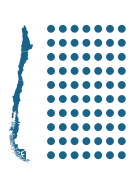


# INTRODUCTION TO HYDROGEN ECONOMY

Climate change challenges present and future generations to implement mitigation and adaptation plans that allow rethinking the development of countries including an ecocentric view. In this line, hydrogen (H<sub>2</sub>) gives us the opportunity to accelerate the energy transition, as well as the possibility of working for a future with less greenhouse gases emissions.

If this new energy source is produced with zero emissions, it will be key to the decarbonization plans of countries, companies, institutions, etc.

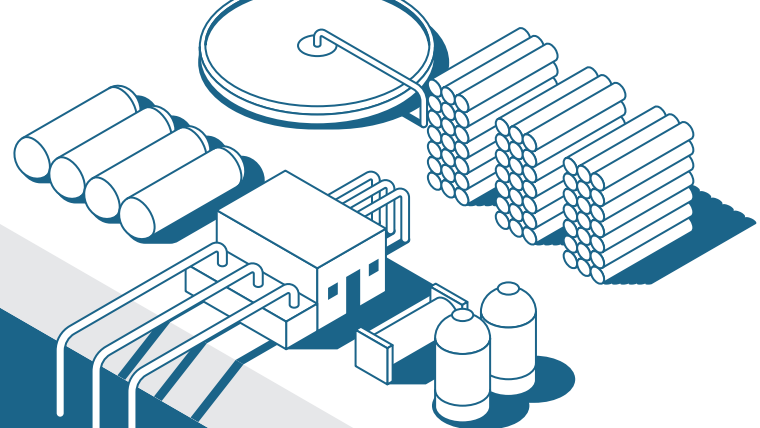
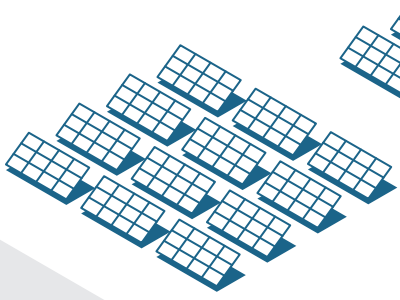
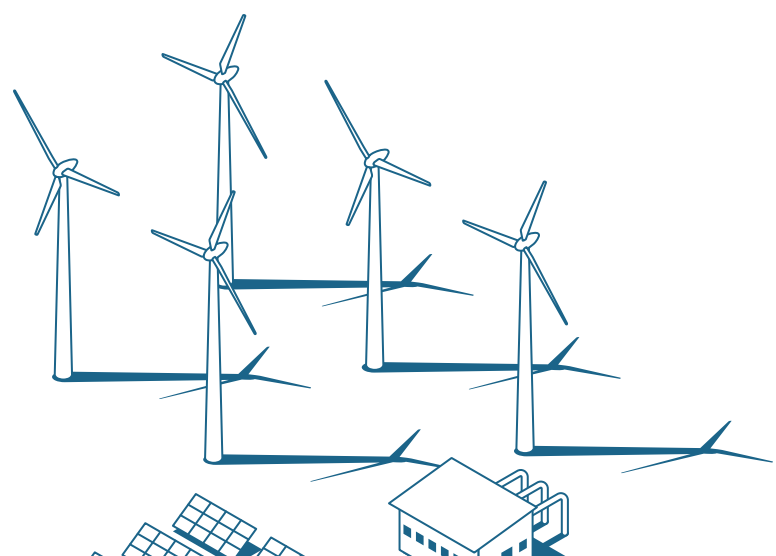
## 1 Renewable energy



Chile's renewable energy potential is more than 1.8 PW, equivalent to 70 times the current installed capacity of the electrical matrix. This will allow Chile to produce green hydrogen at low costs.

**70 times**

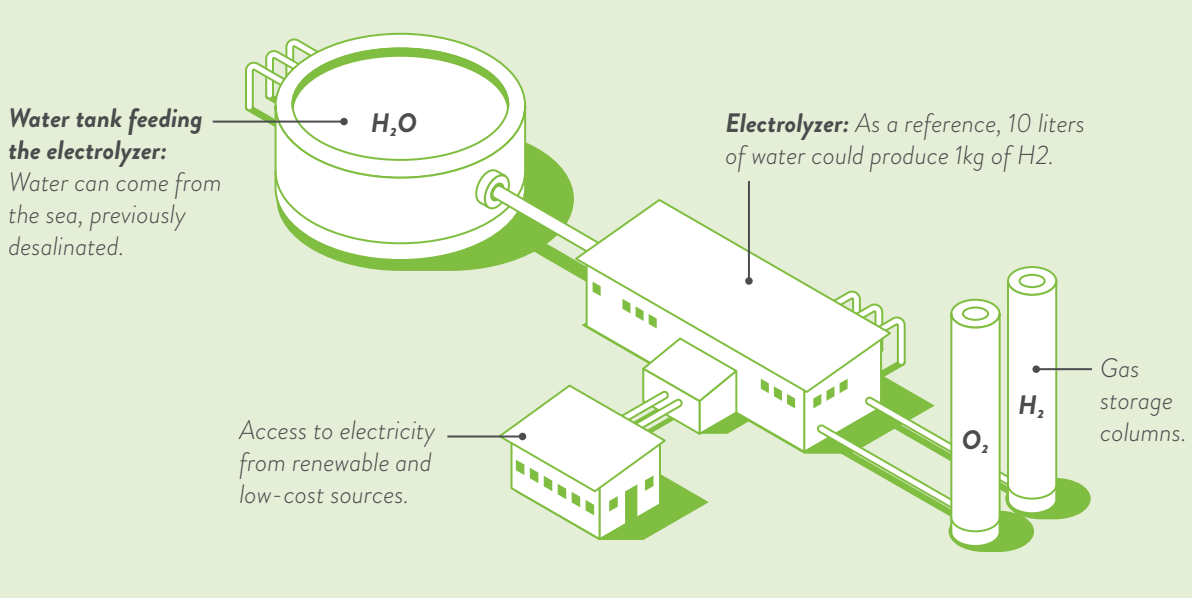
Source: Ministry of Energy



## 2 Desalination plant

The water to generate green hydrogen can be obtained from seawater desalination. However, it must meet a certain degree of purity in order not to damage the electrolyzer. Generally, for a PEM electrolyzer (Proton Exchange Membrane), the water input must be type II according to ASTM 1193 standard.

## HOW THE GREEN HYDROGEN PRODUCTION PLANT WORKS?



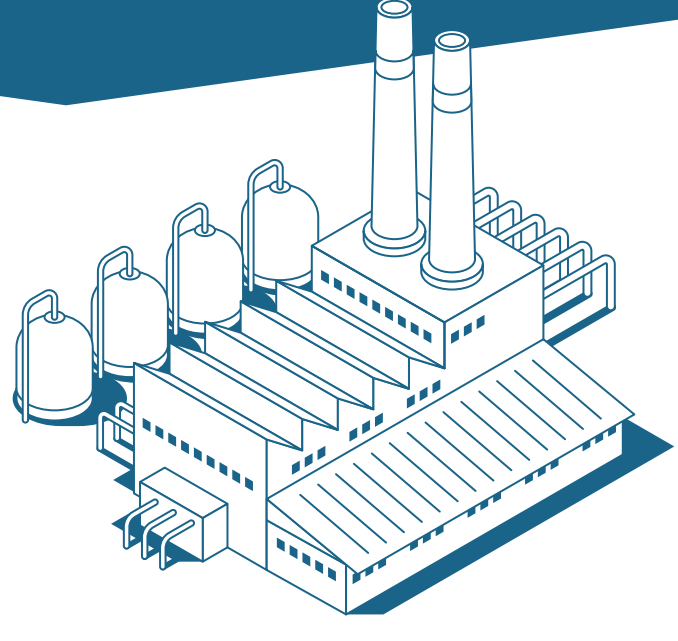
## APPLICATIONS OF GREEN HYDROGEN

### INDUSTRY

At present, the use of hydrogen has been focused as an input in the chemical industry. The production of ammonia for fertilizers and explosives represents 54% of worldwide use.

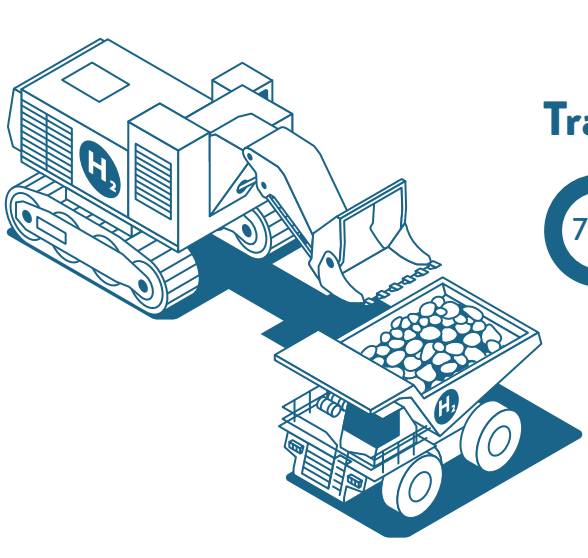
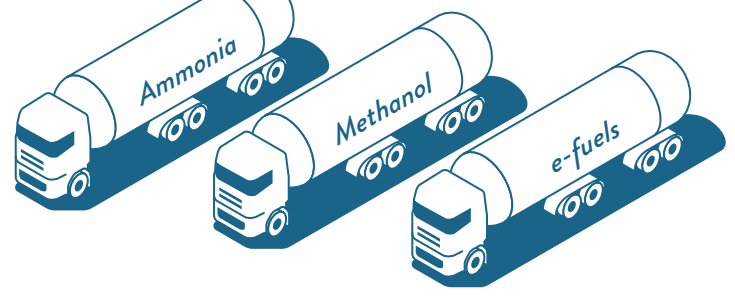
Source: Tractebel.

In Chile, the main use of hydrogen is in the petrochemical industry.



### Hydrogen by-products

There are a number of innovations regarding new uses of hydrogen, one of them is the use of this energy vector as an input for carbon-neutral synthetic fuels which would allow a natural transition without the need to modify the final applications that we currently use, such as cars, buses, energy engines, etc.



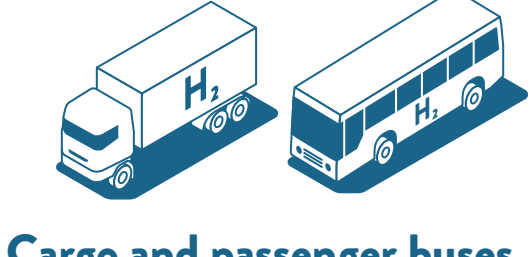
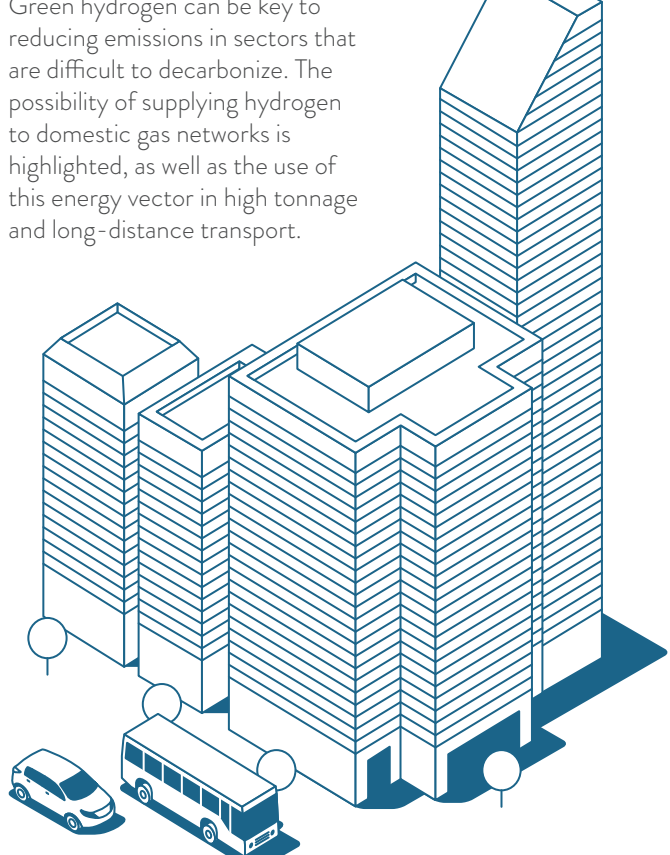
### Transportation in mining

In the mining industry, hydrogen can be used as a fuel for high tonnage mining trucks, replacing the combustion engine with electric motors powered by hydrogen fuel cells. Each of these trucks consumes about 3,000 liters of diesel per day, equivalent to 70% of direct emissions in the sector, equivalent to 4.5 billion kg of CO<sub>2</sub>eq.

Source: SONAMI

### CITY

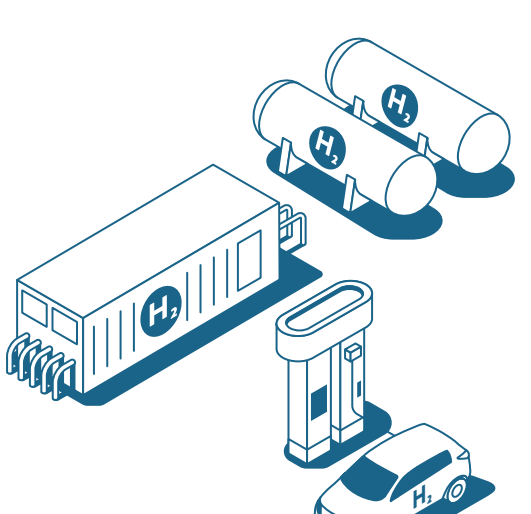
Green hydrogen can be key to reducing emissions in sectors that are difficult to decarbonize. The possibility of supplying hydrogen to domestic gas networks is highlighted, as well as the use of this energy vector in high tonnage and long-distance transport.



### Cargo and passenger buses

According to Chile's NDCs by 2050 71% of freight transport will be hydrogen powered.

Source: Ministry of Environment



### Hydrogen Refueling Station (HRS)

They are the base for H<sub>2</sub> supply in the transport sector. Depending on the final application, storage is usually found in the range of 400 to 1000 bar. The technical standards for this equipment are SAE J2600, SAE J2601, among others.

## HYDROGEN EXPORTS

Green hydrogen seeks a new economy based on clean exports, being this one of the main pillars of the national hydrogen strategy. Hydrogen allows exporting Chile's renewable energy potential to the world.

### H<sub>2</sub> cargo vessels

Transportation by ships is generally carried out via ammonia or hydrogen in liquid form.

**-253°C**

The temperature of cryogenic hydrogen is approximately -253°C.

Source: Shell

