Gobierno de Chile

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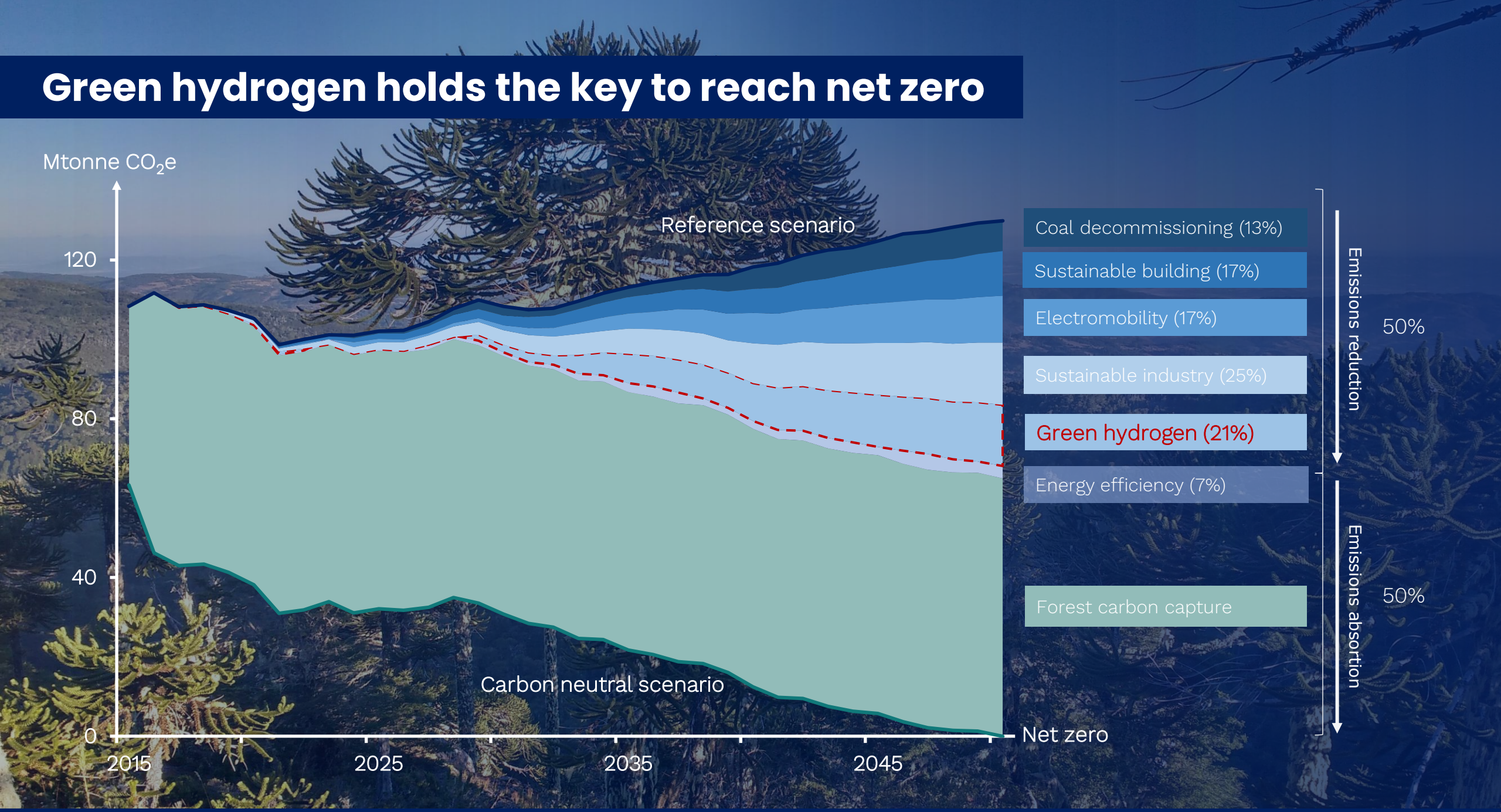
Green Hydrogen

An opportunity for the decarbonization of the mining industry

September, 2021

Green hydrogen holds the key to reach net zero

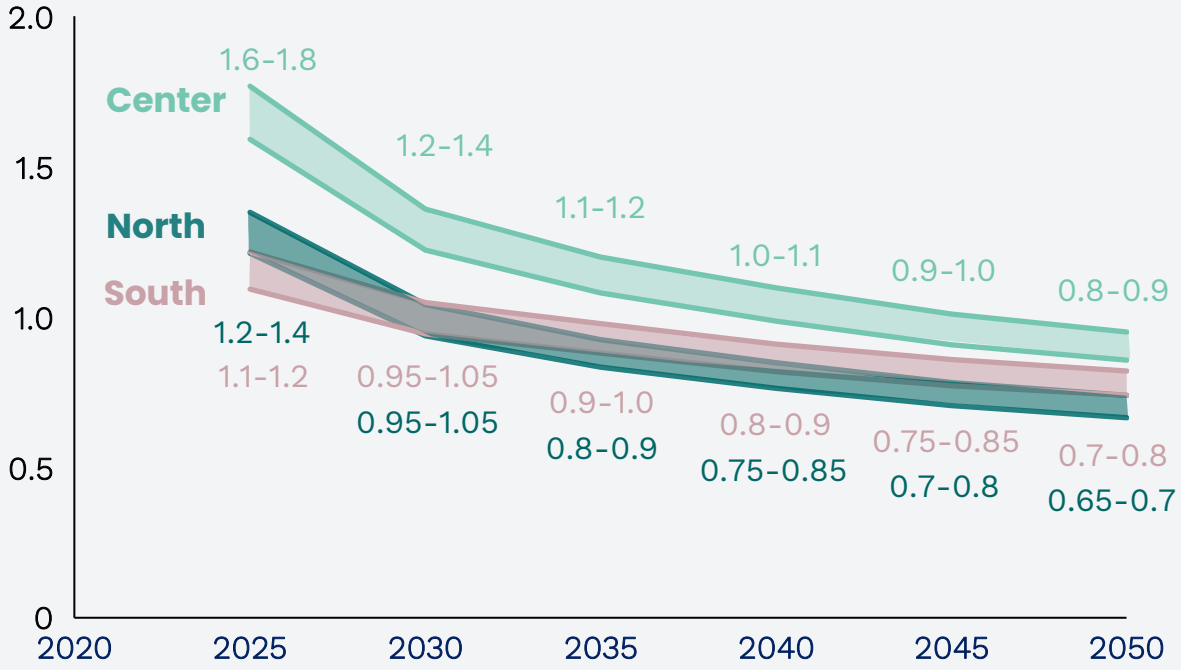


Source Ministry of Energy

Latest estimations put Chile around 1 USD/kg by 2030

Levelized cost of production (USD/kg H_2)

Source McKinsey & Co.

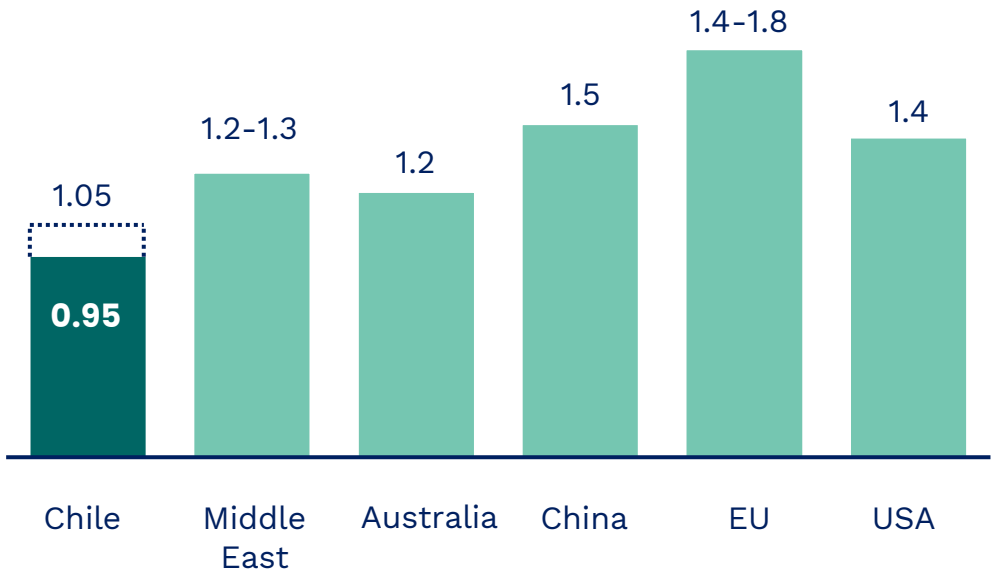


Potential for a 160 Mtonne yearly green hydrogen production according to IEA

Levelized cost of production by 2030 (USD/kg H_2)

Does not consider conditioning, transport, storage nor distribution costs

Source McKinsey & Co.



We have set clear goals to lead the way

2025

5 BUSD

Top destination for green hydrogen investment in LATAM

5 GW

Electrolysis capacity operating and under development

200 ktonne/year

Production in at least 2 *hydrogen valleys* in Chile

2030

Leaders in export of green hydrogen and derivatives

2.5 BUSD/year

The cheapest green hydrogen on the planet

<1.5 USD/kg

Leaders in production of green hydrogen via electrolysis

25 GW

This opportunity will unveil in 3 distinct waves

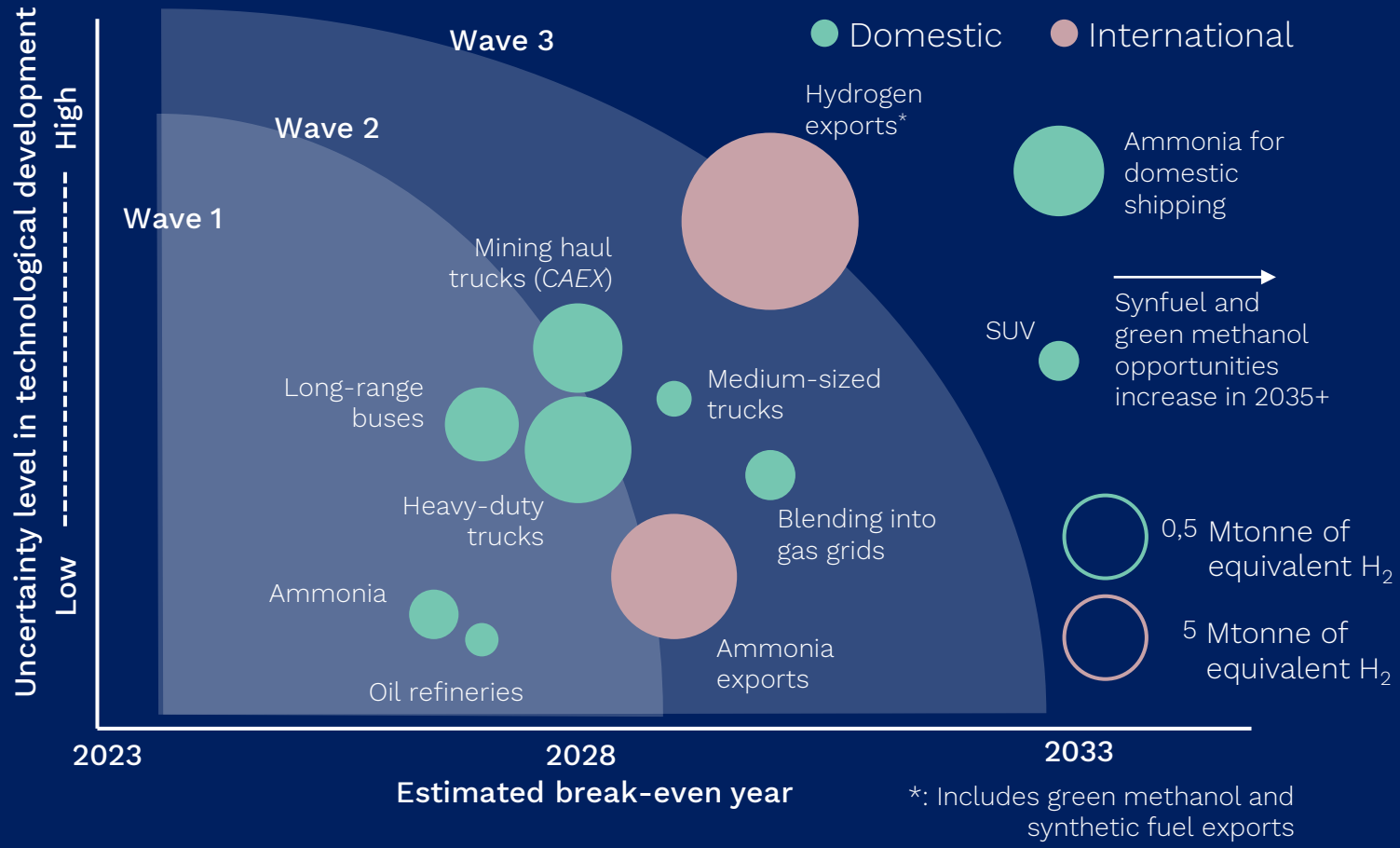
The first wave will include domestic usage with existing large energy or hydrogen demand
The shorter-term opportunities are replacing imported ammonia for local production, and replacing grey hydrogen used in oil refineries. The use of green hydrogen for heavy and long-distance transportation also becomes attractive for fleets and machinery operating in concentrated zones.

The start of export activities and extended local uses will be seen before the decade is over
A clear opportunity for green ammonia exports exists in the medium-term, as well as for the first hydrogen exports. A more competitive production of green hydrogen will also replace an increasing share of liquid fuels in land transportation, whereas blending into grids becomes economical.

New export markets open in the long-term, enabling a massive scale-up of production
Fuels derived from green hydrogen will be key to decarbonize the shipping and aviation sectors, both in domestic and international routes. Export markets will continue to grow as other nations take action to deeply decarbonize their economies.

Projected development of green hydrogen applications

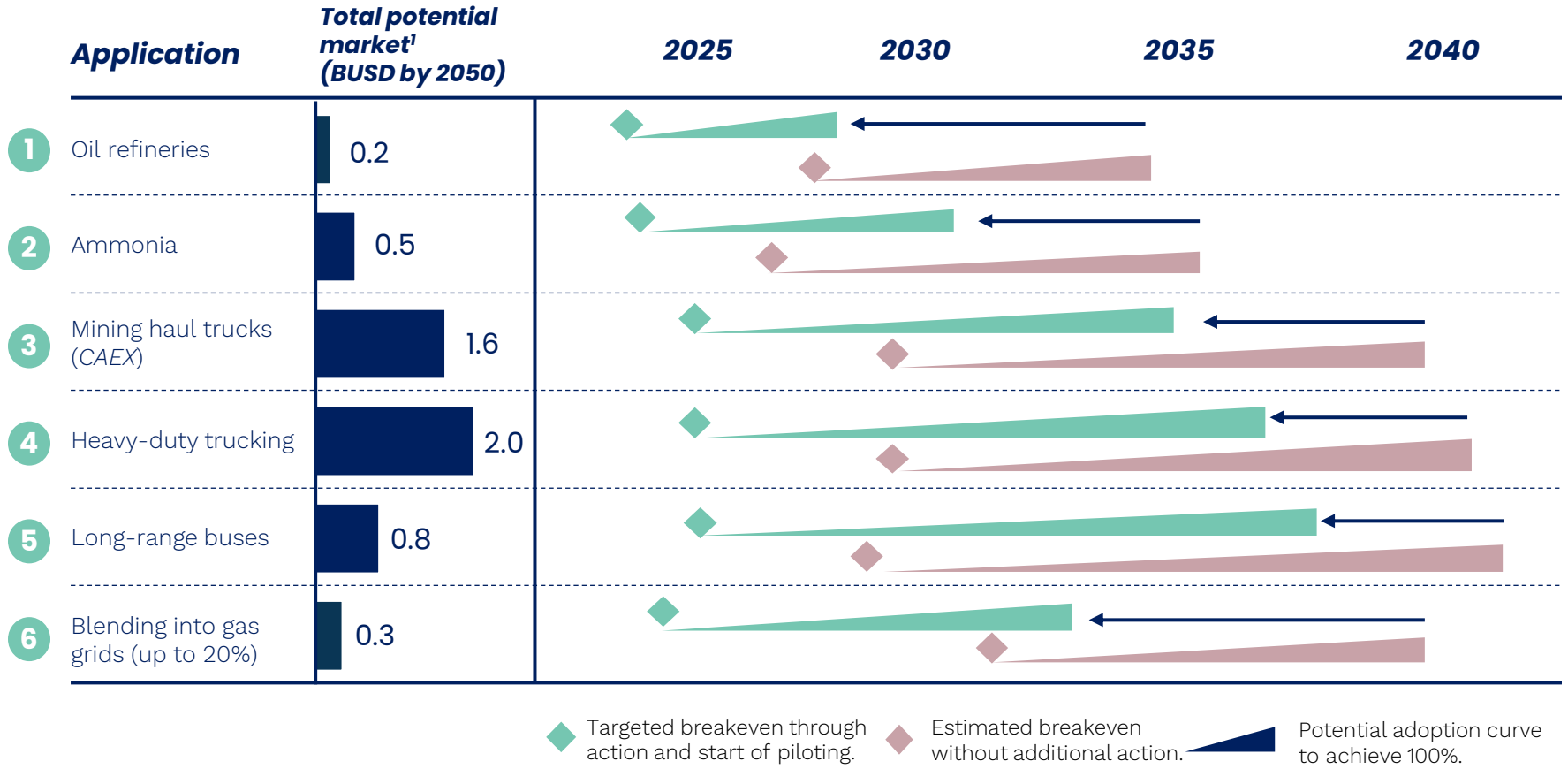
Uncertainty level, market size, and estimated year of breakeven for some applications of hydrogen in Chile. Does not consider carbon price. List of applications not exhaustive.
Source McKinsey & Co.



Wave I: Local applications will ramp up hydrogen demand and activate a domestic industry

We will accelerate the deployment of green hydrogen in 6 prioritized applications to build local supply chains and acquire experience

Public action will kickstart the local hydrogen industry by incentivizing production and create a tangible demand for this clean element and its derivatives. Uses with the earliest economic breakeven and largest concentrated demand will be targeted first. These actions will generate know-how, develop talent, deploy infrastructure, and attract financing. In doing so, the country will be better positioned to tap into export markets.



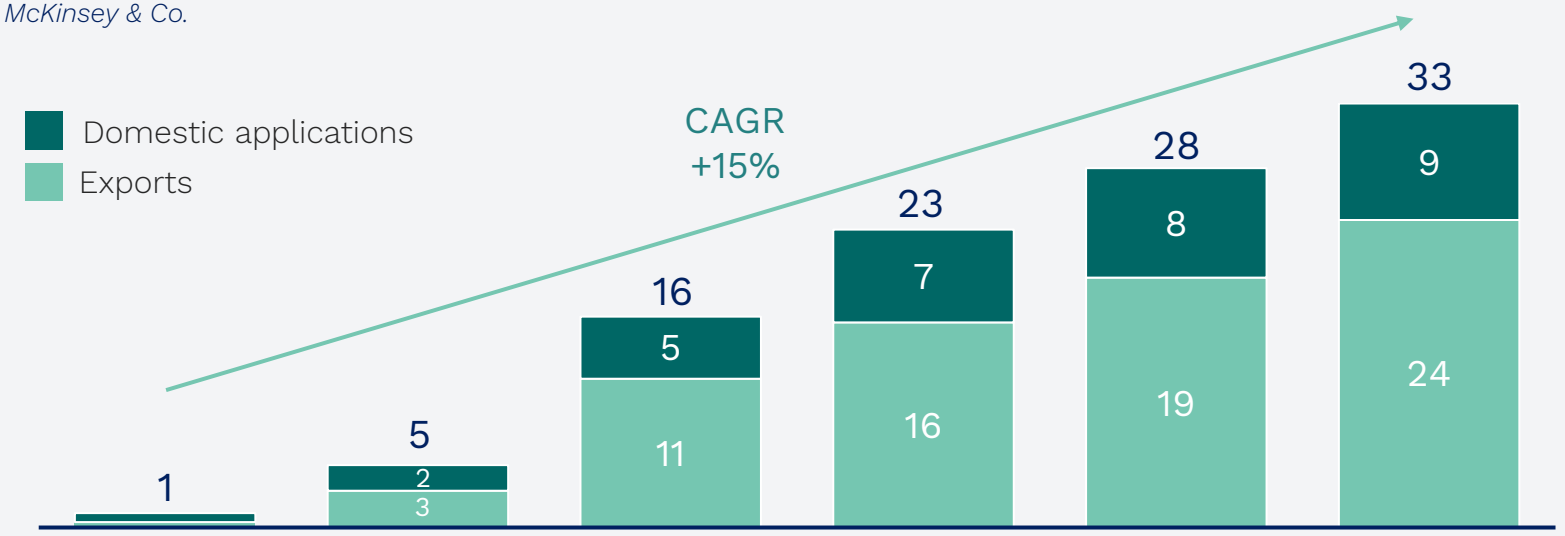
1. Annual sales. Considers the full transition to hydrogen of the energy demand in each application.

Source McKinsey & Co.

A unique opportunity: green hydrogen could be a clean industry as big as the Chilean mining sector

Projection of Chilean markets for green hydrogen and its derivatives (BUSD)

Source McKinsey & Co.



	2025	2030	2035	2040	2045	2050
Associated renewable capacity (GW)	5-8	40	145	200	250	300
Cumulative necessary investment (BUSD)	8	45	150	220	270	330

The competitiveness of Chile in renewable energy production and the global need for clean energy carriers will open the door to the creation of an economic sector that could rival the size of the Chilean mining sector

If timely and effective action is taken, the use of green hydrogen in domestic applications will generate an industry prepared to compete in international export markets. Investment in green hydrogen will lead to significant national capabilities and the creation of dynamic economic ecosystems throughout the country

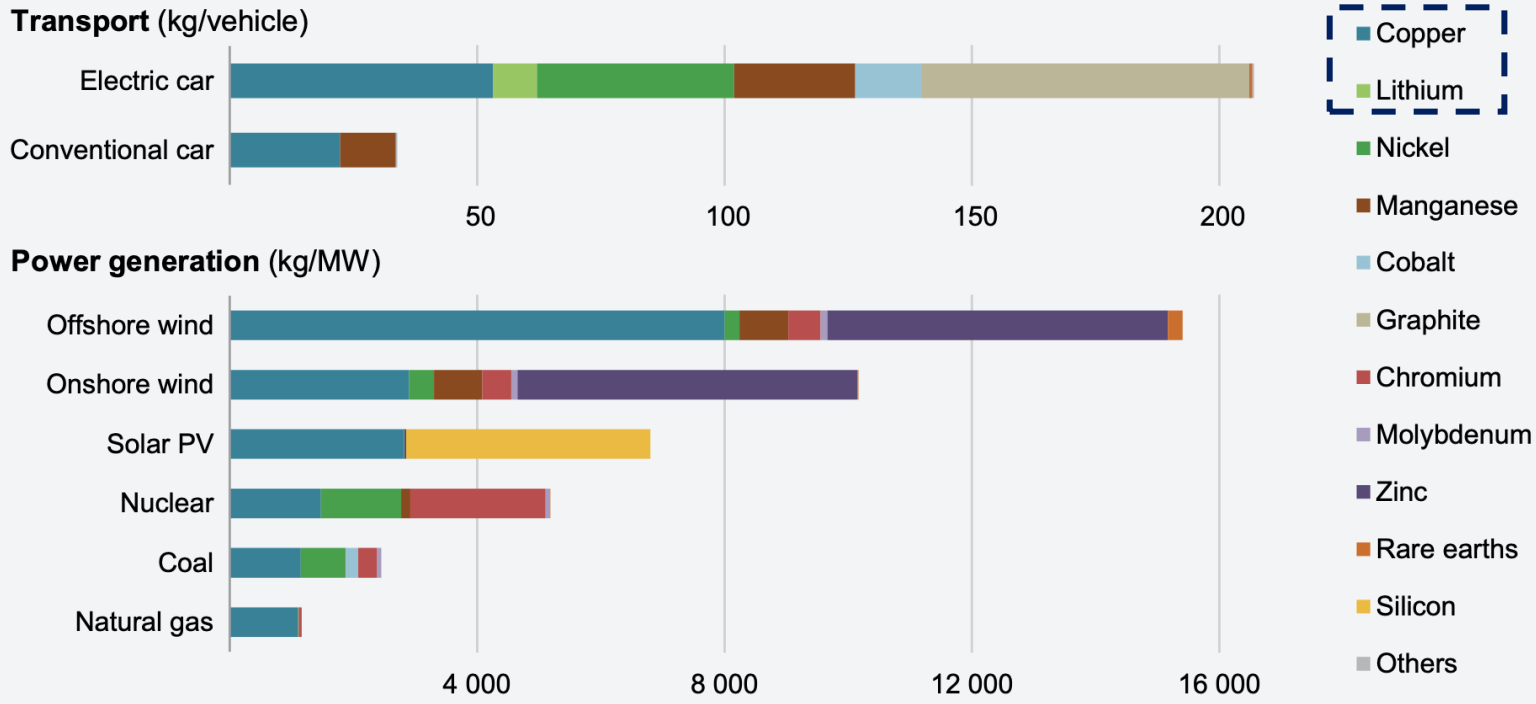
Chile has a solid track record in mining

Mining plays a key role in our economy representing 10% of the Gross Domestic Product (GDP), and more than 50% of the country's exports.

Thanks to its comparative advantages, such as the high concentration of copper deposits, Chile is positioned as a competitive producer of minerals, such as copper and lithium. Copper production is 5,730 tons per year (2020), representing **28% of world copper production**. In addition, Chile has the largest lithium deposits, **with 44% of the world's lithium reserves**, which is a key component for the development renewable energy production and the electromobility industry.

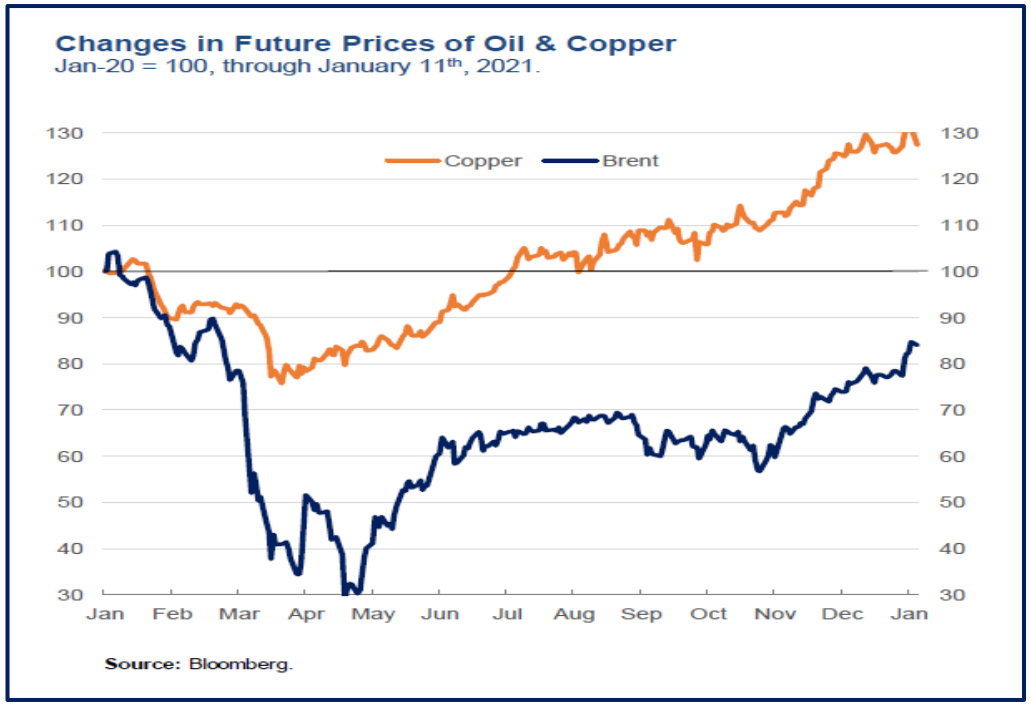
Main minerals used for renewable energy generation

Source IEA



Fast development of clean energies strongly drives demand for strategic minerals

Diesel is a highly volatile fuel when comparing with green hydrogen



Constant – drastic changes in oil price

Random events can cause huge price variations –

~ 1.500 CAEX operating in the Chilean mining industry

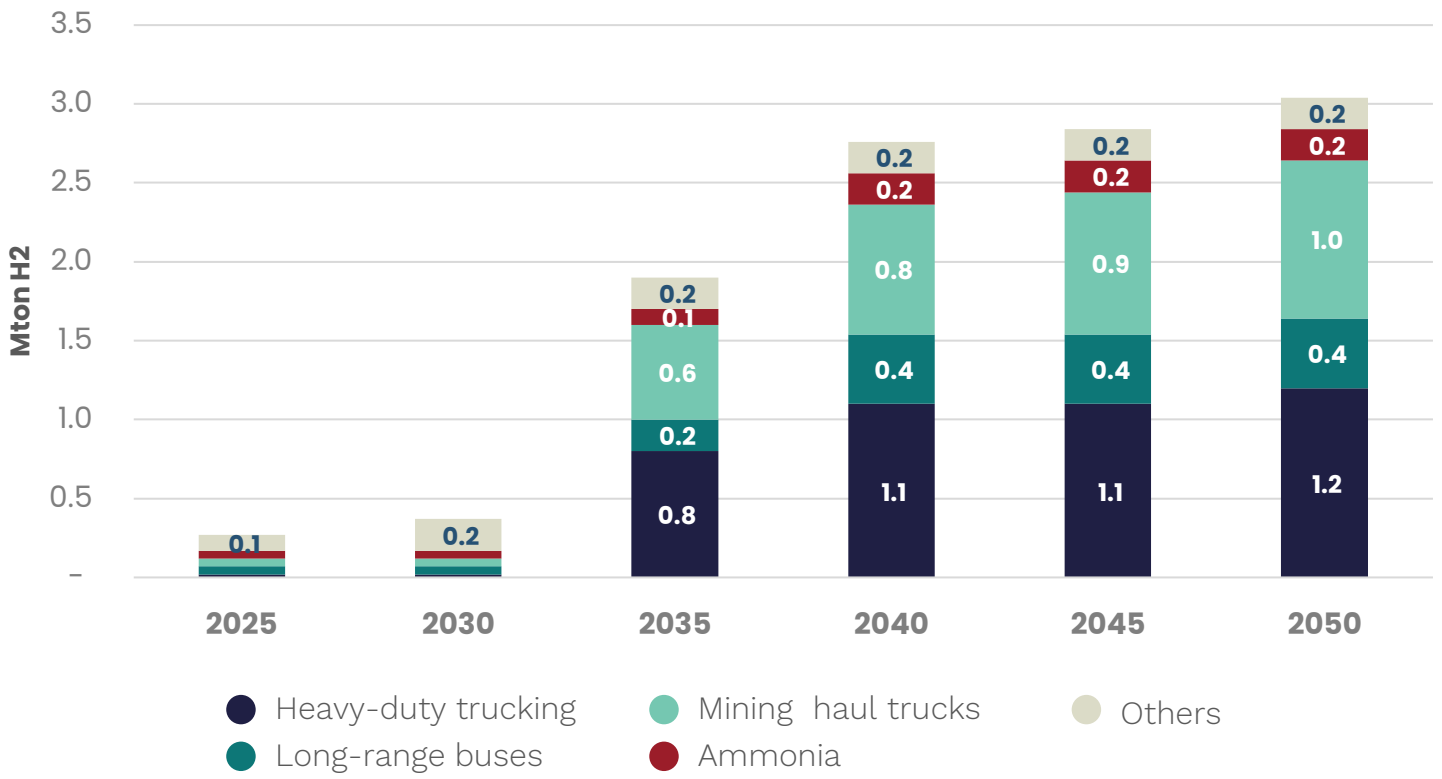
~ 3 million liters/day diesel consumption only for CAEX

~ 1 million ton/year green hydrogen could be consumed for that purpose

**Source Bloomberg & Department of Energy*

Mining will play a key role in hydrogen adoption

Hydrogen consumption in Chile for different applications

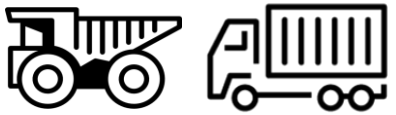
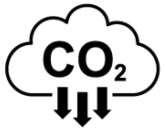
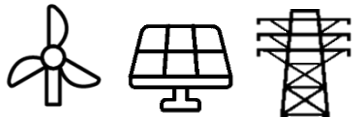


Source McKinsey & Co.

National Mining Policy 2050: a new model for our mining industry

NMP 2050 sets out a navigation chart for industry and the State, based on three pillars: economic, social and environmental, and with ambitious targets.

MINERÍA 2050
POLÍTICA NACIONAL MINERA

Operate zero-emission fleets at large mining companies by the end of this decade.	
Reduce CO2 equivalent emissions from large-scale mining operations by at least 50% by 2030, achieving carbon neutrality by 2040.	
To ensure that the mining sector is powered at 90% by renewable energy sources by 2030 and 100% by 2050.	
Establish measurable and accountable targets for Greenhouse Gas (GHG) emissions of Scope 1, 2 and 3 by 2030,	

Source Política Nacional Minera 2050.

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