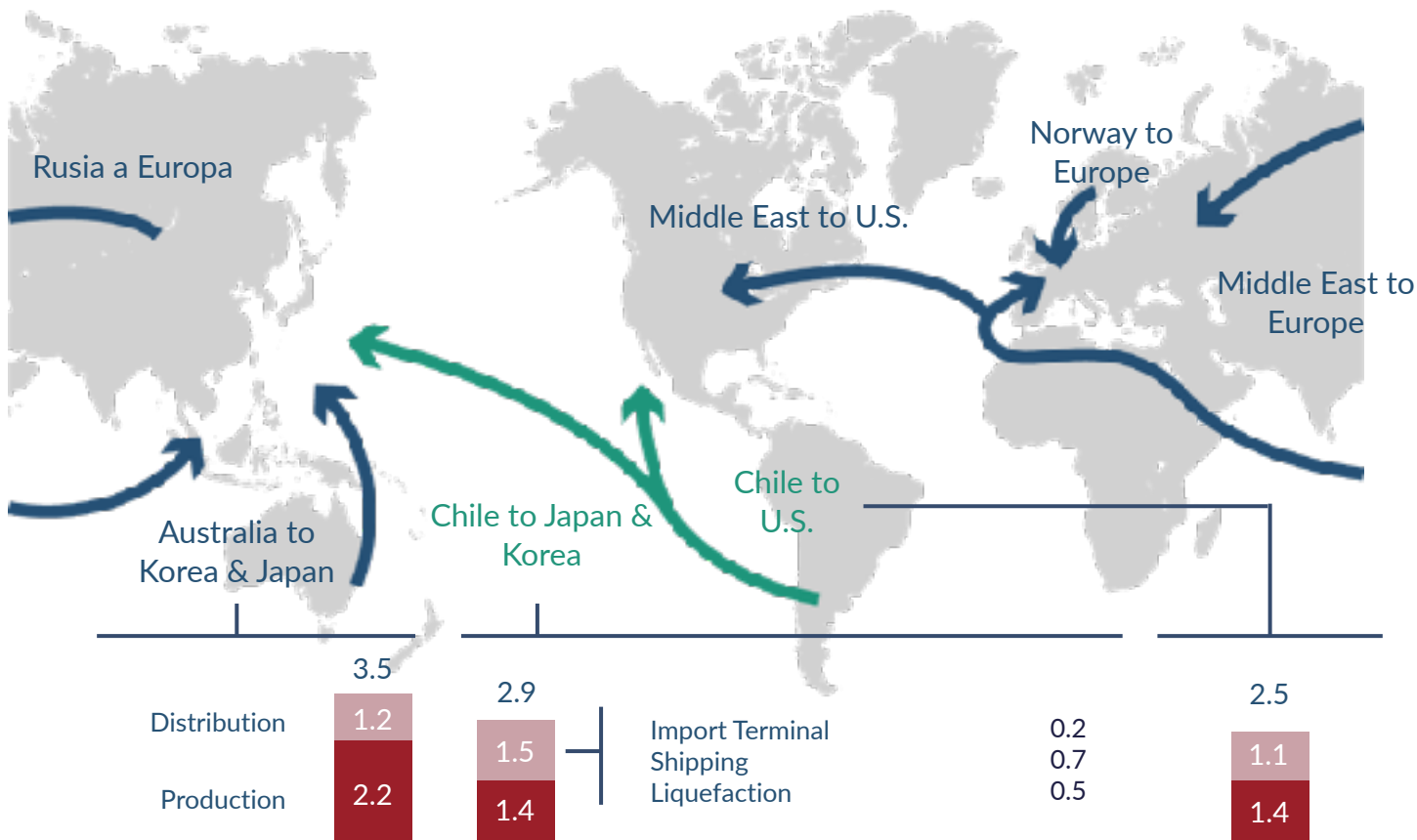
(Source: McKinsey & Co)

Chile will be able to export renewable energy through the products it sells to the world






Cost of liquid H2 at destination port

(Fuente: McKinsey & Co)

Global H2 transport routes



Renewable Energy Transport Vectors

-  LH2 Liquid green hydrogen
-  Cu Green copper and other minerals
-  NH3 Green Ammonia
-  CH4OH Methanol/ Synthetic fuels
-  Wine, salmon and food.
-  Wood pulp

Chile can provide a significant part of the world's green hydrogen

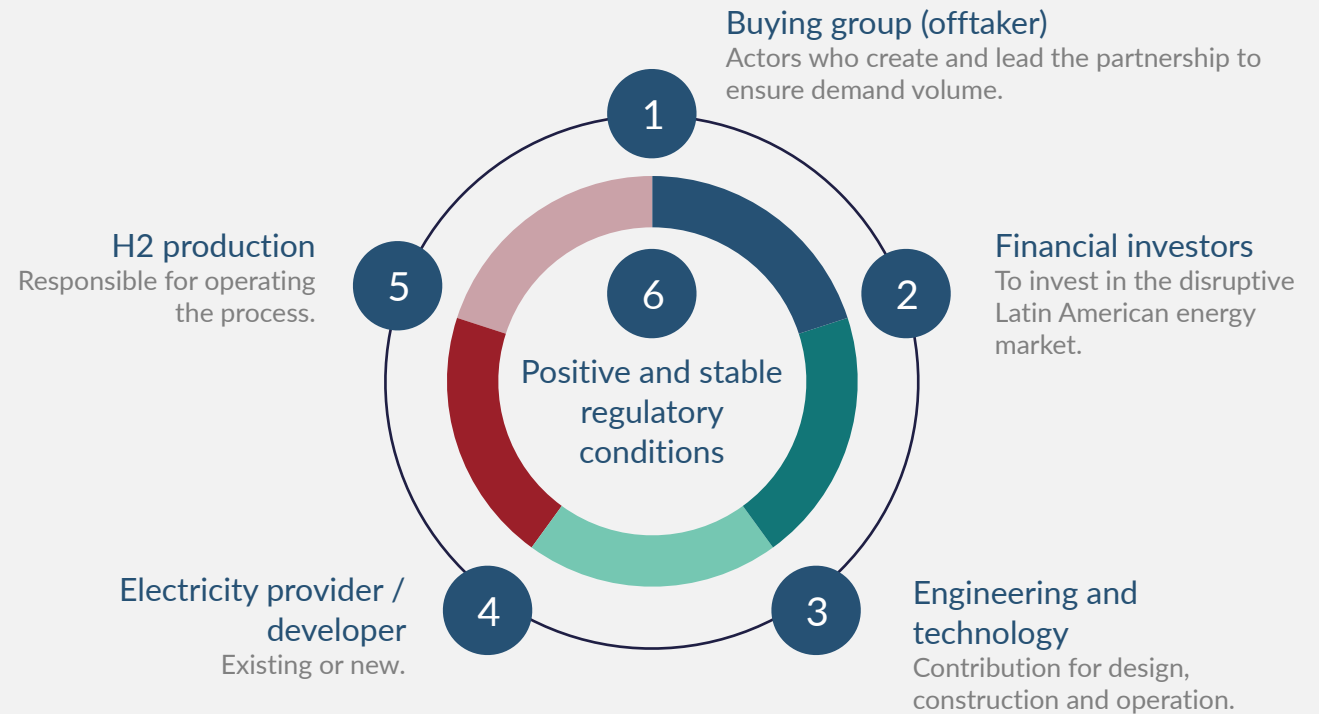
must coordinate value chain actors

Potential market for Chile 2050:

(Fuente: McKinsey & Co)

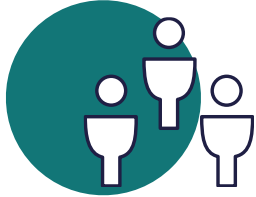
- Capture 50% of the Japanese and South Korean market, and 20% of the Chinese market.
- Production of 25 million tons of H2 per year.
- More than 30 bn USD of income per year.
- 5% of global hydrogen demand.
- 1% of global energy demand.

6 keys to produce on a large scale:

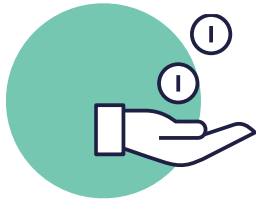


National Green H₂ Strategy

to boost its development



Green Hydrogen Strategy with a participatory process: political leaders, experts, academy and citizen participation.



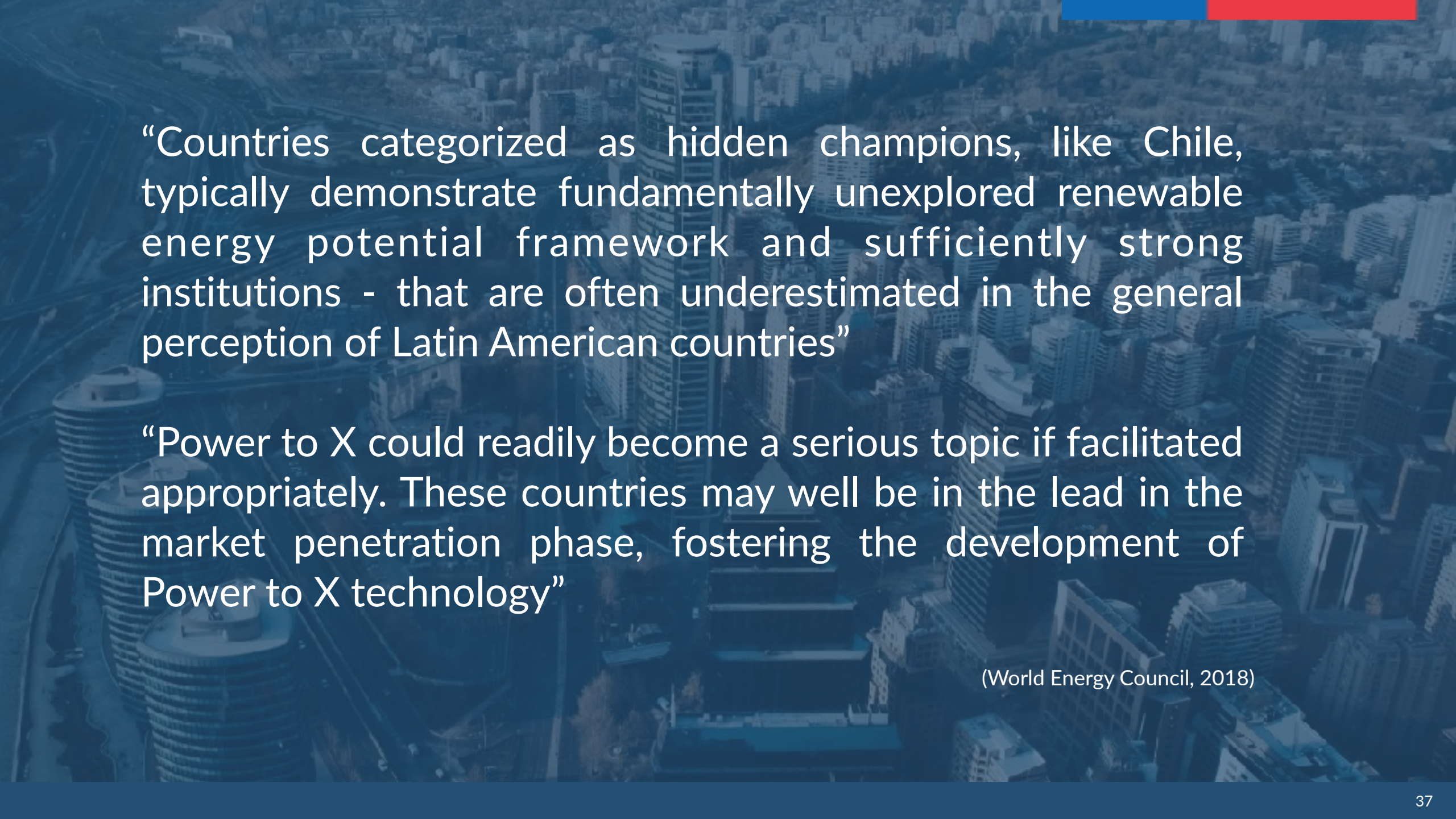
Promotion of pilot projects: follow up of more than 15 pilot projects.



Regulation: gap identification (GIZ studies) and closure.



International cooperation: Germany, Japan, Australia, Singapore, UK and others.



“Countries categorized as hidden champions, like Chile, typically demonstrate fundamentally unexplored renewable energy potential framework and sufficiently strong institutions - that are often underestimated in the general perception of Latin American countries”

“Power to X could readily become a serious topic if facilitated appropriately. These countries may well be in the lead in the market penetration phase, fostering the development of Power to X technology”

(World Energy Council, 2018)



Chile Investments in the Energy Sector

Embajada de Canadá y Cámara
Chileno Canadiense de Comercio
Septiembre 2020

