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NATIONAL **GREEN HYDROGEN** STRATEGY

Chile, a clean energy provider for a carbon neutral planet

National Green Hydrogen Strategy

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Editors:

Max Correa A. – Carlos Barría Q. – Benjamín Maluenda P.

Design: Patricia Escobar A.

Images: Unsplash

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Juan Carlos Jobet E.
Minister of Energy

Hydrogen, the atom composed of just one proton and one electron, is the most abundant substance in the universe. It is also the lightest and one of the smallest elements on the periodic table. Recently, a lot of attention has been paid to this diminutive element and its potential role in combating global climate change. Specifically, the hype around hydrogen has centered on its ability to help cut greenhouse gas emissions in sectors of the economy which are hard to abate. Could it be that the simplest, smallest atom in our universe might hold the key to confronting climate change, our largest, most complex challenge?

Like hydrogen, Chile is small by nature and, accordingly, contributes just 0.3% to global greenhouse gas emissions. However, we too have an outsized role to play in turning the tide on rising emissions and pursuing a low carbon path to growth and development.

What we lack in size, we more than make up for in potential. In the desert in the North, with the highest solar irradiance on the planet, and in the Patagonia in the South, with strong and consistent winds, we have the renewable

energy potential to install 70 times the electricity generation capacity we have today. This abundant renewable energy will enable us to become the cheapest producer of green hydrogen on Earth. Our National Green Hydrogen Strategy is aimed at turning this promise into reality.

The Strategy is the result of collaborative work between industry, academia, civil society and the public sector, and is an essential piece of our carbon neutrality plan and commitment to sustainable development. It will allow us to produce and export products that are created using zero carbon fuels, distinguishing our exports as clean products for end users. It will also enable us to export our renewable energy to the world in the form of green liquid hydrogen, green ammonia and clean synthetic fuels.

Traditionally, Chile lacked fossil fuels and was forced to import the energy it required. Now, the coming of age of the tiniest atom will allow us to drive deep decarbonization in our own country and throughout the world. This Strategy is the first step for Chile in embracing this promise and fulfilling its new potential.

LETTER FROM THE ADVISORY BOARD

“This National Green Hydrogen Strategy marks an essential starting point for a profound transformation of the country's productive identity.”

Our country is committed to reducing its greenhouse gas emissions to help slow down global climate change, moving towards sustainable development. It is in Chile's wealth of clean energies that we see an engine to decarbonize the country's activities, diversify its energy matrix and generate new industries for local development. Chile can transition from a country that grows by extracting non-renewable resources, to one that produces the clean and renewable fuels that the world requires to avoid climate change.

Chile has a unique opportunity to develop a competitive green hydrogen industry that, from electricity produced with low-cost renewable resources, forms an energy source for local use and exportation, and promotes a sustainable economy around it.

This opportunity can have a great impact on our country's brand, adding a green value to the products created in Chile, reducing the carbon footprint in

transportation and offering our renewable energy to those that need it. A concrete opportunity, for example, would be to become the world's leading producer of green copper. This presents the opportunity to generate spaces for innovation, promote growth and local employment, as well as create new companies with local and global impact.

The great challenge of these coming years will be to realize these opportunities through concrete actions. We see that this National Green Hydrogen Strategy marks an essential starting point for a profound transformation of the country's productive identity. But it is also essential, because it positions Chile as a global leader and generates public-private coordination around clear objectives that guide action.

We must promote the use of this energy within Chile, displacing the consumption of fossil fuels in the mining, transport and agricultural sectors, in order to offer products that are low in emissions.

To this end, clear and transparent regulatory signals which level the playing field with dirtier fuels are essential. In addition, clear signals regarding financial support, as well as coordination and leadership from the Executive to attract local and international companies are key. In close collaboration, we must also facilitate the development of an export industry for hydrogen and its derivatives, which will allow us to achieve economies of scale that will make us competitive.

Thus, Chile will become an exporter of renewable energy to the world, through its energy and green label products.

As an Advisory Board for the development of the National Green Hydrogen Strategy, we are very excited to promote this opportunity for the country, helping to lay the foundations for what will be a new industry for Chile, whose success will bring benefits to both the country and the planet.



Ricardo Lagos

Former President of the Republic



Vivianne Blanlot

Former Executive Secretary of the National Energy Commission and Former Minister of National Defense



Marcelo Mena

Former Minister of the Environment and academic



Gonzalo Muñoz

High-Level Champion COP25, cofounder SistemaB and entrepreneur



Klaus Schmidt-Hebbel

Former Chief Economist of the OECD, academic and consultant



Jeannette von Wolfersdorff

Founder of the Observatory for Fiscal Spending in Chile and economist

The path to a participatory strategy



Technical roundtables

Roundtables were carried out with participation from companies, universities, research institutions, and industry associations. Barriers to the development of hydrogen were identified, and actions to solve them were prioritized.

4 sessions throughout June and July 2020

Participants: 66 organizations.

Citizen workshops

Interactive workshops were carried out with representatives from NGOs and citizen associations. Local concerns and perceptions regarding the role of the State in green hydrogen development were raised.

3 sessions in August 2020

Participants: 90 representatives.

Interinstitutional roundtable

Discussion roundtables took place between key public stakeholders to refine a diagnosis, propose objectives, and construct a common vision for the development of green hydrogen in Chile.

4 sessions between April and October 2020

Participants: The Ministries of Energy; Science, Technology, Knowledge, and Innovation; Mining; Economy; Transportation and Telecommunications; Environment; Foreign Affairs; as well as CORFO, InvestChile, and the German agency GIZ.

Advisory Board

A board was formed with experienced public policy and climate action experts to advise the Ministry of Energy on high-level strategic issues regarding green hydrogen public policy making.

4 sessions between May and August 2020

Members: Former President Ricardo Lagos, Vivianne Blanlot, Marcelo Mena, Gonzalo Muñoz, Klaus Schmidt-Hebbel, Jeannette von Wolfersdorff.

Public Consultation

This document is currently under public consultation. To participate, please visit the Ministry of Energy's website at

energía.gob.cl

Bolero solar photovoltaic plant, Antofagasta Region



1

Time for action

The simplest molecule to confront
the most complex challenge

We are facing a climate crisis

Science has warned that the world will experience a climate crisis without precedent in history, caused by human action, unless transformative actions are undertaken on a global scale.

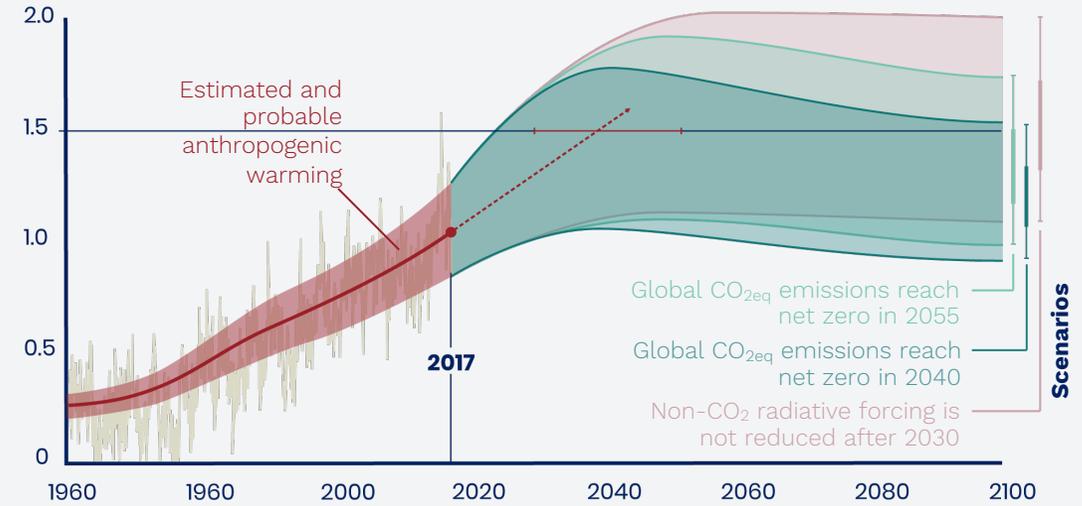
Chile is committed to climate action in a decisive and ambitious manner. In 2020, it updated its Nationally Determined Contribution (NDC) and pledged to become a net-zero emission country by 2050, the only developing country to do so and one of the few to begin parliamentary discussion on a Climate Change Bill. Fulfilling these objectives will require transformative actions in Chile’s society and economy.

Energy production and utilization are at the center of the challenge we face

The way in which energy is produced and used throughout the world will change radically. Three quarters of global greenhouse gas emissions are associated with the energy sector, principally driven by fossil fuel use. Chile has already set itself on a path to energy efficiency and electrification using renewable energy. However, complementary solutions are needed to decarbonize economic sectors and applications in which direct electrification or other solutions are not cost-efficient, reliable, accessible, or safe.

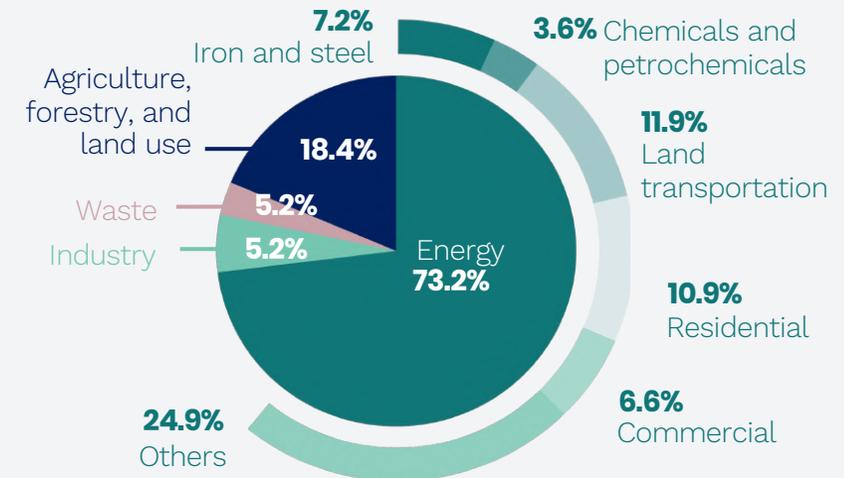
Global warming referenced to 1850–1900 (°C)

Source: IPCC. (2019). Special Report: Global Warming of 1.5°C.



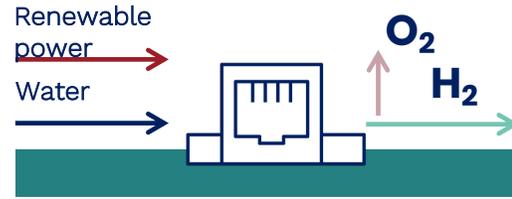
Global greenhouse gas emissions by sector

Source: Ritchie, H. (2020). Published in ourworldindata.org with data from Climate Watch and the World Resources Institute.



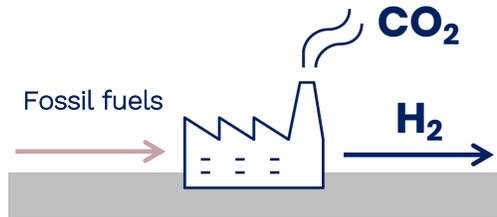
The power of green hydrogen

An industrial gas used widely for more than a century, elemental hydrogen (H_2) can be produced today from water with increasing scale and efficiency. In green hydrogen production, water can be separated into its constituents, hydrogen and oxygen, using renewable power.



Green hydrogen

Historically, it has been produced from fossil fuels in processes that emit greenhouse gases. It has mostly been used in chemical industries and for the refining processes of crude oil.



Grey hydrogen

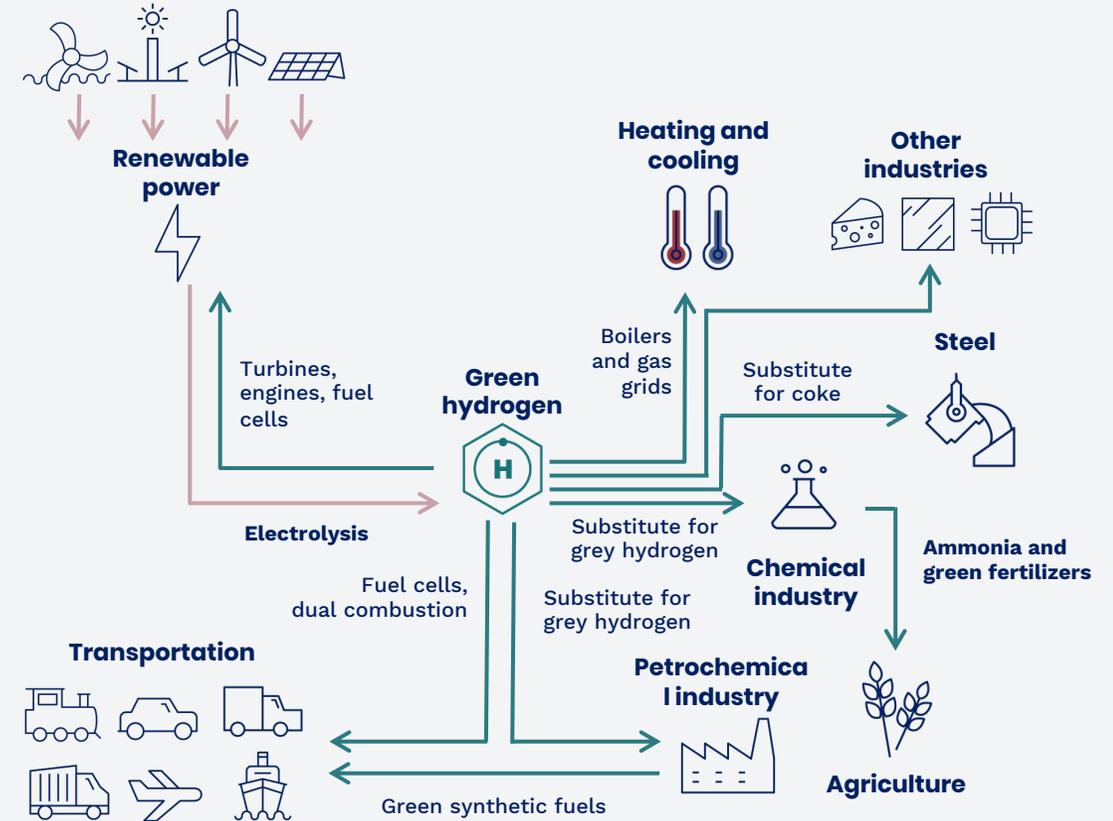
It is a means for using the inexhaustible renewable energy found in various forms on the planet.

It functions as an energy carrier that emits no greenhouse gases when used.

It can replace the use of fuels in the production of electricity, heat, and multiple materials.

Decarbonization potential of green hydrogen

Source: Adapted from Siemens, Power-to-X.

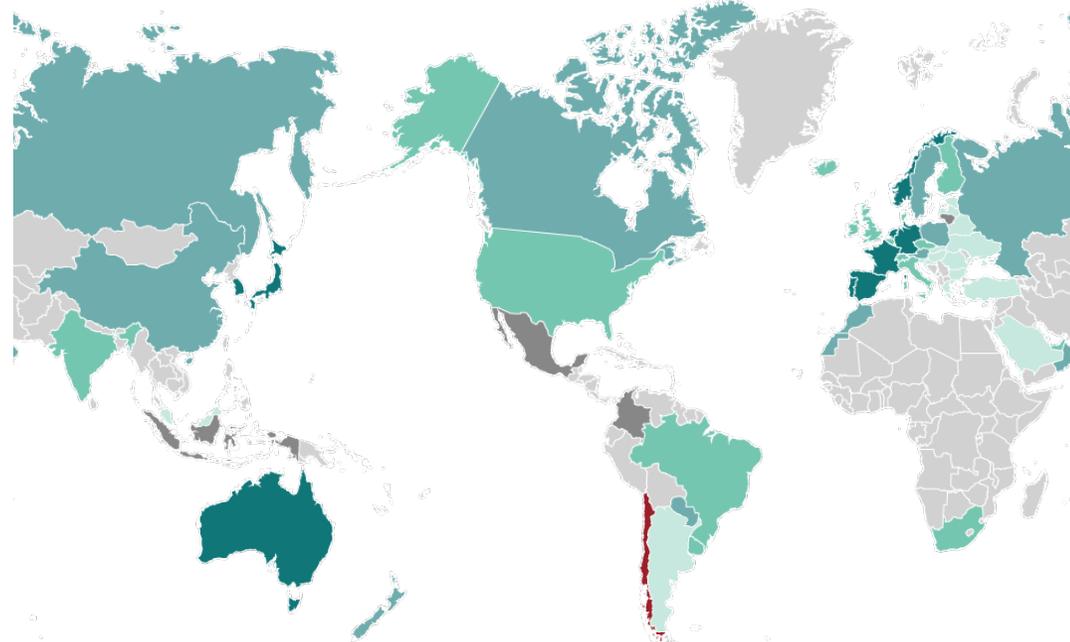


The time for hydrogen has arrived

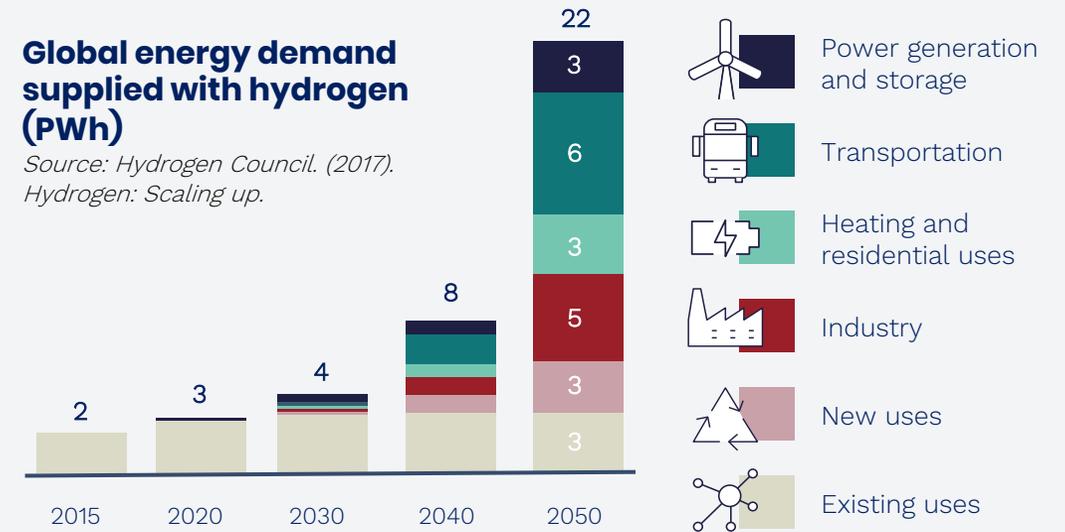
After several decades of waiting for the potential of hydrogen as an energy carrier, this element is now ready to assume a leading role in the global energy and economic transition.

Countries representing almost 90% of global GDP have policies or initiatives for public support of hydrogen

Source: LBST. (2020). International Hydrogen Strategies. Prepared for WEC Germany.



- National strategy available
- National strategy under preparation
- Pilot and demonstrative project support
- Preliminary discussions
- No relevant activities
- Not evaluated



By 2050, the world's economies and energy systems will look greener. The projected reduction in renewable energy and electrolyzer costs, as well as the need for deeper decarbonization of all economic sectors, will drive the emergence of a global market for green hydrogen and its derivatives.

18%
Final energy demand

2.5 TUSD
Total hydrogen market

300 BUSD
Export market

80%
Electrolyzer cost reduction

Hydrogen Council, 2017. Strategy& (PwC), 2020.

Punta Sierra wind power plant, Coquimbo Region

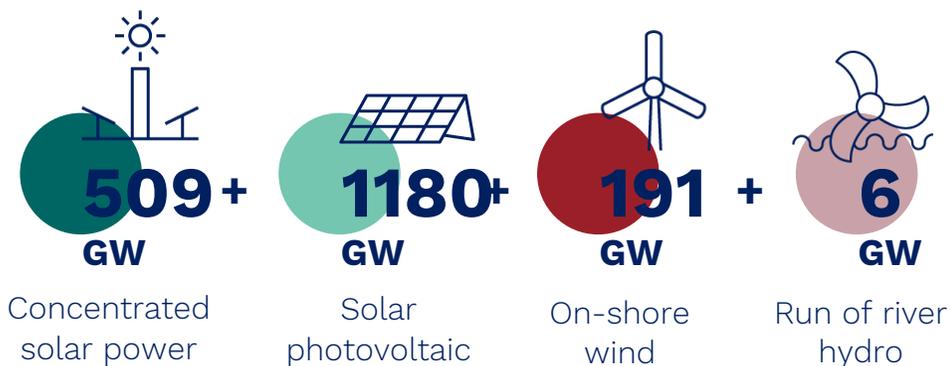


2

**An opportunity
for Chile**

Clean energy for a
global transition

A country rich in the energies of the future



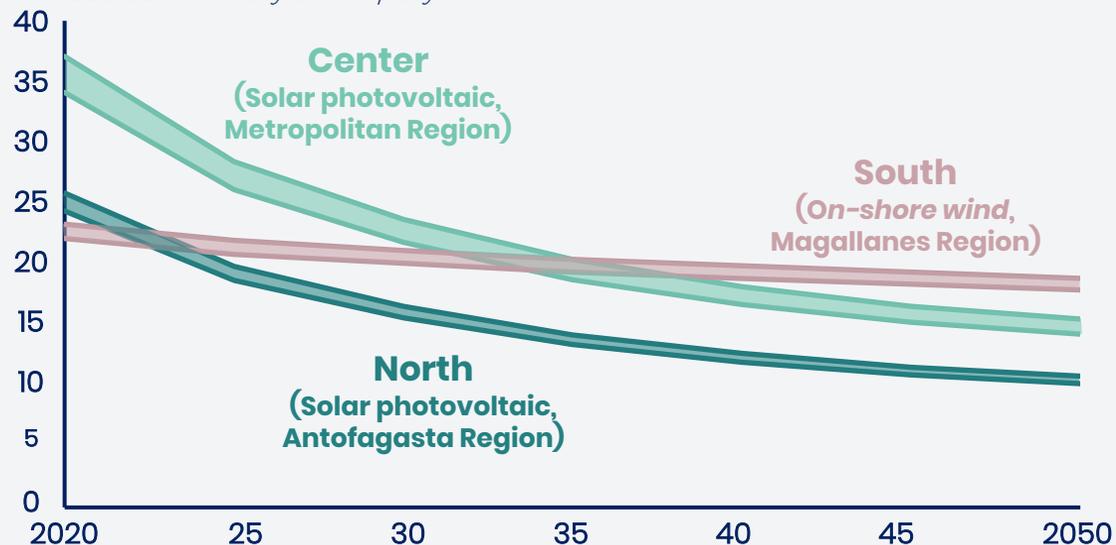
1.800+ GW

of renewable energy potential amounts to 70 times current installed capacity

The solar and wind power sectors are quickly maturing. In the past 6 years, Chile has increased the generation capacity from these sources five-fold and, by 2030, 70% of the power grid is expected to be renewable. The increasing investment in these energies, as well as in energy storage and transmission infrastructure, is a clear indicator of a decisive transition to a more sustainable power system.

Levelized cost of renewable electricity (USD/MWh)

Source: McKinsey & Company.



The most powerful solar radiation on the planet is found in Chile's North.

Capacity factors of 35% can be achieved in monofacial solar photovoltaic plants with 1-axis tracking.



Solar generation in the central part of Chile is already more competitive than fossil-powered electricity generation.

This renewable potential is located close to large consumption centers, gas grids, and logistical hubs, such as ports and distribution centers.



Winds in the far South end of the country blow with the same power on land as off-shore.

120-meter-high wind turbines are able to achieve capacity factors of over 60% on-shore, equivalent to off-shore performance in other countries.

The cheapest green hydrogen on the planet

Levelized cost of green hydrogen (USD/kg H₂)

Source: McKinsey & Company.

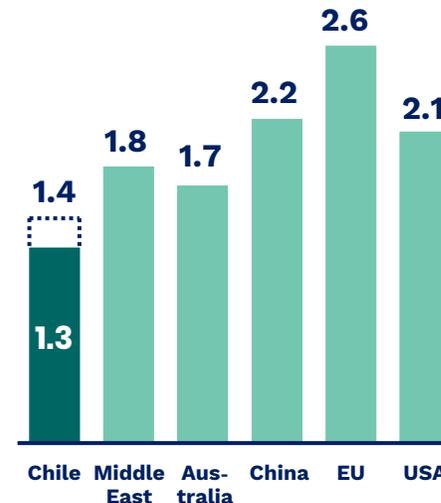


Potential for a 160 Mton yearly green hydrogen production*

*Source: International Energy Agency.

Reductions in electrolyzer and renewable power costs will lead to highly competitive green hydrogen production for domestic use and export.

The increasing availability of green financing, strong corporate commitments to decarbonization, and the existing tax benefits for remote regions are additional factors that will contribute to the competitiveness of business models based on this clean fuel in Chile.



Green hydrogen produced in the Atacama Desert and in the Magallanes Region will achieve the lowest levelized cost of production* on the planet by 2030.

The quality and abundance of the renewable resources found in these regions will enable a large-scale competitive production.

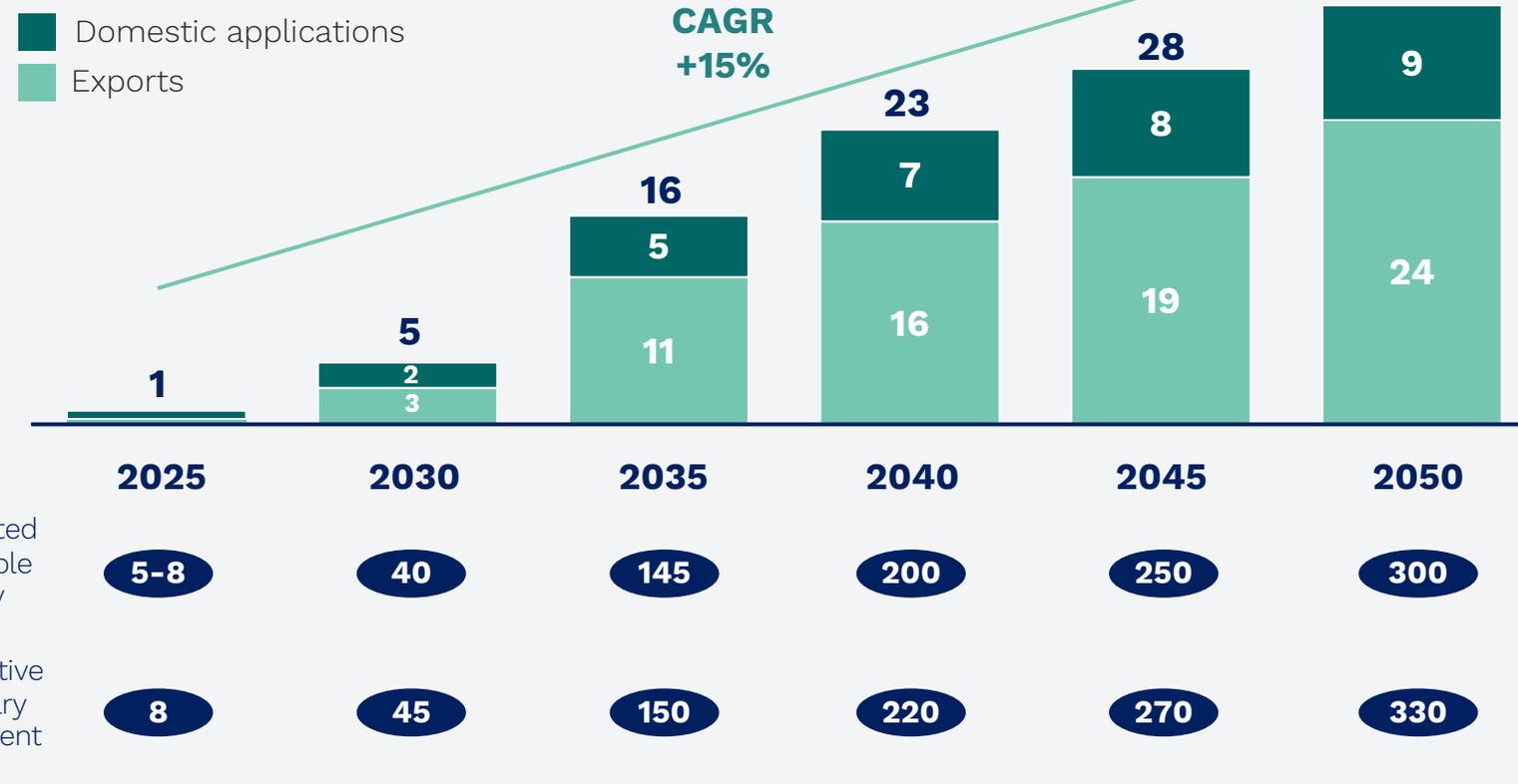
*Does not consider compression, transport, and distribution costs, which vary according to the end-use of hydrogen.

Source: McKinsey & Company.

A unique opportunity: A new, clean industry as large as the Chilean mining sector

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

Source: McKinsey & Company.



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 to the creation of dynamic economic ecosystems throughout the country.

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.

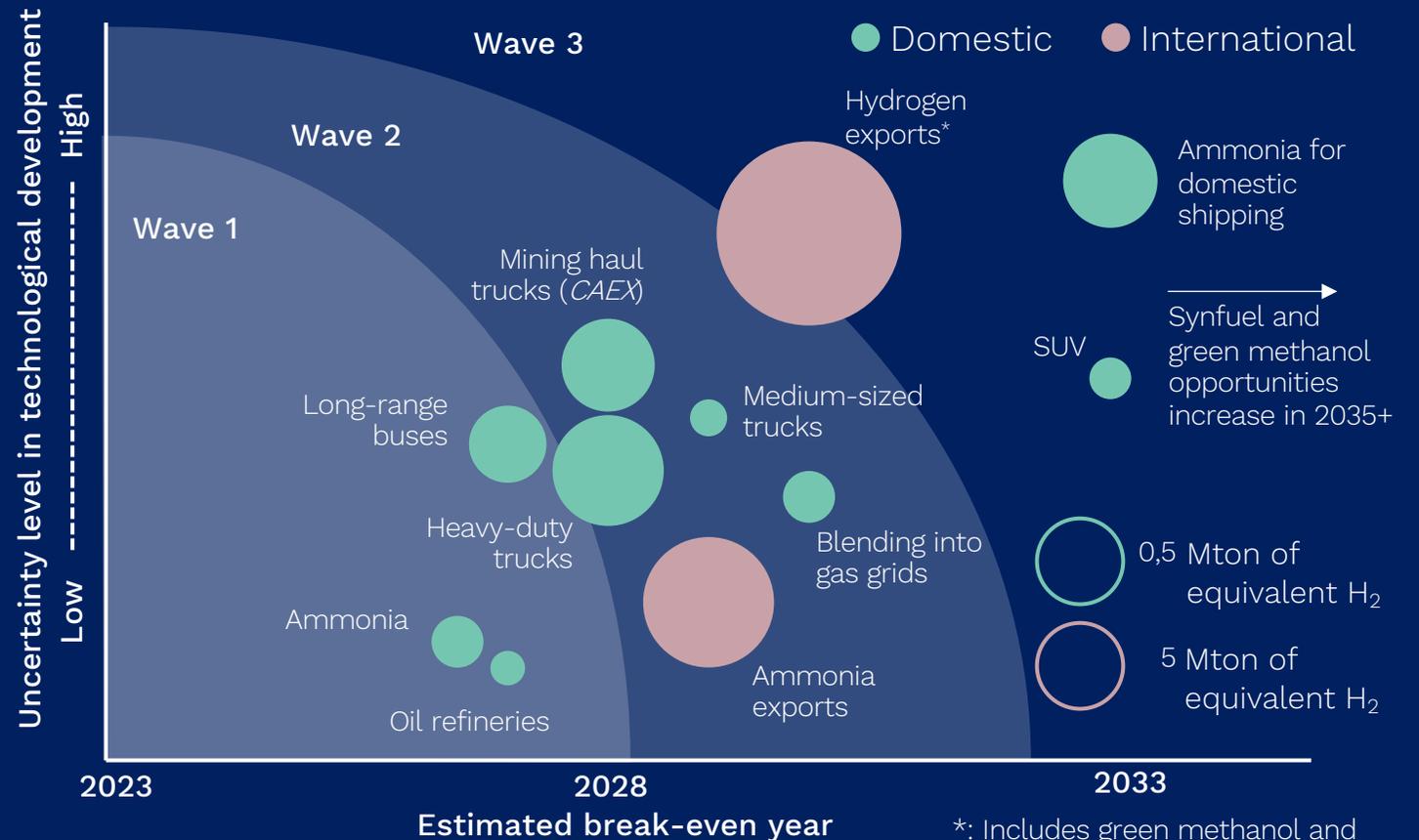
New export markets open in the long-term, enabling a massive scale-up of production.

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 & Company.



*: Includes green methanol and synthetic fuel exports.

A new productive identity for Chile

Chile can tread the path from a country historically focused on exploitation of non-renewable resources to a nation that adds green value to its exports and produces the clean energy carriers which the world needs to abate emissions.

A once-in-a-century opportunity

The renewable energy potential of our country allows for the production of green copper, clean energy carriers, and other exports with low carbon footprint to abate up greenhouse gas emissions around the world. In Chile, up to 25% of carbon emissions could be efficiently mitigated with the use of green hydrogen by 2050.

We will act in a decisive and effective manner to create an industry that shall be a hub for growth and development in our country

If even only a fraction of the full potential for green hydrogen is deployed in Chile, large amounts of investment will generate growth and local value in our regions, as well as creating up to 100.000 new sophisticated and satisfactory jobs, during the next few decades.

7 AFFORDABLE AND CLEAN ENERGY



8 DECENT WORK AND ECONOMIC GROWTH



9 INDUSTRY, INNOVATION AND INFRASTRUCTURE



13 CLIMATE ACTION



17 PARTNERSHIPS FOR THE GOALS



Mural in Providencia, Metropolitan Region

3

Our Strategy

Ambitions for clean industry

We will accelerate investment in domestic applications to become a relevant player in export markets

Clean technologies need more than economic breakeven

Green hydrogen requires early and proactive public-private coordination to lower barriers to its development. Chile has experience in this field from facilitating the growth of renewable energies and electromobility.

Export ramp-up depends on domestic momentum

An efficient and effective entrance into export markets requires first building local knowledge, scale, and infrastructure.

Starting with a domestic hydrogen ecosystem will increase the share of created value that can be captured by local talent and companies.

A late start would forfeit significant opportunity capture

The global hydrogen market will require long-term, locked in contracts to reduce the large investment risks on supply and demand sides. Chile's competitors are already moving to lock in these contracts with future importers.

Establishing reliable long-term relations and contracts with importing countries, parallel to the growth of a local industry, will allow Chile to capture a significant share of the global markets for green hydrogen and its derivatives.

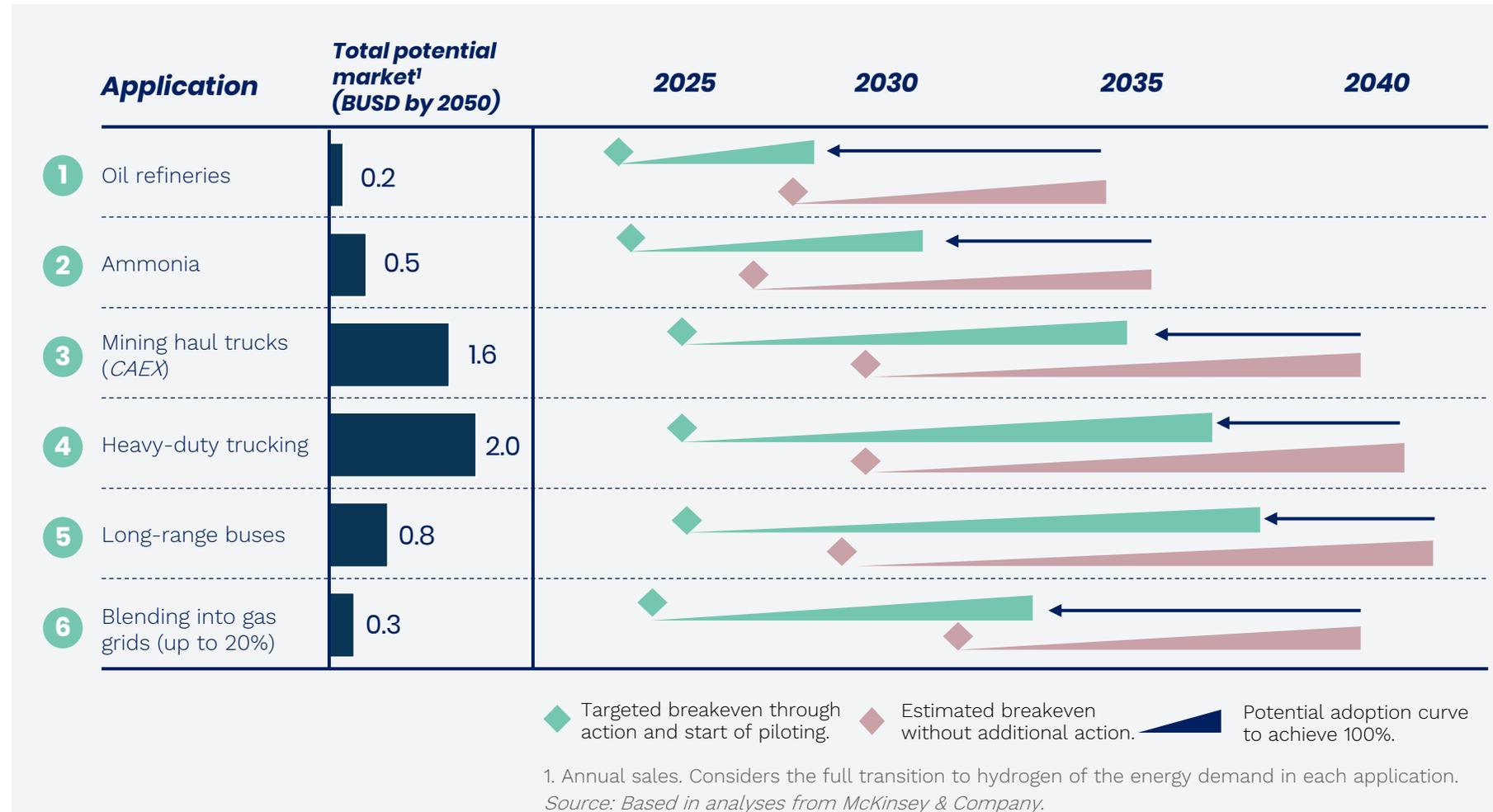


Wave I: 2020–2025

Domestic ramp up and export preparation

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.



Waves II & III: 2025–2030 & 2030 onwards

Capitalizing on export markets and leveraging scale to expand

Wave II: We will leverage our domestic base to scale into a key player in export markets.

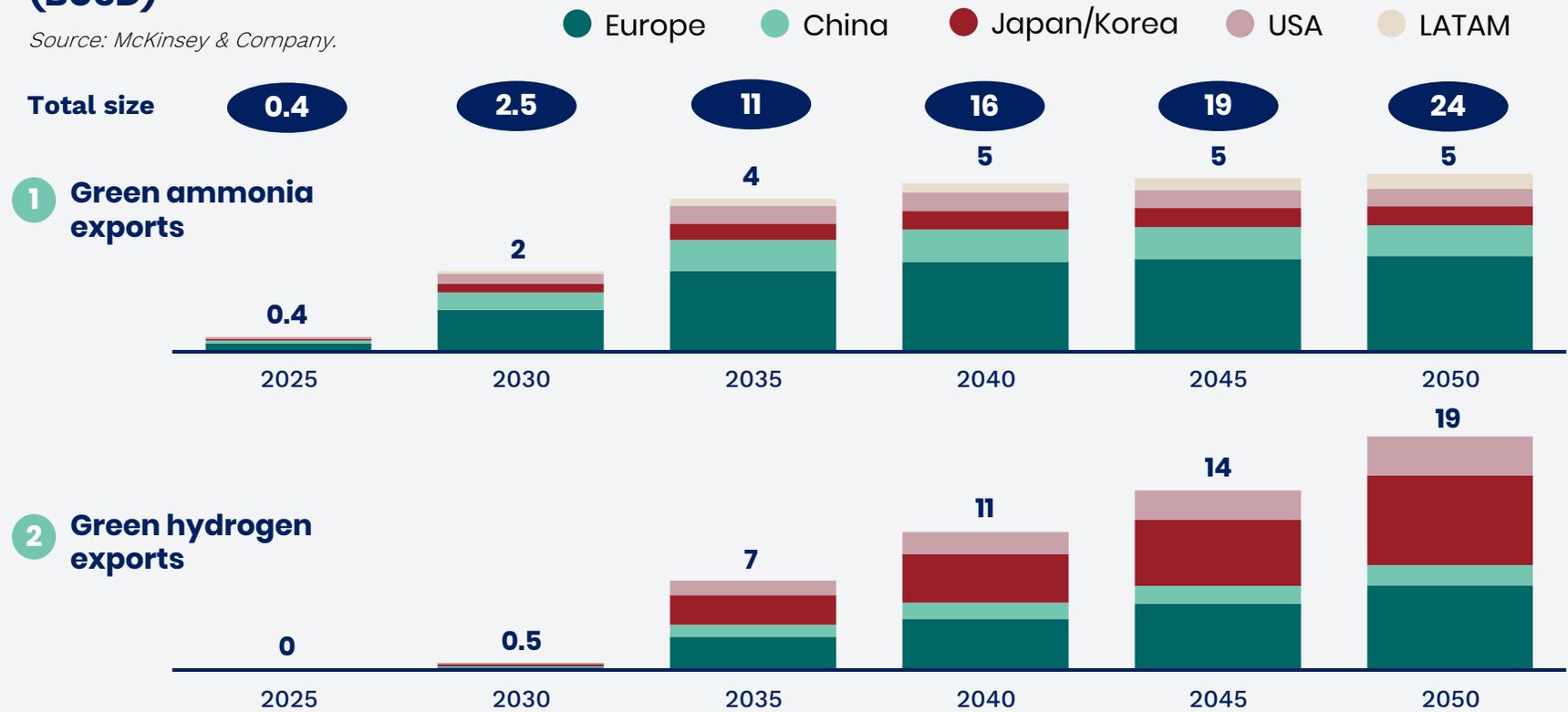
An industry of green ammonia production and exportation will be put in place through support for GW-scale consortiums. Offtake and investment commitments for ammonia and hydrogen exports will be secured.

Wave III: We will exploit synergies and economies of scale to expand as a global supplier of clean fuels.

As countries take action to decarbonize their economies and new technologies are developed, the export markets for clean fuels will scale and diversify, opening opportunities for further growth. Future applications for ammonia in shipping and synfuels in aviation are promising opportunities for additional scale-up.

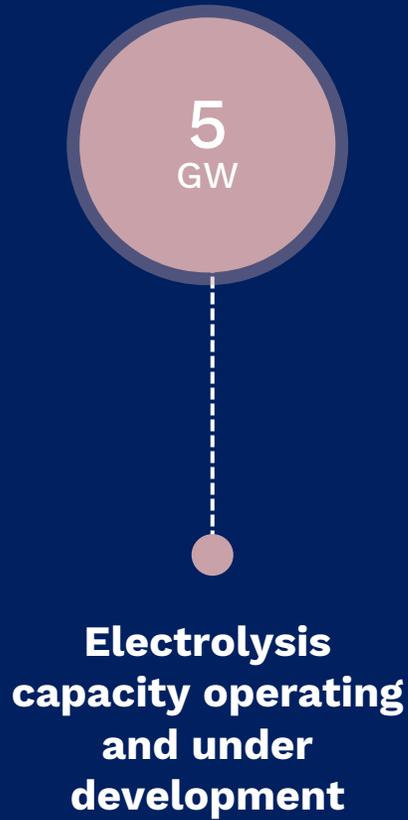
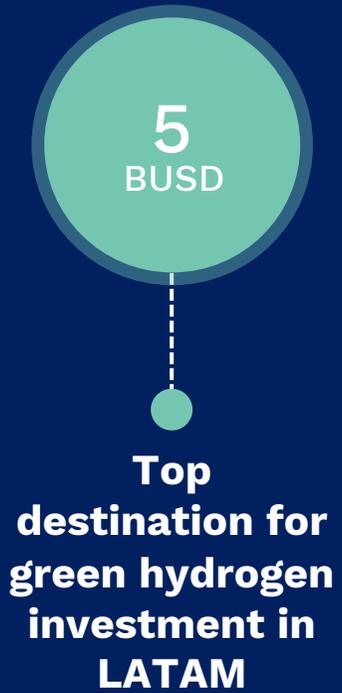
Estimated market size for Chilean exports (BUSD)

Source: McKinsey & Company.



Our ambition

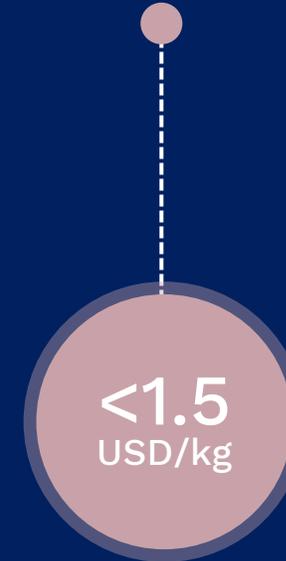
2025



Leaders in export of green hydrogen and derivatives



The cheapest green hydrogen on the planet



Leaders in production of green hydrogen via electrolysis



2030



4

Pillars

Propping up our actions





Mission-oriented policy

The State shall be a facilitator, coordinator, and promoter of the mission to establish a new industry through multisectoral efforts.

The public sector will play a central role in identifying and lowering barriers, as well as reducing regulatory, financial, and technical uncertainties to achieve the intended long-term objectives. Private initiatives and capabilities from companies, academia, and associations, shall build upon these fundamentals to become leading actors in the development of the technologies, businesses, investments, and projects required to scale up efficient and competitive domestic and export markets. This public-private coordination will enable clean, intelligent, and inclusive growth in our country.

Proactive State: Drive and coordinate joint action by various sectors, providing clear signals to private initiatives, as well as promoting local value creation and capture.



Balanced use of resources and land

Green hydrogen industrial development shall be coherent with its socioenvironmental context, incorporating best practices and dialogue.

Chilean institutions will safeguard the safety of the public and our environment, as well as establish a dialogue with local communities. Respect and coherence with territorial planning instruments will also contribute towards a fair energy and economic transition. Institutions shall strive to achieve an industrial growth that improves the living standard of citizens; overseeing the responsible use of water resources and promoting concepts of circular economy.

Quality of life: This industry shall be developed in harmony with its environment, paying special attention to a responsible use of water jointly with neighboring communities and activities.



New economy based on clean exports

Green hydrogen clears the way for a new Chilean export economy based on clean energy carriers and products of low carbon footprint.

To achieve the decarbonization of the global economy, the world requires green minerals, food, raw materials, and manufactured goods. Chile will excel in fulfilling these needs with a clean and competitive export sector based both on green hydrogen and its derivatives, as well as on the production of low carbon goods. Just as over a century ago Chilean saltpeter was at the core of the world's food supply, today its green ammonia will enable low carbon fertilizer production for a modern agriculture. And, for the first time in its history, Chile will become a net exporter of energy to the world.

Exporting vocation: Chile remains committed to an open economy. In the future, it will supply clean products to a global energy transition, from green minerals to carbon-neutral synthetic fuels.



Efficient pathway to a net-zero country

Our country is committed to a transition towards a net-zero economy, in which green hydrogen will play a fundamental role.

An efficient transition from fossil fuels to clean energy systems requires the use of green hydrogen and its derivatives, such as methanol, ammonia, and synthetic fuels, in sectors such as maritime, air, and land transportation, mining, industry, and power. Efforts in Chile will be focused on integrating green hydrogen and its derivatives in applications in which these abate emissions in an efficient manner. Other solutions will be needed to abate sectors and applications in which hydrogen use is not cost-effective or feasible.

Complementarity: Green hydrogen will enable a net-zero economy alongside other solutions. Competitive energy efficiency shall be prioritized whenever it is feasible.



Green hydrogen as a catalyst for local growth

The industry and projects created around this clean fuel will generate local hubs for investment, innovation, and economic activity.

Public and private stakeholders are collaborating closely to develop green hydrogen in Chile. The State shall continue to promote investment and innovation that effectively produces local value in the communities and regions where hydrogen is developed. Initiatives that create opportunities for national employment and capability development will be encouraged, while safeguarding the needs, desires, and strengths of each territory. Likewise, the State shall explore and promote applications for green hydrogen that produce relevant local co-benefits.

Participatory environment: Projects and applications will be harmonically integrated into our country, giving preference to the creation of local value and growth.



Openness to the world

Only through international collaboration will the global green hydrogen economy be developed at the speed that climate action requires.

Our transparency, solid institutional framework, non-discriminatory investment rules, and transparent openness to trade have allowed for internationally competitive and dynamic economic sectors to develop in Chile. These same characteristics make it an attractive destination for investing in clean technologies and will be required to enable a rapid scale-up of the green hydrogen industry. Its first stages shall be accelerated by a new paradigm of cooperation and competition, vision denominated as “coopetition”, in which exporting and importing countries will share experiences and technologies.

A good partner: Chile will collaborate widely with public and private international stakeholders to scale up global green hydrogen markets.

Coast in Viña del Mar, Valparaíso Region

5

Action plan

Committed, together

Promotion of domestic and export markets

Green hydrogen is still at an early stage in our country. Pilots and demonstrative projects are still under development, and challenges to the scale-up of production and use in various applications persist. The key perceived barriers to accelerated development are asymmetries of information, lack of coordination between supply and demand sides, technological and financial risks, as well as cost gaps in relation to fossil-powered solutions. Initiatives that support and increase the competitiveness of early green hydrogen projects will kick-start a well-functioning market, will reduce uncertainties for investors and developers, and will unlock economies of scale and economies of scope.

Welder in La Pintana, Metropolitan Region

Launch of a funding round of up to 50 MUSD to support green hydrogen projects

Early and efficient green hydrogen projects focused along the whole value chain will be supported with financial assistance to help close economic gaps. Selected projects will help to achieve the target of 1.5 USD/kgH₂ by 2030. This will aid a functioning market and the growth of local industry. The funding round will support companies and national and international consortiums to invest in scalable and replicable green hydrogen projects in Chile.

Establishment of a public-private roundtable, to discuss the path towards a carbon price and taxes that better reflect the externalities of fossil fuels used in Chile.

A roadmap towards adequate mechanisms, prices, timings, and graduality regarding the internalization of social costs incurred when using fossil fuels will be constructed through dialogue between key and varied stakeholders. Proper pricing of emissions originating from hydrocarbon use will level the field for competition between conventional fuels and new energy carriers. Recent international studies and recommendations shall be strongly considered, such as those by the IMF and the OECD, to achieve the goals of the Paris Agreement.

Chile will deploy a green hydrogen diplomacy to position itself internationally as a source of clean fuels and energy carriers.

The strong and wide-reaching network of commercial and technical agreements that Chile is a part of will be leveraged to mobilize human and material resources that accelerate the development of green hydrogen in the country. International platforms and diplomatic relations with 171 States will be key to unlocking the potential for green hydrogen locally and globally.

Standards, safety, and piloting

Regulation is a cornerstone upon which all industries are built upon. Early definitions regarding standards and oversight activities will safeguard the safety of operators, users, the public, the environment, goods, and infrastructure, as well as accelerate the scale-up of production, storage, handling, and usage of green hydrogen and its derivatives. Clear and stable regulation also delivers certainty to developers and investors so projects and applications can be implemented with reduced risk. Regulatory mechanisms that allow for pilot projects and for dedicated authorizations for projects whose regulation is still not available, are also necessary.

Chuquicamata copper mine, Antofagasta Region

Bridging of regulatory and standards gaps throughout the hydrogen value chain to ensure safety and give certainty to investors.

A regulatory development plan, coordinated throughout all public services that hold regulatory authority over the hydrogen value chain, will be executed to establish the standards required by industry. The result of this action will be more agile and safer development of domestic applications and export industry. Regulation will be developed in coordination with the private sector, promoting international standardization and harmonization.

Establishment of a task force to accompany developers in permitting and piloting processes for green hydrogen projects and derivatives.

Coordinated of public services through an agile framework to enable smooth piloting and development of hydrogen projects and new applications, especially in the mining, transportation, and energy sectors. These actions will reduce uncertainty for private initiatives, generate learning, solve market coordination failures, and insure a safe introduction of new fuels and processes.

Review of natural gas regulation and infrastructure to promote the introduction of green hydrogen quotas.

The physical capability of existing natural gas infrastructure to safely incorporate blending of hydrogen will be studied. International experience will also be considered when discussing a gradual mechanism for green hydrogen quotas in gas grids. Such a regulatory mechanism would create a stable and large-scale demand for domestic production of this clean fuel, would further utilize existing infrastructure, and would complement natural gas in the energy transition to a sustainable energy system.

Social and local development

Sustainable development of this new industry will take into consideration development throughout the country. The interests, activities, groups, collective visions, needs, and strengths present in each region shall be considered when developing projects. If this transversal development is achieved, then the green hydrogen potential of Chile will truly enable organic and decentralized growth. Early and transparent dialogue between the various stakeholders in each initiative is a condition for success in this regard, in addition to the exploration of the multiple existing alternatives for value sharing between private initiative and local communities. Further, studying new potential uses for green hydrogen to reduce pollution and generate synergies in various regions could lead to a more efficient and coherent development of new infrastructure and local policies.

San Pedro de Atacama, Antofagasta Region

Creation of early and transparent participatory mechanisms between communities and projects.

Dialogue between hydrogen project developers and neighboring communities will be articulated by the State, ensuring robust communication and capacity building. Agreements and mechanisms between the stakeholders may be brokered in order to promote the generation of local supply chains, capabilities, and best practices regarding territorial and communal interests.

Exploration of green hydrogen uses to replace or complement fossil fuel-based generation in isolated electric systems.

Green hydrogen may be a key mechanism to facilitate higher integration of renewable energy into power grids that are isolated from the National Electricity System. An evaluation of this potential will be carried out, as well as the identification of specific barriers to green hydrogen deployment in these systems, including potential regulatory and market barriers to their integration into planning and expansion processes of medium-sized systems.

Assessment of opportunities and challenges offered by green hydrogen to territorial plans, policies, and distribution.

Policies and plans that determine the potential land uses in various regions have not usually considered the alternative of green hydrogen deployment. These instruments will be re-assessed in light of the new possibilities that green hydrogen unlocks, in order to facilitate a coherent and rational integration of these activities in our regions and their use of land and natural resources. Potential synergies and challenges with other human activities and requirements, such as use of water resources, shall be specifically considered.

Capacity building and innovation

Local technicians and specialists with adequate knowledge and skills will consolidate a national hydrogen ecosystem. Strong local capacities will give way to new businesses, technical innovations, and productive employment. The State, in its strategic role, will promote educational, research, development, and innovation activities associated to green hydrogen. Special emphasis will be given to applications of national interest that contribute to the objectives laid out in this Strategy. Navigating the learning and development curves of this new sector will generate new knowledge that can spur unique local competitive advantages. A sophistication of the local supply side of goods and services will ensue, as well as the opportunity for exporting know-how and new techniques from Chile to the rest of the world.

ESO Telescope in Cerro Paranal, Atacama Region

Industry, academia, and technical centers will work together to identify gaps and prepare national capabilities to supply a new, burgeoning industry.

Competencies and technical skills required along the value chain of green hydrogen will be identified jointly by public and private stakeholders. A coordinated preparation of those capabilities by national educational institutions will be articulated. A timely preparation in this regard will improve the projections for sophisticated, satisfactory, and good quality work positions.

An R&D roadmap to solve local implementation challenges will be constructed by the public and private sectors.

A roadmap with milestones, pilots, and necessary activities to develop new required knowledge for an accelerated deployment of green hydrogen will be elaborated. This work shall include collaboration with the awardee of the Clean Technologies Institute –innovation platform with public funding of up to 193 MUSD –. Such a planning effort will tend to the demands originating in the growth of a dynamic, challenging, and technologically advanced sector.

A work group with public companies will be created to accelerate the adoption of green hydrogen in their activities and in their supply chain.

Conditions and actions necessary to efficiently incorporate green hydrogen in the processes and activities of public companies will be determined, in order to promote a cost-effective emissions reduction. The competitiveness and capabilities of State-owned enterprises, such as ENAP and Codelco, shall be strengthened through this action, in a world that demands an increasing share of clean products and energy carriers.

Governance

Ministry of Energy
Division for
Fuels and New Energy Carriers

**National Council
for Green
Hydrogen**

Will be responsible for monitoring this Strategy, coordinating the execution of its action plan, and carrying out an update process every 3 years.

Will coordinate through

**National
task force**

Accelerate the deployment of hydrogen projects and applications

**Public-private
dialogue platform**

Connect industry, academia, civil society, and international partners

**International
task force**

Attract investment and support formation of GW-scale consortiums

Nahuelbuta National Park, Araucanía Region

Promotion of domestic and export markets

Set up a Public–Private Agreement for Hydrogen in Mining and Transportation, alongside key public and private stakeholders to define specific barriers and actions to be carried out to accelerate the adoption of hydrogen in these sectors.

Promote studies and coordination initiatives jointly with countries that declare themselves as net hydrogen importers to promote commercial initiatives for export–import.

Exchange experiences and formulate collaborative initiatives to bolster the deployment of green hydrogen production and use in Chile through bilateral and multilateral agreements.

Study and promote the establishment of international certification systems for carbon footprint and guarantees of origin of green hydrogen.

Analyze, hold, and lease public lands which display adequate conditions for competitive development of green hydrogen and its derivatives.

Standards, safety, and piloting

Modify Law DFL 1 from 1979 and Law DL 2.224 to define hydrogen as an energy carrier and, thus, allow for by-laws to be emitted to regulate safety issues along its value chain.

Communicate about the request process for dedicated authorizations from the Superintendency for Electricity and Fuels, as well as communicate procedures and conditions to carry out piloting in various applications.

Review and update power market regulation to effectively allow the participation of hydrogen technologies in the provision of various services, including energy, capacity, and ancillary services.

Social and local development

Communicate knowledge of green hydrogen to the general public with a focus on environmental and safety opportunities and challenges to generate increasing trust in its use.

Analyze and promote reconversion and/or reutilization of infrastructure of coal power plants for the production and utilization of green hydrogen.

Review land use regulations applicable to the green hydrogen value chain and review associated permitting processes to identify and reduce potential barriers to its development.

Study key infrastructure needs associated with each region to identify opportunities for local development.

Capacity building and innovation

Prepare diverse groups of public servants, such as regulators, evaluators, overseers, and others, on the implications of green hydrogen development on their fields of action.

Elaborate a plan to prepare emergency response teams, including firefighters, paramedics, and others.

Horizontally communicate through industry and academia the results and lessons learned in publicly funded R&D initiatives, such as technological development consortiums.

Identify and connect stakeholders that develop research and development activities to promote collaborative innovation on solutions that address local challenges prioritized for the country.



National Green Hydrogen Strategy