



REPÚBLICA
PORTUGUESA

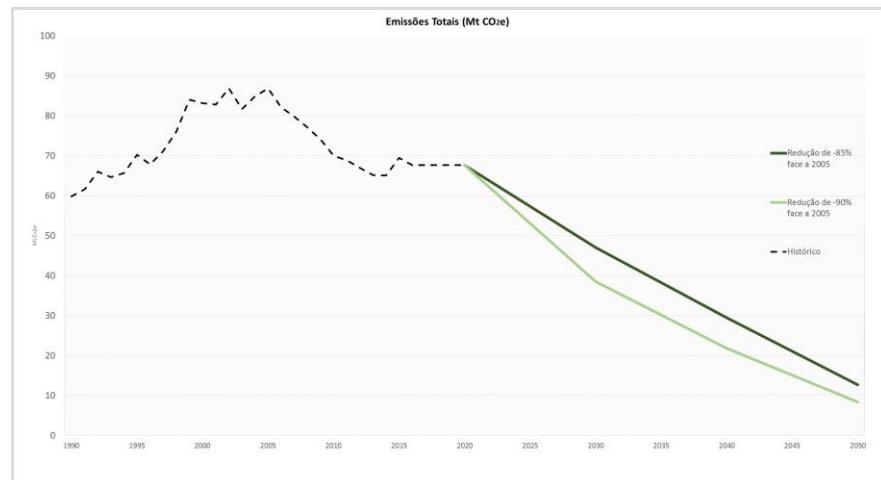
PORtUGAL NATIONAL HYDROGEN STRATEGY (EN-H₂)

A new ally for the energy transition in Portugal

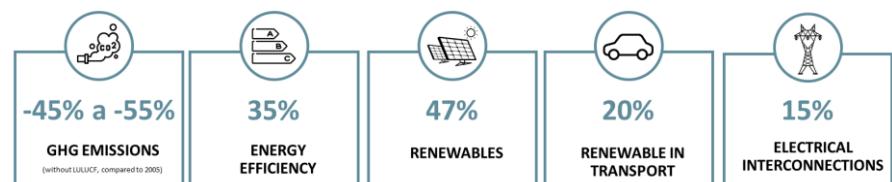
PORtugal is committed to achieving the objective of carbon neutrality in 2050, setting ambitious, but realistic goals for 2030

- In order to achieve the goal of carbon neutrality in 2050, it will be necessary to comply with a trajectory that leads to a reduction of 85% to 90% in GHG emissions by 2050;
- The National Energy and Climate Plan 2021-2030 (PNEC 2030) defines the policies and measures for the next decade to achieve carbon neutrality in 2050;
- Achieving carbon neutrality, and the 2030 targets, means betting on a combination of different technologies and energy vectors;
- Hydrogen will be a fundamental vector for the decarbonization of various sectors of the national economy towards carbon neutrality.

GHG reduction trajectory in the 2050 horizon (Source: RNC2050)



Targets for 2030 (Source: PNEC 2030)





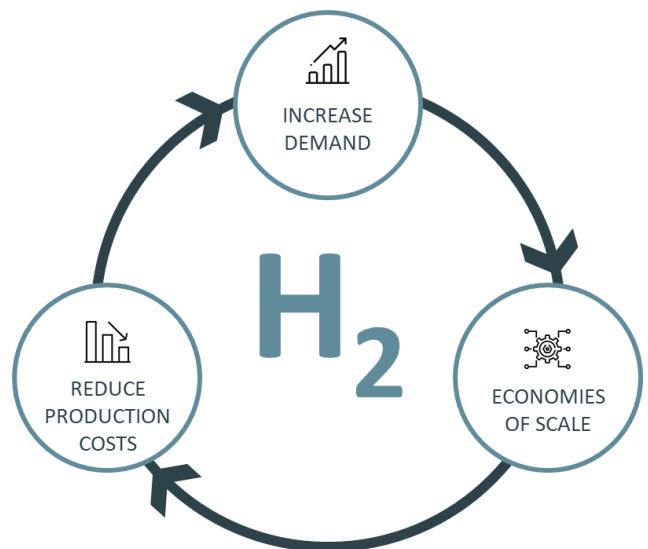
PORtugal is a leading country in renewable energies in the European context and has achieved high levels of renewable penetration

	2018	EU position	2020 target	2030 target
RES in Final Energy consumption	30.3%	6 th	31% ⁽¹⁾	47%
RES in the Electricity sector	52.2%	5 th	60%	80%
RES in the Transport sector	9.0%	5 th	10% ⁽¹⁾	20%
RES in the Heating and Cooling sector	41.2%	7 th	36%	49%

(1) Binding target
SOURCE: EUROSTAT

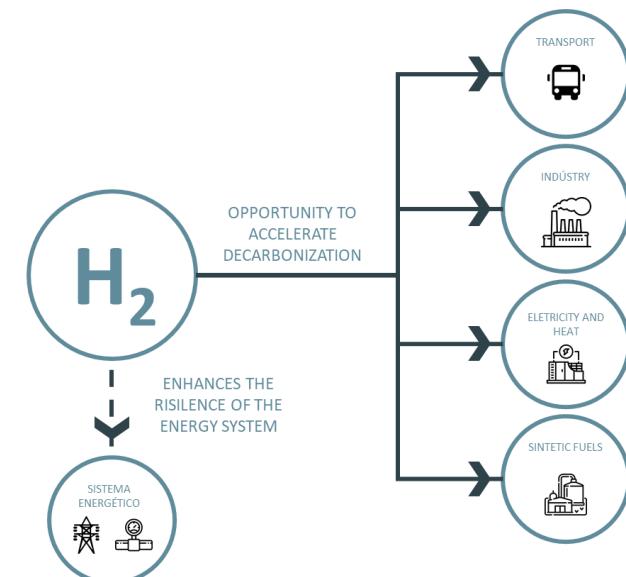
THE NATIONAL HYDROGEN STRATEGY (EN-H₂) AIMS TO FACILITATE AND ACCELERATE THE ENERGY TRANSITION IN THE VARIOUS SECTORS AT THE SAME TIME THAT STRENGTHENS THE NATIONAL ECONOMY

- The EN-H₂ has as main objective to introduce an element of incentive and stability for the energy sector, promoting the gradual introduction of hydrogen as a sustainable pillar and integrated in a more comprehensive strategy of transition to a decarbonized economy.
- Frames the current and future role of hydrogen in the energy system and proposes a set of measures and targets for incorporating hydrogen in the various sectors of the economy.
- Gives a solid framework to all companies and promoters with hydrogen projects making possible to consolidate these projects into a broader and more coherent Strategy.
- Promotes an industrial policy around hydrogen, based on the definition of a set of public policies that guide, coordinate and mobilize public and private investment in projects of production, storage, transportation and consumption of renewable gases in Portugal.



HYDROGEN WILL FACILITATE AND ACCELERATE THE ENERGY TRANSITION IN VARIOUS SECTORS, WITH A PARTICULAR FOCUS ON TRANSPORT AND INDUSTRY

1. Complements the electrification strategy, reducing decarbonization costs;
2. It substantially reinforces security of supply, as hydrogen allows renewable electricity to be stored for long periods of time;
3. Reduces energy dependence by using endogenous sources of renewable origin in its production;
4. Reduces GHG emissions in various sectors of the economy as it more easily promotes the replacement of fossil fuels (refining, chemistry, metallurgy, cement, mining, ceramics and glass)
5. Promotes efficiency in energy production and consumption by allowing solutions on a variable scale as needed, close to the place of consumption and distributed throughout the national territory;
6. Promotes economic growth and employment through the development of new industries and associated services.



IT WILL BE ONE OF THE SUSTAINABLE PILLARS THAT ENSURES THE TRANSITION TO A DECARBONIZED ECONOMY AT THE SAME TIME THAT IS A STRATEGIC OPPORTUNITY FOR THE COUNTRY

OPPORTUNITIES FOR THE COUNTRY

DECARBONIZATION OF THE ECONOMY

Hydrogen has the potential to be a decarbonization vector across various sectors of the economy, with a greater impact on Industry, Transport and Energy, positioning itself as a cost-effective solution in the medium term.

ASSET FEASIBILITY

The growing production and consumption of hydrogen presents an opportunity to make the current natural gas infrastructure viable, leveraging the complementarity between the electricity sector and the gas sector (coupling sector).

STRENGTHENING RENEWABLE ENERGY SOURCES AND INCREASING THE SYSTEM'S RESILIENCE

Hydrogen will play an important role in enabling greater incorporation and valuation of renewable electricity.

STRENGTHENING OF THE RENEWABLE ENERGY EXPORT POTENTIAL

The production of hydrogen, in the part that exceeds the goals of internal consumption, constitutes an opportunity for Portugal to become an increasingly exporting country of renewable energies, taking advantage of its competitiveness and great potential in this sector.

PROMOTING INDUSTRIALIZATION

The national industry, using existing knowledge and capabilities, can take advantage of this new hydrogen economy through, for example, the production of equipment with high export potential (Salvador Caetano already produces hydrogen buses)

RESEARCH, DEVELOPMENT AND INNOVATION

The development of a hydrogen economy contributes to enhance national Research and Innovation (I&I)

CREATION AND RECONVERSION OF EMPLOYMENT (GREEN)

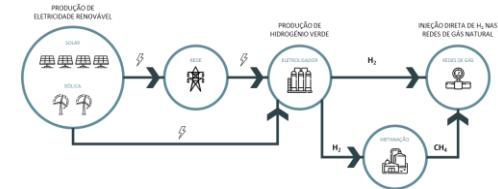
Portugal has already demonstrated that the adoption of ambitious policies associated with the energy transition and decarbonization are directly related to economic growth and job creation

STRENGTHENING INTERNATIONAL COOPERATION

THE CHARACTERISTICS OF PORTUGAL ENERGY SYSTEM DETERMINED THE SELECTION OF A SET OF STRATEGIC CONFIGURATIONS FOR THE HYDROGEN VALUE CHAIN

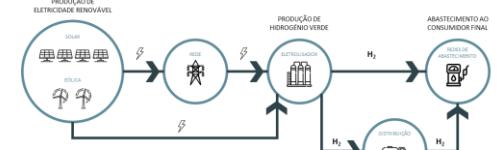
POWER-TO-GAS (P2G)

Green hydrogen can be injected directly into the natural gas networks (transport and distribution) or through the conversion of hydrogen to synthetic methane



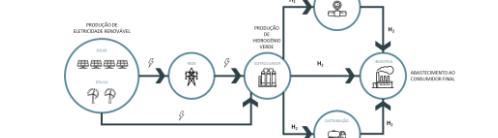
POWER-TO-MOBILITY (P2M)

Hydrogen is transported, or produced locally, to supply vehicle filling stations



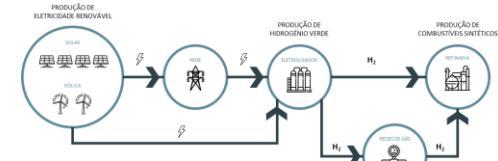
POWER-TO-INDUSTRY (P2I)

Replacing natural gas with hydrogen in the industrial sector (refining, chemistry, steel, among others) contributes more quickly to reducing your GHG emissions



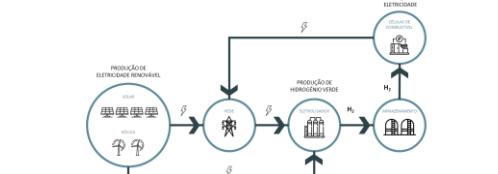
POWER-TO-SYNFUEL (P2FUEL)

The use of green hydrogen has great potential to decarbonize the production of fuels, replacing them with synthetic fuels from renewable sources (production of "green" synthetic fuels for aviation)



POWER-TO-POWER (P2P)

Excess renewable electricity can be converted to hydrogen, stored and then converted back to electricity via fuel cells or in properly adapted gas power plants



PORtugal PRESENTS VERY FAVORABLE CONDITIONS, EVEN UNIQUE, FOR THE DEVELOPMENT OF PROJECTS AROUND THE HYDROGEN, HAVING ALREADY CALLED THE ATTENTION OF INTERNATIONAL PLAYERS

CRITERIA FOR THE SELECTION FOR HYDROGEN PROJECTS

1. Off-take	<ul style="list-style-type: none"> ▪ Proximity to off-take ▪ Existence of industries (steel, refining, chemistry) 	+++
2. Water	<ul style="list-style-type: none"> ▪ Access to water sources, namely sea water or wastewater, which are technically possible today and without incurring significant cost increases. 	+++
3. Renewable resources	<ul style="list-style-type: none"> ▪ High availability of renewable resources 	+++
4. Land	<ul style="list-style-type: none"> ▪ Land availability (600 m² for every 100 MW of electrolyzers) 	++
5. Policy	<ul style="list-style-type: none"> ▪ Favorable policy framework ▪ Existence of support mechanisms 	+++
6. Curva de preço / % Renováveis	<ul style="list-style-type: none"> ▪ Market with significant number of hours with electricity at low cost ▪ High availability of renewable electricity or access to PPAs 	++
7. Infrastructure	<ul style="list-style-type: none"> ▪ Access to transport infrastructure (gas pipelines and ports) 	+++



THE PORTUGUESE GOVERNMENT ALREADY HAS IN COURSE SHORT-TERM ACTIONS THAT ALLOWS TO RECOGNIZE AND VALUE HYDROGEN

MAIN INITIATIVES IN THE SHORT TERM

INITIATIVE	DESCRIPTION	TYPE	STATUS
REGULATING HYDROGEN INJECTION IN THE GAS NETWORKS	Enabling the injection of hydrogen, and other renewable gases, into the natural gas transport and distribution networks has the advantage of reducing costs and barriers to the entry of hydrogen into the system, prevents gas assets from becoming idle in the future, takes advantage of a system in operation that allows the immediate integration of hydrogen in the national energy system.	LEGISLATION	ONGOING
SET HYDROGEN INCORPORATION TARGETS	Ensure the demand side, in addition to boosting the production side, which creates the necessary conditions for a true hydrogen economy in Portugal, so ambitious but realistic targets for incorporating hydrogen in the various sectors of the economy will be set, compatible with the ambition of the various sectors in the energy transition, with the current and future investment capacity and with the availability of technological solutions.	LEGISLATION	ONGOING
SUPPORT INVESTMENT IN HYDROGEN PROJECTS	Prepare and launch a Call to support projects for the production and distribution of energy from renewable sources, which will include the hydrogen component, which will have a budget of around 40 million euros.	FINANCING	ONGOING
IMPLEMENT A MECHANISM TO SUPPORT THE PRODUCTION OF HYDROGEN	Clear and transparent support mechanism to the production of green during the period 2020-2030 by providing support to cover the difference between the production cost of green hydrogen and the price of natural gas in the national market, which will have no translation in the tariffs paid by consumers.	FINANCING	STARTING



IN PARALLEL GREAT PROJECTS AROUND THE HYDROGEN ARE BEING DYNAMIZED THAT ALLOWS TO TAKE ADVANTAGE OF THE COMPETITIVE ADVANTAGES OF PORTUGAL

MAIN PROJECTS

PROJECT	DESCRIPTION	SECTOR	STATUS
INDUSTRIAL PROJECT FOR THE PRODUCTION OF GREEN HYDROGEN IN SINES	Base investment of more than 2.85 billion euros, it is an anchor project of industrial scale that will take advantage of the strategic location of Sines, where an industrial unit of at least 1 GW of green hydrogen production will be installed until 2030, which will position Sines, and Portugal, as an important hub of green hydrogen.	ENERGY	ONGOING
DECARBONIZE A NATIONAL INDUSTRY PRIORITY SECTOR	Streamline and support the decarbonization of a subsector of the industry through hydrogen, which, due to its importance in the national economy and its weight in GHG emissions, represents a strategic opportunity for Portugal (steelmaking that allows Portugal to position itself leading country in the production of “green steel”).	INDUSTRY	STARTING
DECARBONIZE THE TRANSPORT SECTOR	Promote and support hydrogen, in addition to electricity and advanced biofuels, as a solution to achieve decarbonization in the road transport (heavy freight, urban logistics and passenger), in parallel with the dynamization of supply infrastructures.	TRANSPORT	STARTING
IMPLEMENT A COLLABORATIVE LABORATORY (COLAB)	Reference laboratory at national and international level, which will develop R&D activities around the main relevant components of the hydrogen value chain, and which will boost the development of new industries and services, based on highly qualified human resources.	SCIENCE AND TECHNOLOGY	STARTING
USE WASTEWATER FOR THE PRODUCTION OF HYDROGEN	Enhance synergies between the energy and water sectors, with a view to harnessing wastewater to produce green hydrogen, which will constitute a new investment opportunity and to give economic value to a resource that is almost entirely unused.	ENERGY AND WATER	STARTING

PORtugal's Strategy aims to develop a hydrogen economy that contributes to economic growth

EN-H₂ OBJECTIVES FOR 2030



7 000 M€

INVESTMENT IN HYDROGEN PRODUCTION PROJECTS



900 M€¹

SUPPORTS TO INVESTMENT AND PRODUCTION



300-600 M€

REDUCTION IN NATURAL GAS IMPORTS



5%

H₂ IN FINAL ENERGY CONSUMPTION



5%

H₂ IN THE CONSUMPTION OF THE INDUSTRY SECTOR



5%

H₂ IN THE CONSUMPTION OF TRANSPORT SECTOR



15%

H₂ INJECTION IN NATURAL GAS NETWORKS



50-100

SUPPLY STATIONS



2 GW

CAPACITY INSTALLED IN ELECTROLYSERS

(1) Production support mechanism + PO SEUR financing (Considering that the Financial Framework 2021-2027, still under discussion, may allocate 25% of the global expenditure budget to climate action, which includes the energy transition).

NEXT STEPS

1. Publish the revision to the Decree-Law that establishes the organization and functioning of the National Gas System (SNG), which provides, among others, for the injection of renewable gases into the gas networks and the figure of the producer of renewable gases;
2. Start the dialogue with the main stakeholders of the sector - Energy, Transport, Industry - including national associations, which aims to discuss and establish the goals for incorporating hydrogen in the various sectors;
3. Initiate a public consultation process on the EN-H₂;
4. Continue with the implementation of the industrial hydrogen project in Sines, including the submission of an application to the IPCEI (Important Projects of Common European Interest) statute;
5. Continue with the dialogue with European and international partners in the field of Hydrogen (Netherlands, Japan, Canada);
6. Start the work on the implementation of the Hydrogen CoLab;