

Hydrogen
for Climate Action



Green Spider



Antonio Martínez Rodríguez
Transformation Chief Officer, Enagás



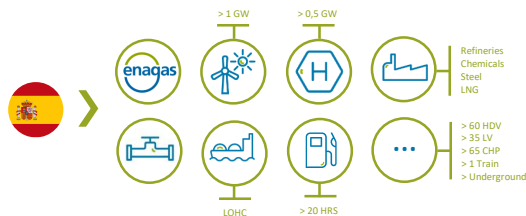
| **hydrogenious**
LOHC TECHNOLOGIES

Dr. Daniel Teichmann
CEO, Hydrogenious LOHC Technologies

South to North Green H₂ Network:

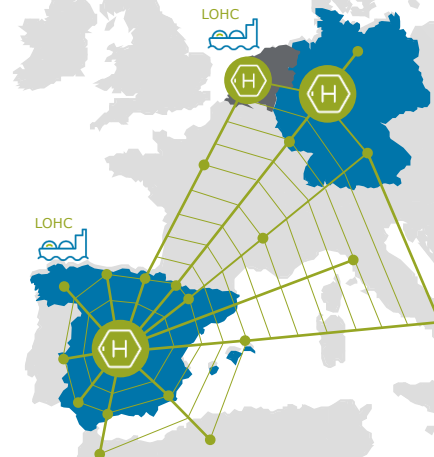
Large scale green H₂ network

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LNG: Liquefied Natural Gas
HDV: Heavy Duty Vehicles
LV: Light Vehicles
CHP: Combined Heat and Power
HRS: Hydrogen Refuelling Station
LOHC: Liquid Organic Hydrogen Carrier

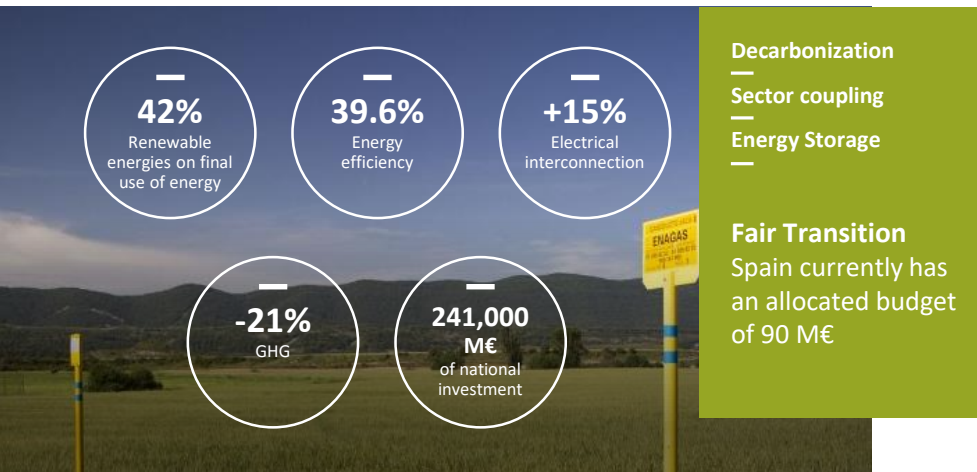
~ 2,250 M€





Spanish National Targets

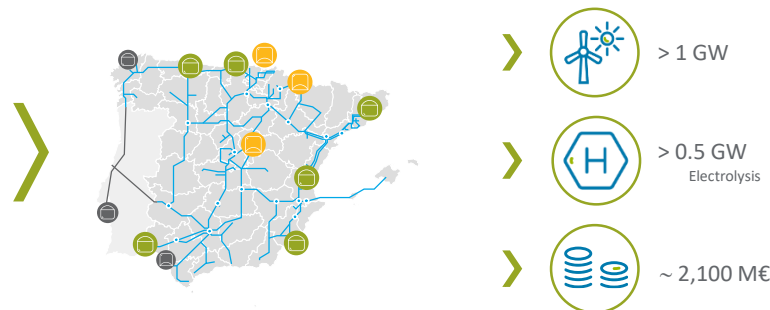
PNIEC 2030 *



* Long term vision: Renewable energy surplus & curtailments up to 76 TWh that could be managed through Green Hydrogen production

IPCEI: Spanish Hydrogen Hubs

Development of a large scale green H₂ network to export to Europe

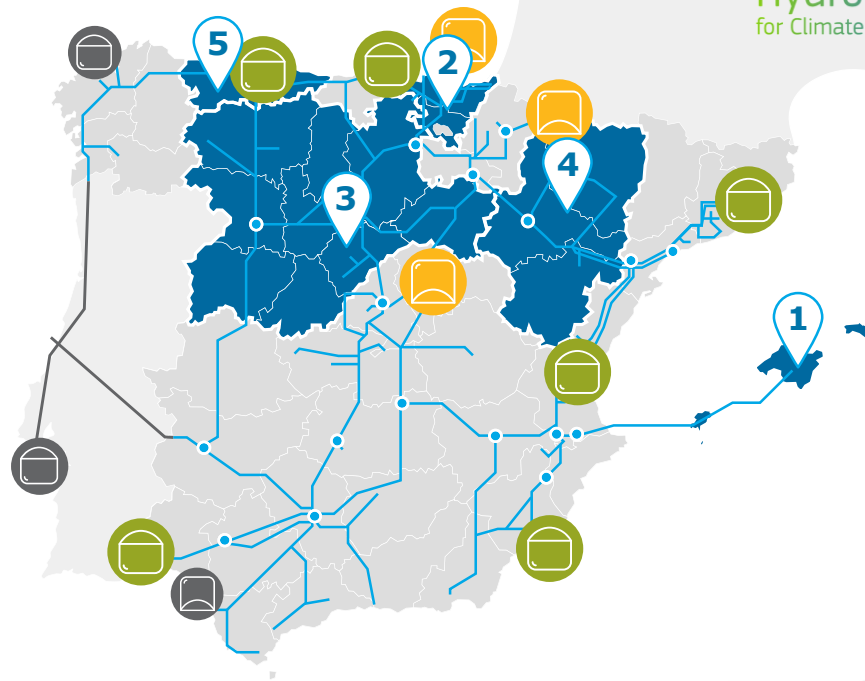


Currently, in Spain there is a 2% of renewable curtailment equivalent to 2 b€ of losses (REE)



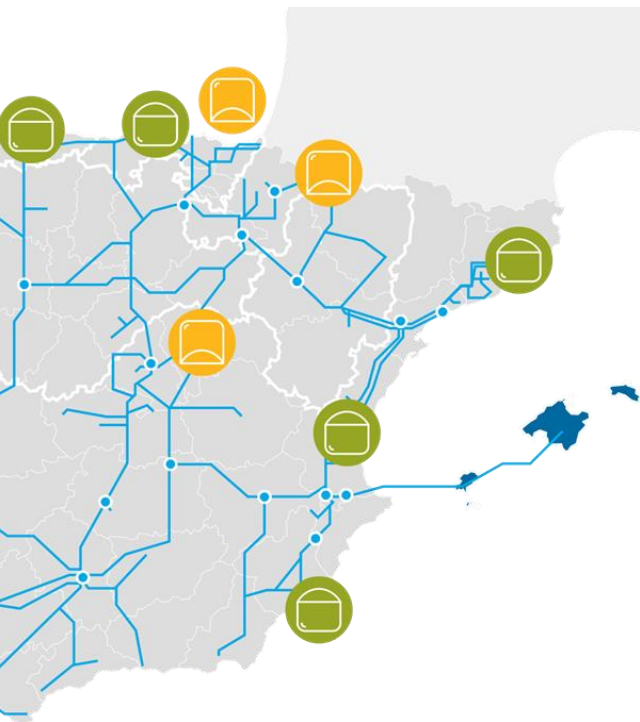
Development of a green hydrogen network to connect Europe

- 1** Baleares Hub
- 2** País Vasco Hub
- 3** Castilla y León Hub
- 4** Aragón Hub
- 5** Asturias Hub



Enagás

- LNG terminal
- Storage
- Compressor station
- Pipeline
- Infrastructures of other operators



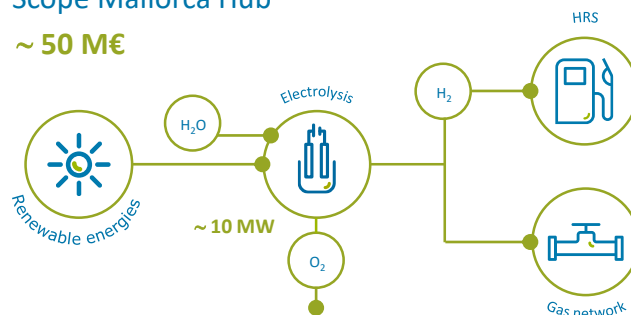
Baleares Hub:

Power to green Hydrogen Mallorca

Production of green hydrogen, through a photovoltaic plant, for its use as transportation fuel in a **fleet of buses** and also for its **injection into the gas grid**.

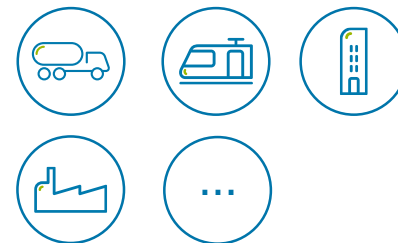
Scope Mallorca Hub

~ 50 M€



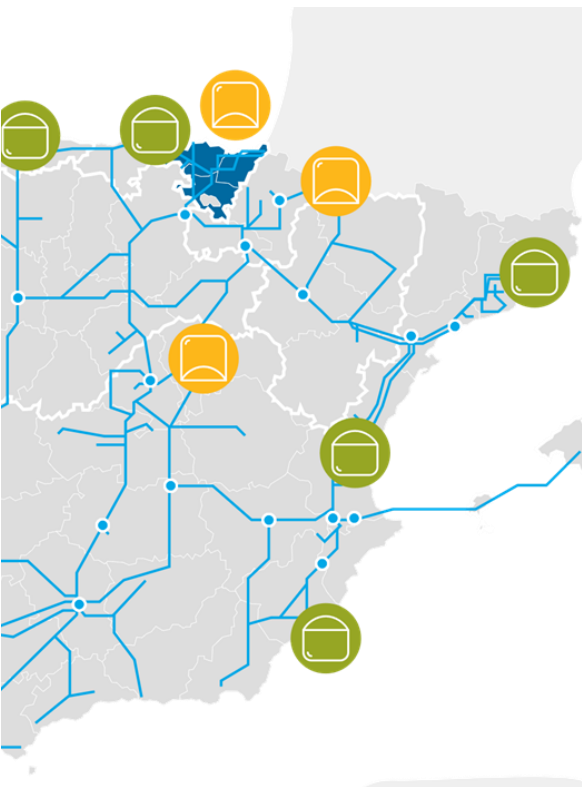
European Partners to be defined
for each application

~ 30 M€



Partners

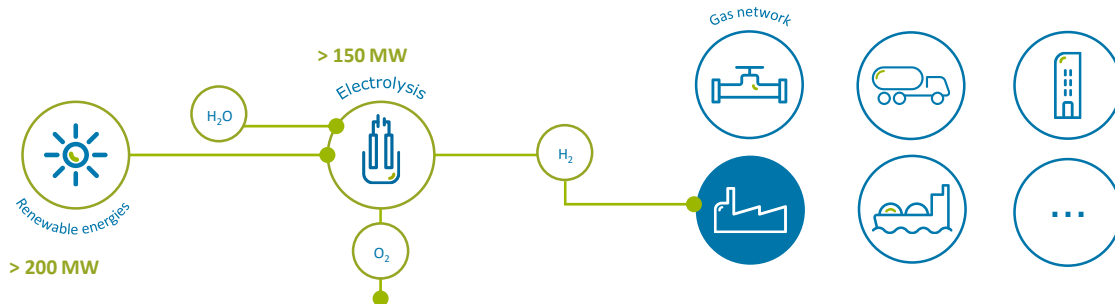




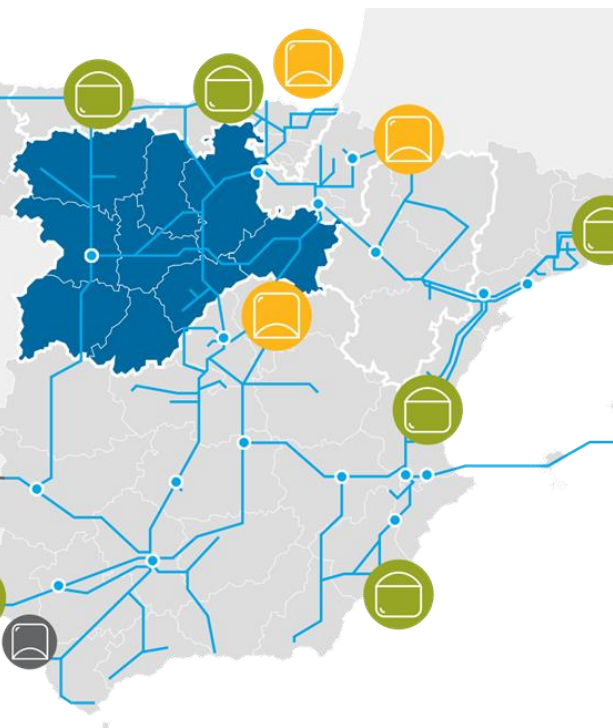
País Vasco Hub:

Industrial sector, Refineries

> 650 M€



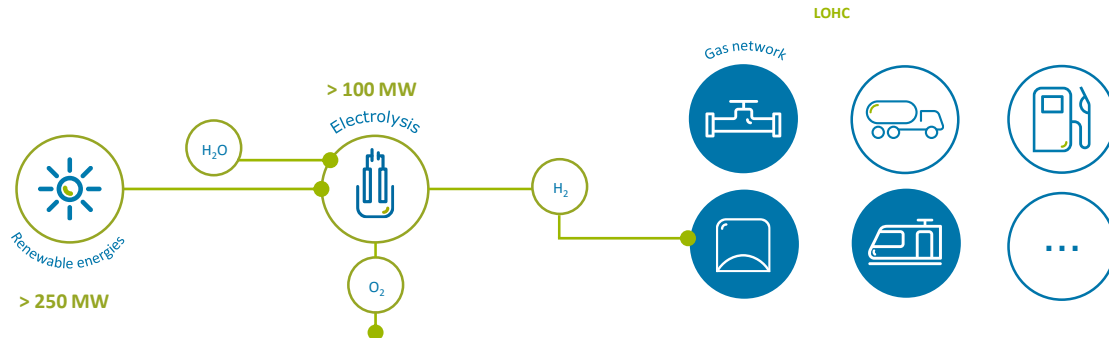
European and local Partners to be defined for each application



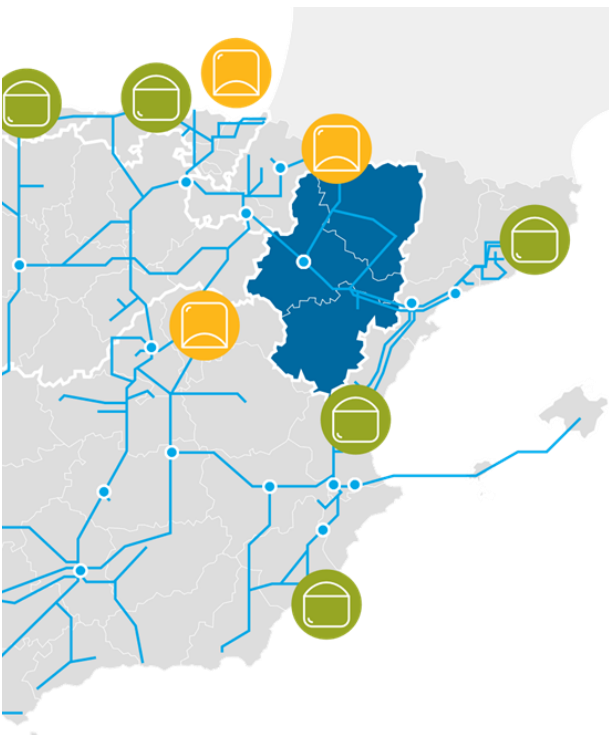
Castilla y León Hub:

LOHC, Train, Underground storage

> 620 M€



European and local Partners to be defined for each application



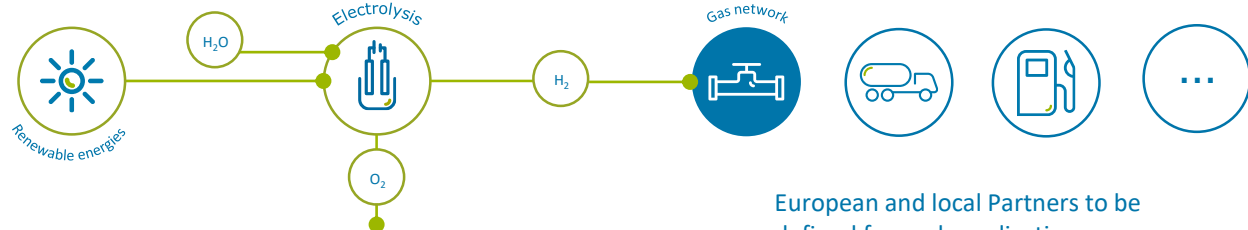
Aragón Hub:

Local uses & Singular facilities

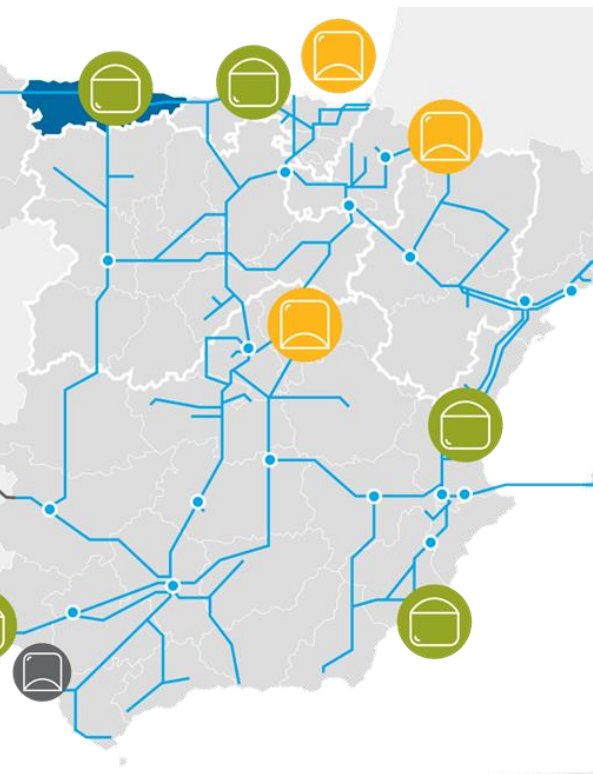
> 320 M€

> 150 MW

> 50 MW



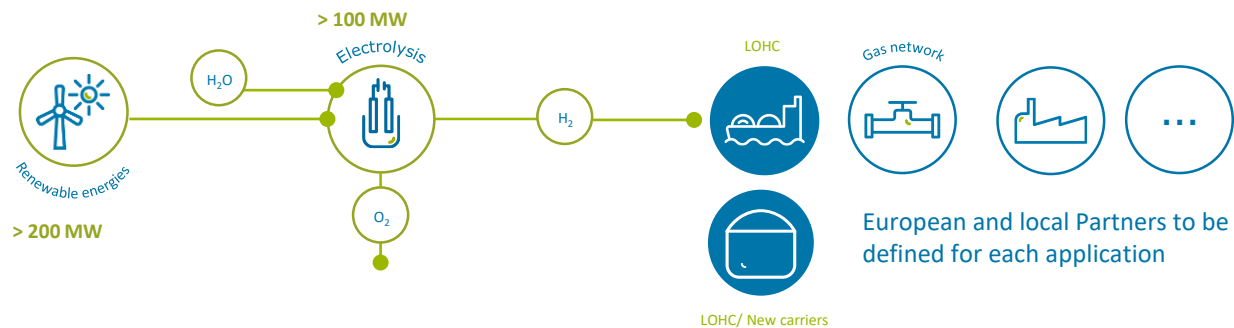
European and local Partners to be defined for each application



Asturias Hub:

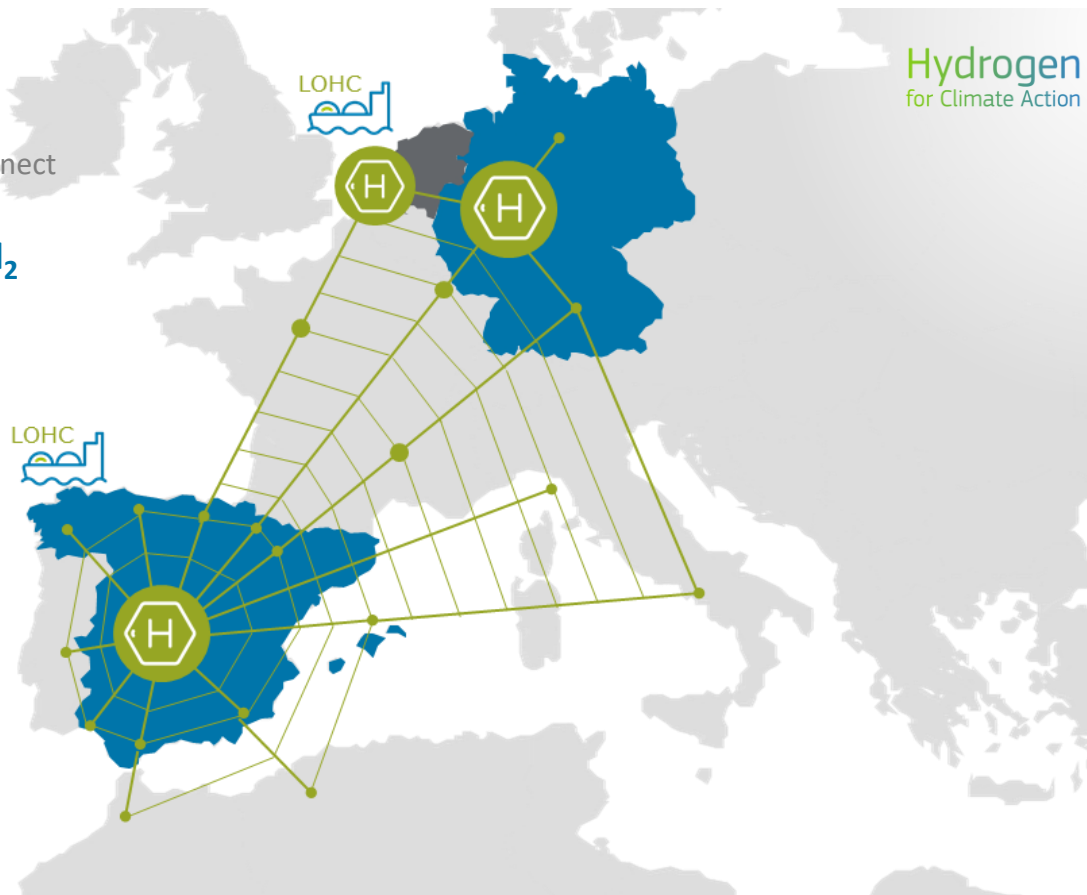
Steel, Port, Link to Europe

> 400 M€



Green hydrogen network to connect Europe:

South to North Green H₂ Network



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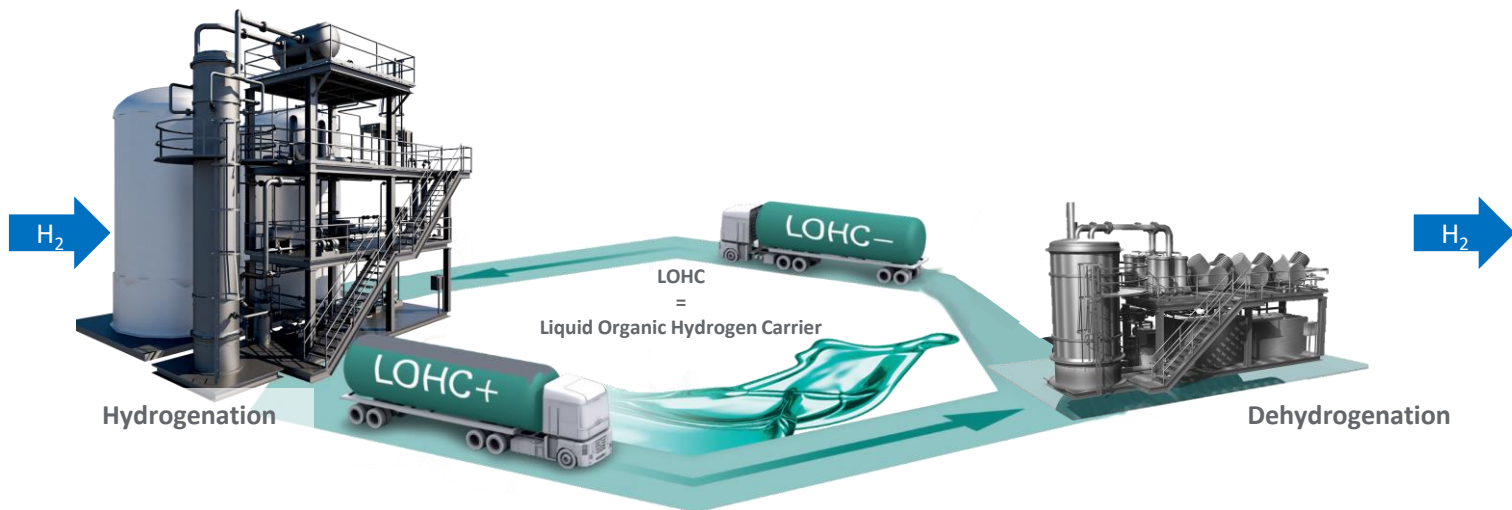
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The LOHC technology enables easy international hydrogen distribution



Liquid Carrier
(diesel like)

57kg H_2/m^3 LOHC

Hardly flammable /
non hazardous

Ambient conditions

Existing infrastructure



The advantage: use of existing fuel infrastructure on global scale



Very large capacity carriers can carry up to 18,000 t hydrogen with LOHC



Transport low cost green hydrogen to industrial markets



Easy and fast handling by pumping a liquid



Low CAPEX due to possible usage of existing charter infrastructure



Usage of existing ship and port infrastructure

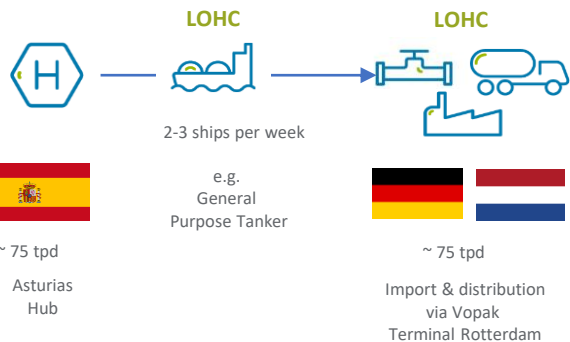


High distribution flexibility enables serving of different markets on short notice

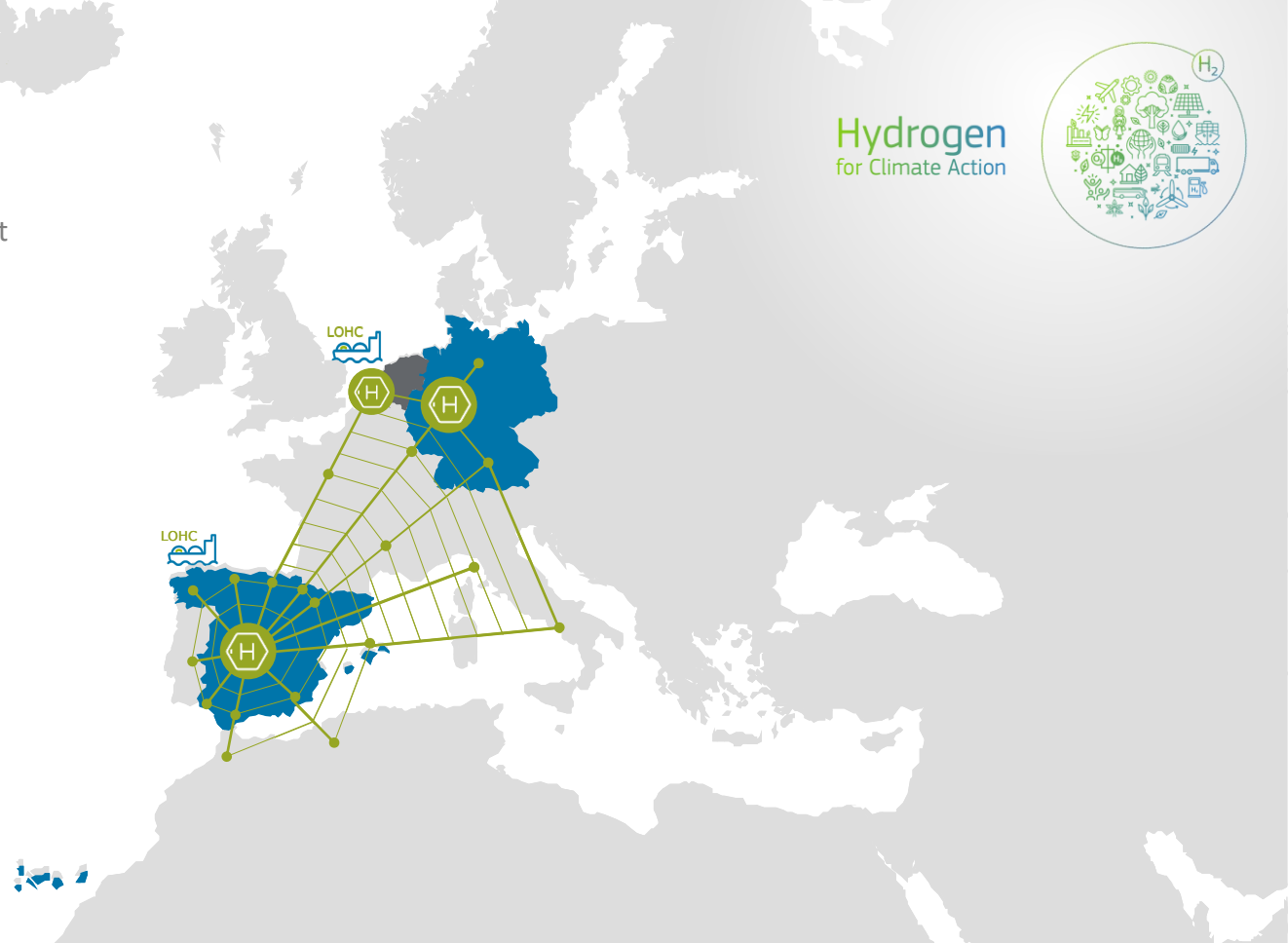


Green hydrogen network to connect Europe:

South to North Green H₂ Network



> ~ 150 M€



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