# Renewable hydrogen, a key energy carrier for Spain and Europe

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# **Europe paves the way in H**<sub>2</sub>





# **Europe paves the way in H**<sub>2</sub>

#### **Green Deal**

Roadmap to a **climate-neutral EU** by 2050.

## Fit for 55

Package of measures to **reduce emissions by at least 55%** by 2030.

Europe continues to move forward on H<sub>2</sub> regulatory frameworks Decarbonisation goals in the EU

Carbon neutrality by 2050

#### **REPowerEU**

European plan to **reduce dependence on Russia** and accelerate the energy transition.

The focus of H<sub>2</sub> demand is on sectors that are difficult to decarbonise, such as industry and heavy transport

> Hydrogen as an energy carrier

## 2030 target: 20Mt of hydrogen consumption in Europe











# **Europe paves the** way in H<sub>2</sub>

#### **REPowerEU Corridors**

DE ENAGÁS

- Lever for the integration of European markets, to conynect producer countries with centres of demand.
- Keys to European energy independence and security of supply.
- The cost of H<sub>2</sub> transmission by pipeline over long distances is 2 to 4 times lower than transmitting electricity over high-voltage lines to produce hydrogen at destination, according to a study by European Hydrogen Backbone.
- The transmission of hydrogen by pipeline **reduces energy losses and avoids over-sizing the electricity infrastructure** to get the same amount of hydrogen to the destination.





# Enagás, catalyst for an H<sub>2</sub> market





## Enagás, catalyst for an H<sub>2</sub> market



\*Enagás' participation is in line with the framework established by the CNMC and will be adapted to EU regulatory developments in this area





#### H<sub>2</sub>'s main projects and partners



2. Relating to Enagás, S.A.'s % stake in Enagás Renovable.

Projects in green have been pre-awarded under the H2 Pioneros programme of PERTE ERHA



DÍA DEL HIDRÓGENO DE ENAGÁS

# Enagás, catalyst for an H<sub>2</sub> market

Main partners in Spain for the development of hydrogen projects

## enagas renovable





# **Enagás, catalyst for an H**<sub>2</sub> **market**

#### Enagás Hydrogen Infrastructures: HNO

As a European TSO, Enagás is ready to be **operator of the future hydrogen network**  More than **50 years' experience** as a developer, owner and operator of the natural gas network

A network of infrastructures that should be the starting point for the development of the future **Spanish H**<sub>2</sub> **Backbone Network**  The **proposed European legislation** confirms that TSO status is compatible with HNO status

H2MED, the first axes and the storage facilities of the future Spanish H<sub>2</sub> Backbone Network were submitted by Enagás to the EU call for Projects of Common Interest on 15 December 2022, according to the announcement made by the Spanish Government









#### **Capacities of Spain**



H2MED presentation at the Euro-Mediterranean Summit as the first European Green Corridor





#### **Renewable H<sub>2</sub> production potential**

The estimated **renewable H**<sub>2</sub> **production potential in Spain** in 2030 is **between 2 and 3 Mt** and in 2040, between 3 and 4 Mt



DIA DEL

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IDIA DEL

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#### Spanish H<sub>2</sub> Backbone by 2030\*

Transmission and storage projects submitted to PCI call for proposals

# High H<sub>2</sub> production potential connection with unmet local demand

**1** H2

DIA DEL I**drógeno** 

DE ENAGÁS

- H2Med (Barmar-CelZa)
- **2** Vía de la Plata Axis
- **3** Cantabrian Coast Axis
- 4 Valle del Ebro Axis

#### Connection "H<sub>2</sub> valleys" for supply guarantee

- **5** Puertollano Connection
- 6 Levante Axis
- Coruña Zamora Connection Project submitted by Reganosa to the PCIs
  - Underground storage facilities

\*This network is subject to what is defined in the Government's Binding Planning and prior cost-benefit analyses (CBA)





#### Spanish H<sub>2</sub> Backbone by 2040\*

- 8 Irún and Larrau exports: existing interconnections dedicated to H<sub>2</sub> to increase exports to France.
- 9 Meshing of the Central Zone (Huelva-Córdoba-Madrid-Navarra): meshing to satisfy demand in the central area, provide security of supply, and guarantee exports and imports North Africa-Europe.
- (10) North Africa import, Tarifa-Córdoba and Alcázar de San Juan-Montesa: the following interconnections exist to increase exports to the rest of Europe.
- **1** H<sub>2</sub> Storage Facilities in Cantabria and Basque Country: incorporation of storage facilities to guarantee supply to the H2 transmission infrastructure.
- Yela H<sub>2</sub> storage facility. (Other potential storage facilities in southern Spain are under study).

DIA DEL IDRÓGENO

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\*This network is subject to what is defined in the Government's Binding Planning and prior cost-benefit analyses (CBA)





#### **Current infrastructure network**



#### Spanish H<sub>2</sub> Backbone by 2040





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Synergies between gas grid and H<sub>2</sub> grid in 2040





#### **Benefits**

### Socio-economic

- Industrial development
- Innovation development
- Investment attraction

## **Energy and environmental**

- Emissions reductions
- Air quality improvement
- Renewables promotion
- Contribution to national objectives



#### **Social**

- Just transition
- Employment
- Contribution to local economies
- Sustainable development goals



# Schedule







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# Investments and financing





#### Projects submitted by Enagás to the European Union's call for PCIs

	Capacities	Technical specifications	Investment	
H2Med-BarMar Total	Maximum capacity: 2 Mt	Length: <b>455 km</b> Diameter: <b>28"</b> Max. depth: <b>2,600 m</b> Operating pressure: <b>210 bar</b> BCN compression station: <b>140 MW</b>	≈ €2,135 M*	
H2Med-CelZa Total	Maximum capacity: 0.75 Mt	Length: <b>248 km</b> Diameter: <b>28''</b> Operating pressure: <b>100 bar</b> Zamora compression station: <b>24.6 MW</b>	<b>≈ €350 M</b> ≈ <b>€157 M</b> Spanish side	
Total H2MED: <b>≈ €2.500 M</b>				

\*Investment for each operator to be decided



#### **Projects submitted by Enagás to the European Union's call for PCIs**

		Segments	Technical specifications	Investment
Spanish Backbone	Axis 1	<b>Cantabrian Coast Axis</b> Connection of demand in the northern area with H <sub>2</sub> production points.	Approx. length: 1,500 km	≈€1,650 M
		<b>Valle del Ebro Axis</b> Connection of demand in the northern area and Castellón, and $H_2$ Tarragona valley, to the high $H_2$ production in Aragón.	Route: • Gijón-Torrelavega-Vizcaya- Álava-La Rioja-Zaragoza-Teruel • Teruel-Tarragona	
		<b>Levante Axis</b> Castellón-Murcia, to connect Murcia H <sub>2</sub> valley and Cartagena e-Terminal.	<ul> <li>Tarragona-Barcelona</li> <li>Teruel-Castellón-puerto Sagunto</li> <li>Puerto Sagunto-Cartagena</li> </ul>	
	Axis 2Vía de la Plata Axis H2 production connection Extremadura a Castilla León demand by 2030 northern a Musel export potentialPuertollano Connection To connect Puertollano H2 valley	Vía de la Plata Axis H <sub>2</sub> production connection Extremadura and	Approx. length: 1,250 km	≈€1,850 M
		Castilla León demand by 2030 northern area and Musel export potential	Route: · Giión-Musel · Mérida-Huelva	
		<b>Puertollano Connection</b> To connect Puertollano H <sub>2</sub> valley	<ul> <li>Gijón-Avilés</li> <li>Gijón-Salamanca</li> <li>Salamanca-Mérida</li> <li>Mérida-Vegas Altas</li> <li>Salamanca-Mérida</li> </ul>	no



Projects submitted by Enagás to the European Union's call for PCIs

	Capacities analysed	Technical specifications	Investment
H <sub>2</sub> storage North 1	Under analysis Potential capacity 2030: <b>335 GWh</b>	New salt cavern in Cantabria	≈€580 M
H <sub>2</sub> storage North 2	Under analysis Potential capacity 2030: <b>240 GWh</b>	New salt cavern in the Basque Country	≈ €590 M

The axes in question act as major collectors of hydrogen production distributed throughout the national territory. This, together with the development of potential underground storage facilities under study, will allow optimisation of infrastructure needs, both in terms of compression and the transmission capacity of the pipelines, with average diameter ranges considered to be 16"-36".



#### The investment will take place from 2026

The final amount will be conditioned by:

- Final list of PCIs
- Final objectives of the **PNIEC**
- Government Planning
- Results of the calls for interest and Open Season
- Final percentage of the current infrastructure network that can be reused
  - Final technical characteristics of the projects

H2MED ≈ €2,500 M\* TOTAL

**BarMar** ≈ €2,135 M

CelZa ≈ €350 M in total

(≈ €157 M Spanish side)

Axis and storage facilities of the Spanish H<sub>2</sub> Backbone

≈€4,670 M

Investment figures are gross without considering potential subsidies In the case of BarMar (H2MED), the investment for each operator is still to be decided





# Financing

1

EU funds. CEF-E programme for projects and other European funding streams

2

**Open Seasons.** Firm commitments from future off-takers that may give rise to project finance mechanisms

3

**Cross-border cost allocation**. The Infrastructure Regulation provides for mechanisms to allocate the costs of PCIs to the beneficiary countries by mutual agreement



Tolls associated with the use of infrastructure





# Conclusions





# Conclusions

- Enagás, catalyst of the H<sub>2</sub> market in its triple capacity as TSO (potential HNO), participates in the promotion of renewable gas projects through Enagás Renovable and as GTS
- As a European TSO, Enagás is ready to be an operator of the future hydrogen network
- Enagás submitted the H2MED projects and the backbone lines of the Spanish H<sub>2</sub> Backbone Network to the EU's Project of Common Interest candidacy in December, as announced by the Spanish Government
- The company is working on the projects in full coordination with the TSOs in Portugal and France, as commissioned in December and in line with European plans and Enagás' Strategic Plan

#### Net Zero infrastructure

- Enagás is a pioneer in the development of renewable gases and has the technical knowhow and societal instruments for the development of a renewable hydrogen market.
- The Iberian Peninsula has a network of infrastructures that will be the starting point for the development of a future H<sub>2</sub> backbone network
- Enagás will start non-binding supply and demand matching mechanisms in 2023 to optimise the development of the backbone network
- Spain has the conditions to become Europe's main renewable H<sub>2</sub> hub



# Annexes





## Market analysis 2030-2040

#### Methodology for identification of H<sub>2</sub> transmission infrastructure needs in 2030-2040





# Thank you very much



