



REGIONE
LAZIO

Energy transition in Lazio and PNRR projects in the field of hydrogen-based technologies

Luigi Palestini – Area Transizione Energetica - Direzione Regionale Ambiente,
Cambiamenti Climatici, Transizione Energetica e Sostenibilità, Parchi – Regione Lazio

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The Regional Energy Plan

Regional Energy Plan (PER)

The Regional Energy Plan (PER-Lazio) is the tool with which the regional competences in the field of energy planning are implemented, with regard to the rational use of energy, energy saving and the use of renewable sources.

It is the result of a shared and transparent consultation with public and private stakeholders and incorporates both the results of this consultation and the regional strategic guidelines

- First version of the PER approved in 2001, in an international context very different from the current one
- Start of the construction process of a new PER in 2020
- Compared to the PER 2020, a new update is underway to align it with recent and ambitious European policies (Europe "carbon neutral" goal by 2050)
- Application in the PER of Lessons Learned in previous projects:
 - choice of a very long-term Policy Instrument, the Lazio Regional Energy Plan (PER) to improve it with the project (strategic objectives of the PER to be implemented by 2050)
 - Action Plan of the Region to improve the section “Policies and Programming” of the new version of the PER with the inclusion of priority guidelines, objectives and interventions regarding hydrogen that are influenced by the Best Practices about Hydrogen identified by **Smart Hy Aware** project.

The sources of the PER

- Paris Agreement
- Dynamics of global energy trends
- European climate and energy targets for 2020, 2030 and 2050
- European Green Deal (COM/2019/640 final) and the consequent 'Fit for 55' legislative reform package
- PNRR
- New National Energy Strategy (SEN 2017)
- Integrated National Energy and Climate Plan (PNIEC) approved in 2019

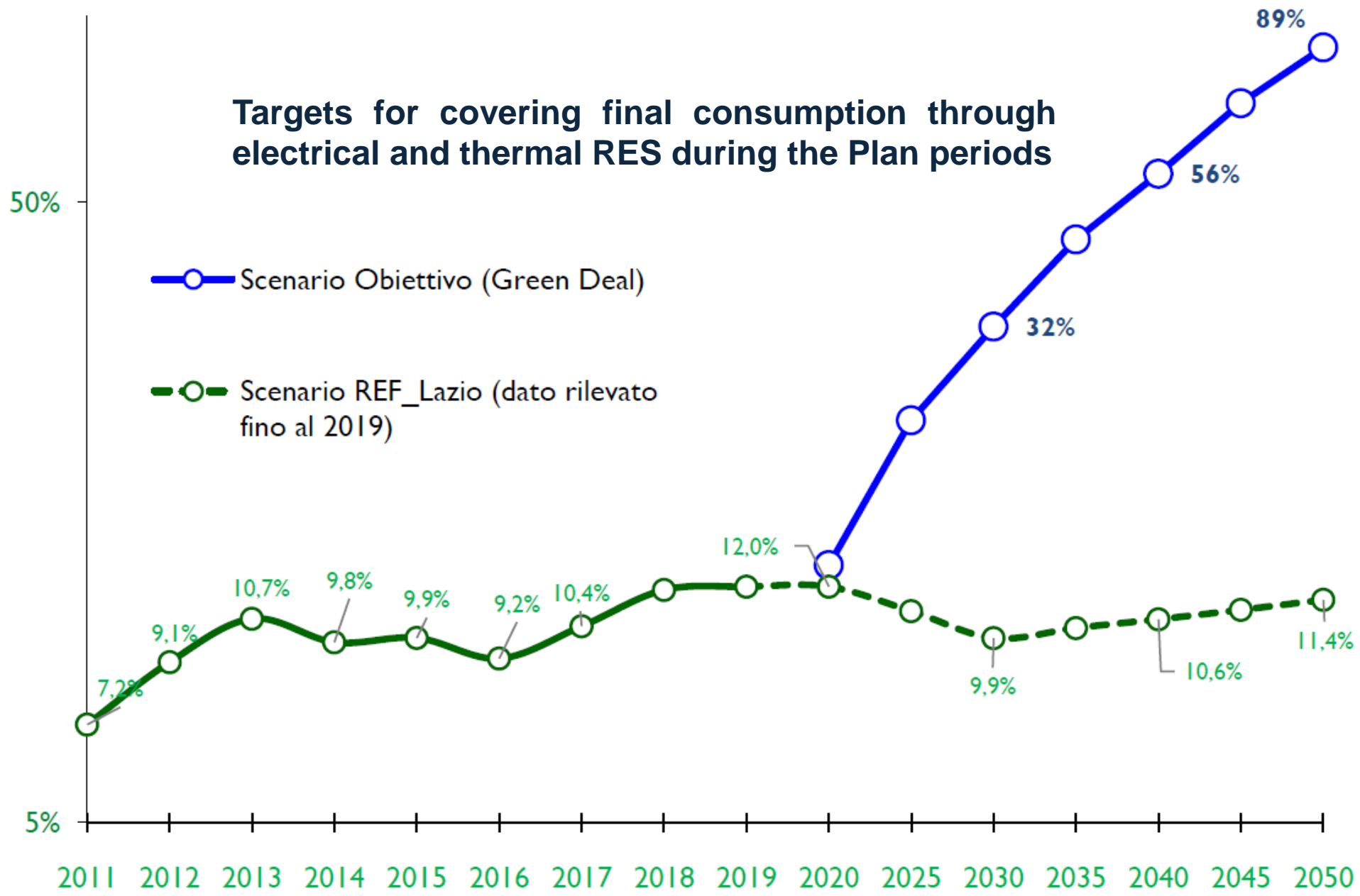
The (ambitious) objectives of the Region contained in the PER:

- support Lazio's transition to a climate-neutral economy in 2050 and fight climate change through the deployment of the green economy
- promoting adaptation to climate change and risk prevention and management.

The European objectives underlying the PER have also been taken up by Italy through the National Recovery and Resilience Plan (PNRR).

It has taken on the centrality of the ecological transition, the increase in energy efficiency and the development of renewable energy functional to the pursuit of decarbonization objectives.

The scenarios described in the PER Lazio

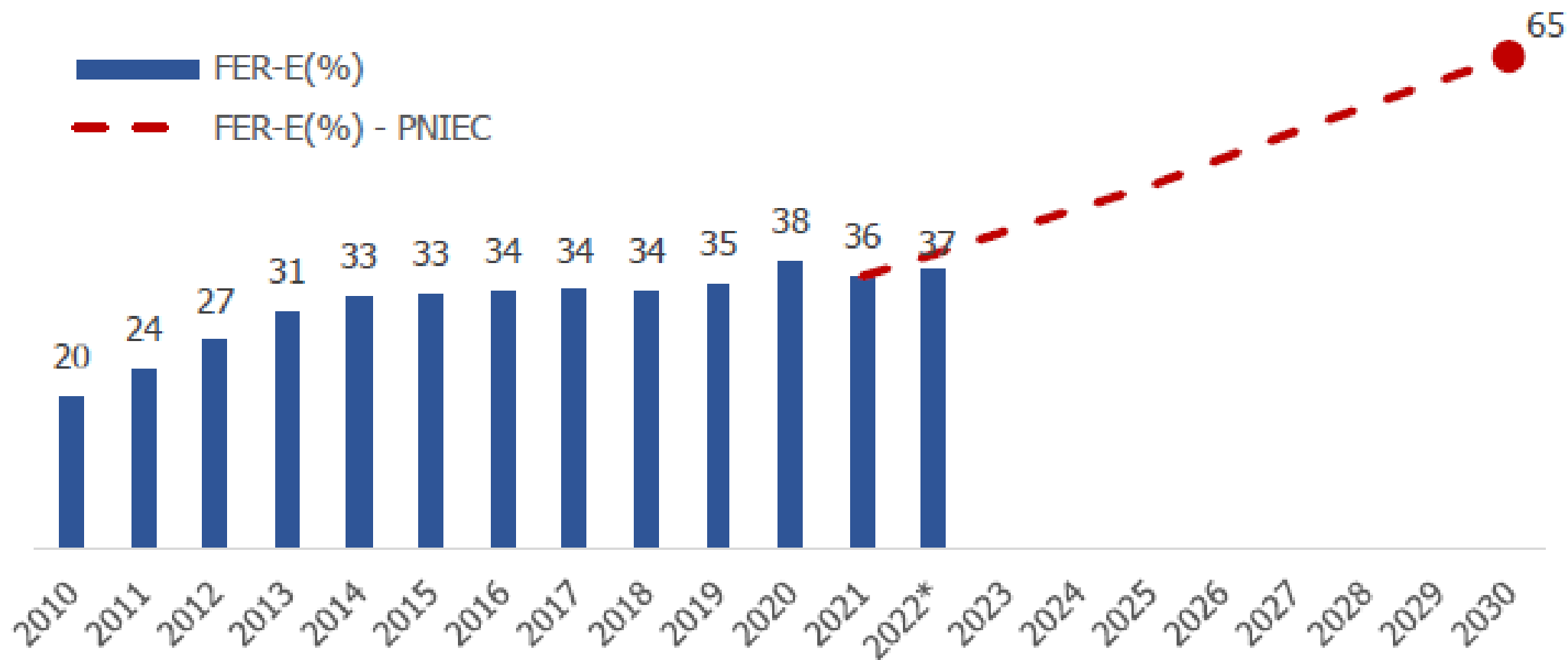


Other regional energy and environment plans and strategies

The Regional Energy Plan (PER) and other plans

- PTE - Plan for the Ecological Transition of the Lazio Region (DGR no. 16/2023)
- PRMTL - Regional Plan for Mobility, Transport and Logistics
- Regional Sustainable Development Strategy (DGR no. 170/2021)
- Regional guidelines and guidelines for the identification of areas not suitable for the construction of plants powered by renewable energy sources (DGR no. 390/2022)
- Regional Air Quality Plan
- Three-year programme and annual plans for the Blue economy
- Guidelines for urban and peri-urban forestation in the Lazio region

Penetration of RES in the electricity system in Italy (in %)



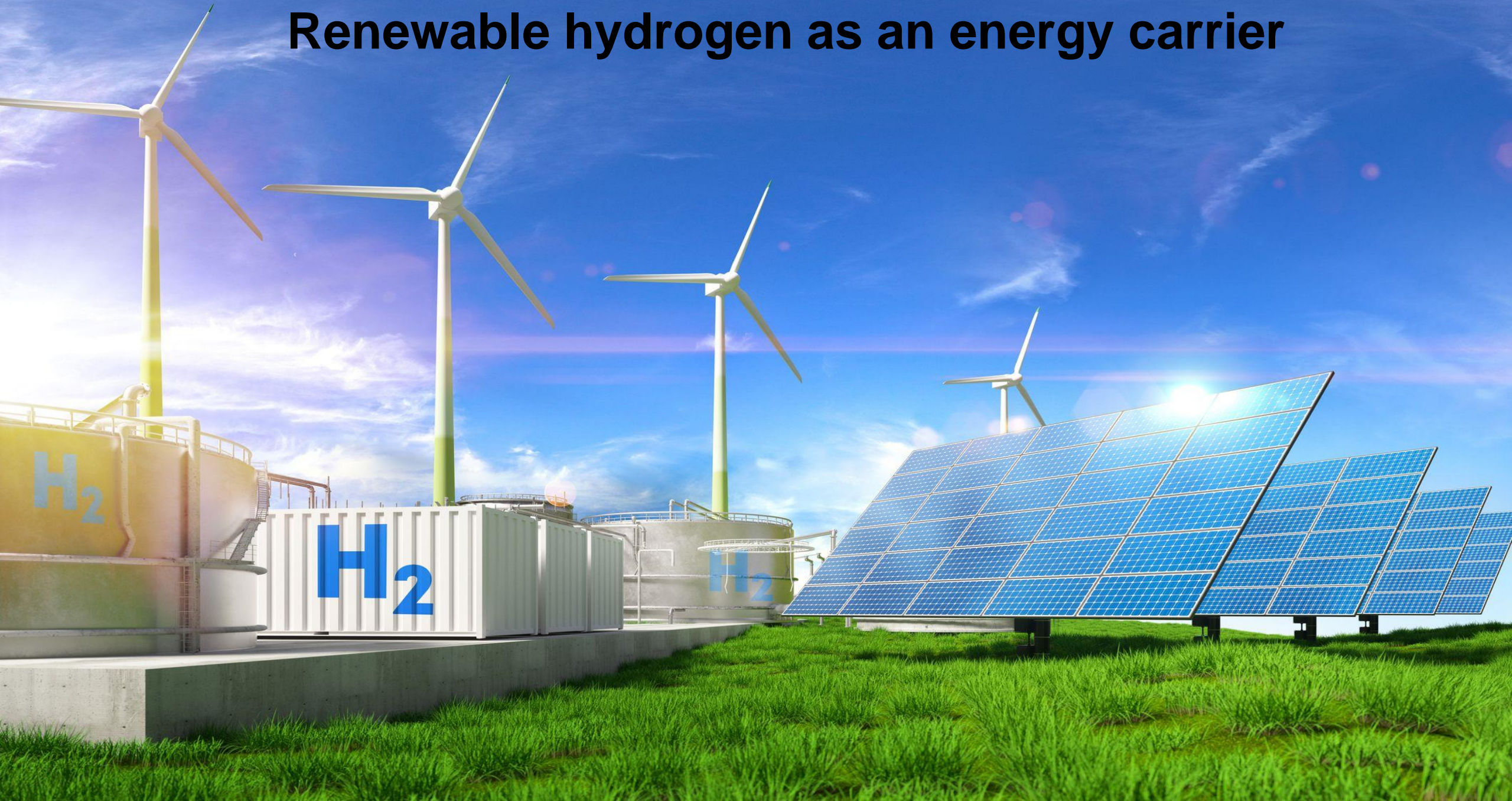
* Dati 2022 preliminari

Source: GSE Half-Year Energy and Climate Report – First Half 2023

RES plants authorized by the Region until August 2023

Province	Photovoltaic		Wind		% out of the total Lazio
	N. Plants	MWp	N. Impianti	MWp	
Frosinone	6	110,22			3,12
Latina	27	476,56			13,39
Rieti	0	0			0
Roma	16	231,48			6,54
Viterbo	73	2692,22	1	29,4	76,95
Lazio	122	3510,48	1	29,4	100

Renewable hydrogen as an energy carrier



L'idrogeno come abilitatore della transizione energetica in Europa

Enable the renewable energy system → Decarbonize end uses

Enable **large-scale renewables integration** and **power generation**



Distribute energy across sectors and regions



Act as a **buffer** to increase system resilience



Help decarbonize **transportation**



Help decarbonize industrial energy use



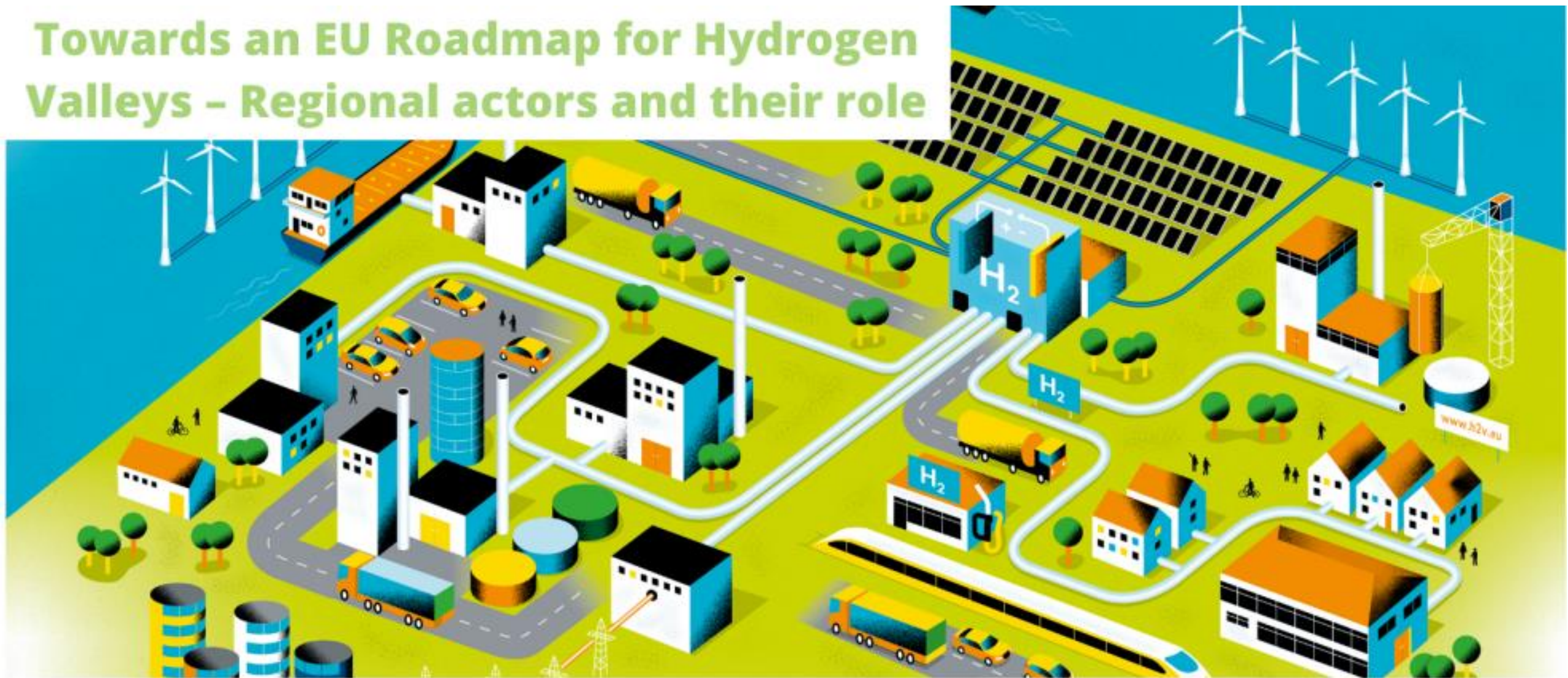
Help decarbonize **building heat and power**



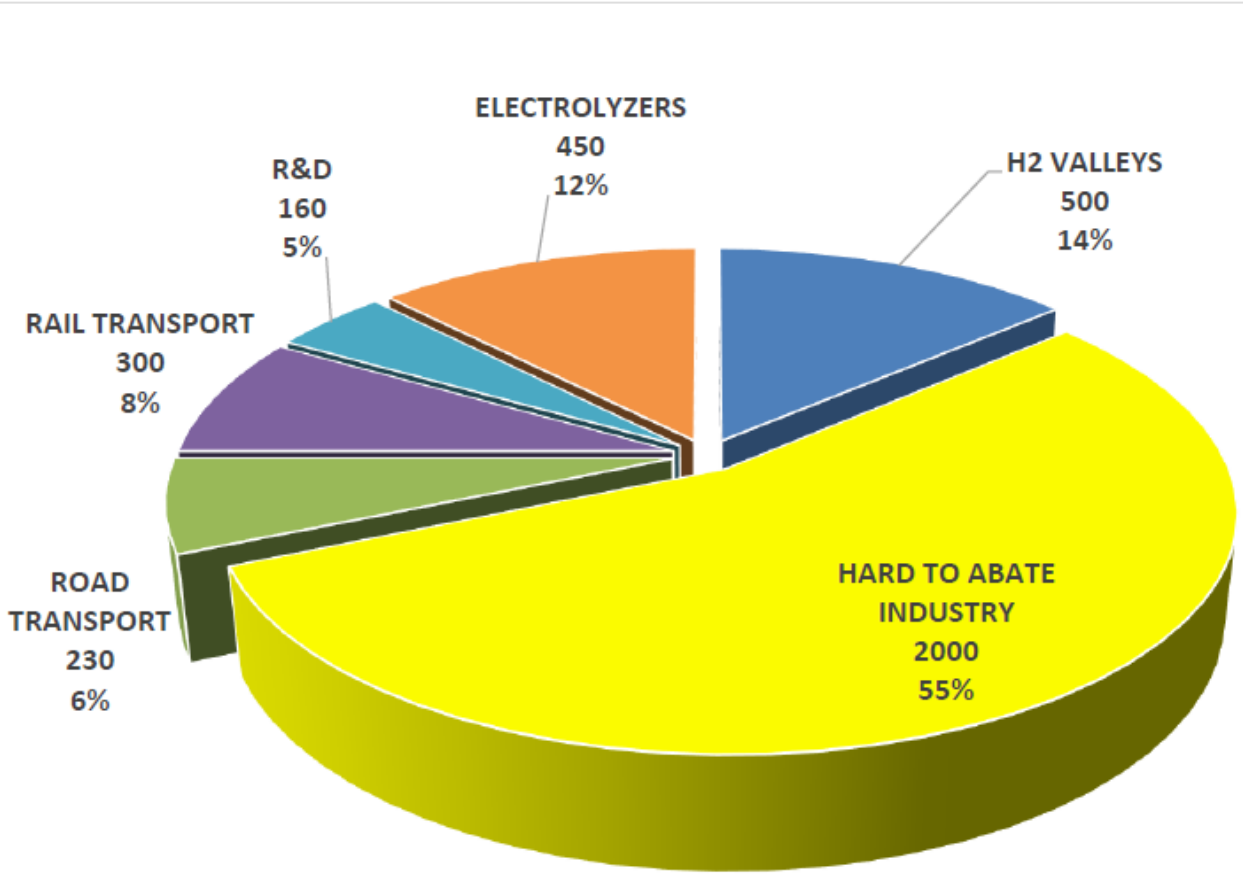
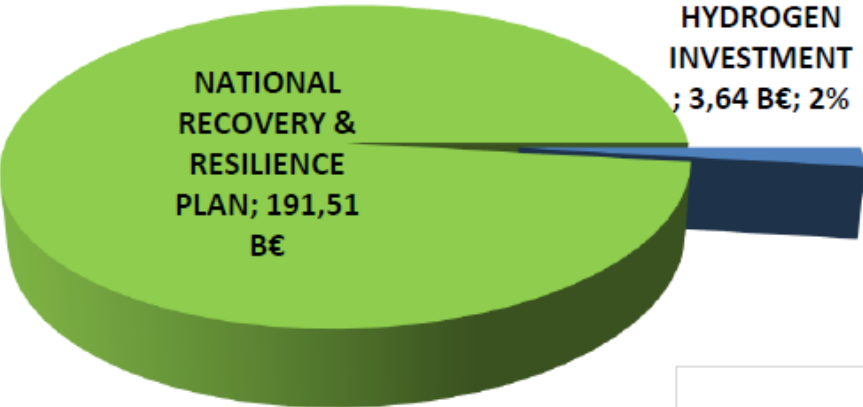
Serve as renewable **feedstock**

PNRR M2C2 Investment 3.1 "Production of renewable hydrogen in brownfield sites": projects under construction in Lazio

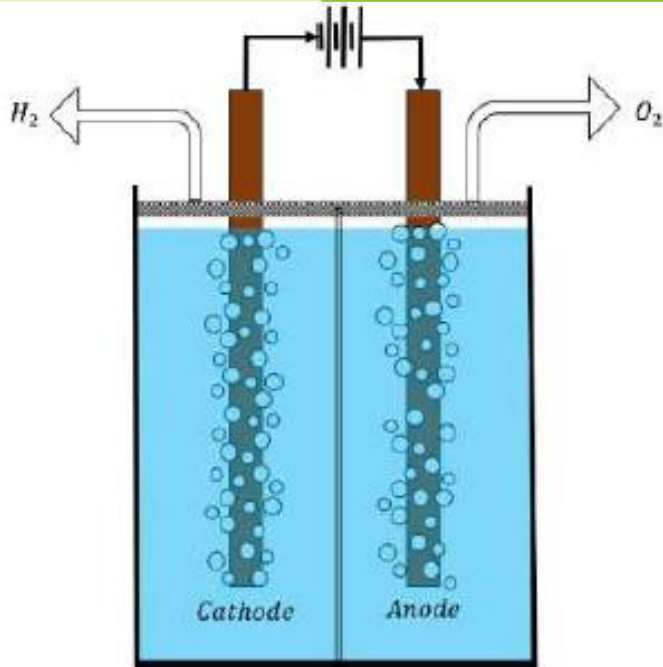
Towards an EU Roadmap for Hydrogen Valleys – Regional actors and their role



Hydrogen in the Italian Recovery & Resilience Plan (PNRR)



**PNRR
Misura 2
Componente 2
Investimento 3.1**



PNRR M2C2 I3.1 Production in brownfield sites

Redevelopment of disused industrial areas for the production of hydrogen, to be used for local transport and industry

Objective of the investment

Create 10 hydrogen valleys, i.e. industrial areas with an economy partly based on hydrogen, to promote the production and use of H_2 in industry and transport at the local level. To contain costs, brownfield sites already connected to the electricity grid will be used: electrolyzers will be installed there for the production of hydrogen through RES over-generation or dedicated RES production in the area.

The total area of industrial areas in Italy, in 2011, was about 9,000 km^2 : almost as much as Umbria. Most are strategically located to help build a widespread network of hydrogen production and distribution to nearby SMEs.

**PNRR
Misura 2
Componente 2
Investimento 3.1**

Activities carried out for the implementation of this Italian Recovery Plan Investment :

- 2022 Italy's Environment Ministry decree: It delegate the regions and allocates 17 million euros to Lazio for Hydrogen Valleys
- January 2023: Lazio Region Call for proposal
- March 2023: Approval of the ranking of project proposals (milestone)
- 2024 New funds for this investment from the RePower EU plan
- 2026 Three Hydrogen Valleys in Lazio Region

**PNRR
Misura 2
Componente 2
Investimento 3.1**

On the basis of the ranking, the projects to be financed with the available resources are:

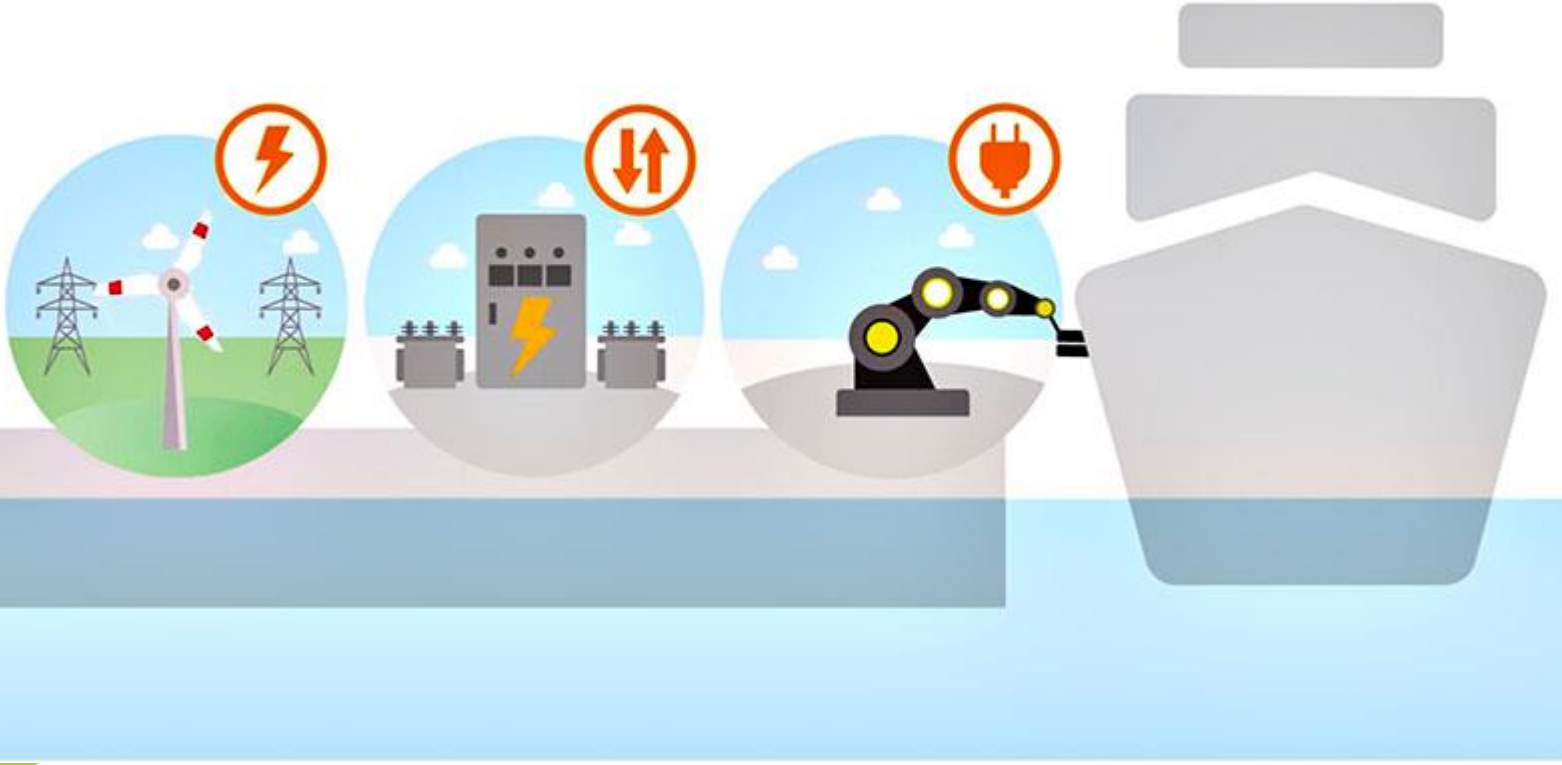
"H2-Civitavecchia", presented by CFFT - Civitavecchia Fruit & Forest Terminal S.p.a. for the **Civitavecchia (RM)** area and fully financed by the PNRR

"Helios" presented by Engie Servizi S.p.a. – Società Gasdotti Italia S.p.a. – Consorzio Industriale del Lazio for **Patrica (FR)** area and fully financed by the PNRR

In addition, the following project will be financed with Repower EU resources:

"Indeco Green Hydrogen Hub" presented by Greenthesi – Indeco, for the **Borgo Montello (LT)** area

Cold Ironing at Port Docks



PNRR
M2C2
Investment 3.1

Project H2-Civitavecchia
(Civitavecchia Fruit & Forest Terminal)
Location: Civitavecchia Interport (RM)

Uses of hydrogen:

- Cold ironing (electrification of docks at the Port through the supply of hydrogen to make up for an electricity generation of 3 MW and to store 30 MWh necessary for power supply and balancing)
- Heavy goods and passenger mobility (tank capacity 35 kg; driving distance 400 km)
- Average mobility of goods and people (tank capacity 10 kg; driving distance 300 km)

Impianto da 3 MW		
Potenza totale impianto	3,02	[MW]
Energia annua prodotta	7.767,11	[MWh/year]
Produzione per 3.024 MW	144,77	[t _{H2} /anno]
Ore equivalenti annue	1588	h _{eq}
Efficienza	53,65	[MWh/t _{H2}]
Consumo H ₂ O	190	[l/h]



PNRR

M2C2 Investment 3.1

Helios Project

(Engie Servizi, Società Gasdotti Italia,
Consorzio Industriale del Lazio)

location: Patrica (FR)

PV system power: 6,962.55 kWp

Electricity produced by PV plant: 10,057.52 MWh

of which consumed by the electrolyser: 9,720.3 MWh

Equivalent annual production hours of the PV system: 1452 h

4.5MW Electrolysis Unit

Electrolyser unit efficiency: 54.7 kWh/kg H₂

H₂ electrolyzer production capacity: 83 kg/h

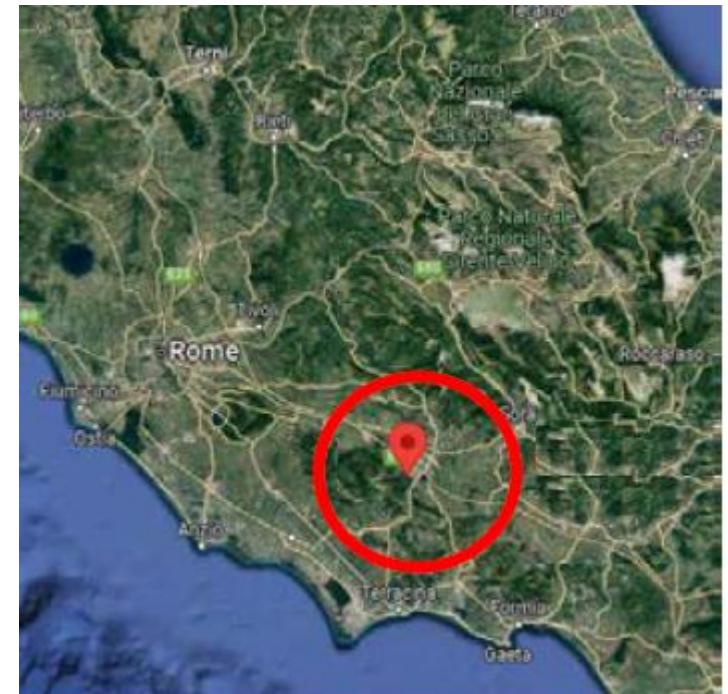
Actual water consumption: 850 l/h (full load), i.e. 10.2 l/kg H₂

Total H₂ production: 290.65 tons/year

Uses of hydrogen:

Initial phase with the involvement of the pilot user of the project (Novamont S.p.A.), currently connected to the DX-Sacco pipeline, intending to use hydromethane blends in concentrations of up to 20%. Powered by a new "hydrogen ready" gas pipeline about 1.5 km long

Extension of the use of hydrogen blends to all companies currently connected to the DX-Sacco pipeline (6 in total in addition to the pilot company)



PNRR M2C2 Investment 3.1

Indeco Green Hydrogen Hub Project
(Greenthesis - Indeco)
location: Borgo Sabotino (LT)

PV system power: 3 MWp

Electricity produced by RES: 3,112.70 MWh

Battery Energy Storage Capacity (BESS): 5.5 MWh

Annual production hours of the PV system: 1354 h

1MW Electrolysis Unit

Electrolyser unit efficiency: 53.3 kWh/kg H₂

H₂ electrolyzer production capacity: 18.75 kg/h

Actual water consumption: 190 l/h (full load),

Total H₂ production: 156 tons/year

H₂ storage with a maximum capacity of 1000 kg

Uses of hydrogen:

Objective of the project: Production of green hydrogen, through an innovative and advanced electrolysis process, powered by part of the permeate, coming from a three-stage reverse osmosis plant for the recovery of landfill leachate. Blending use in the gas network for nearby industries in the following sectors:

- food
- pharmaceutical
- iron and steel
- Trucking



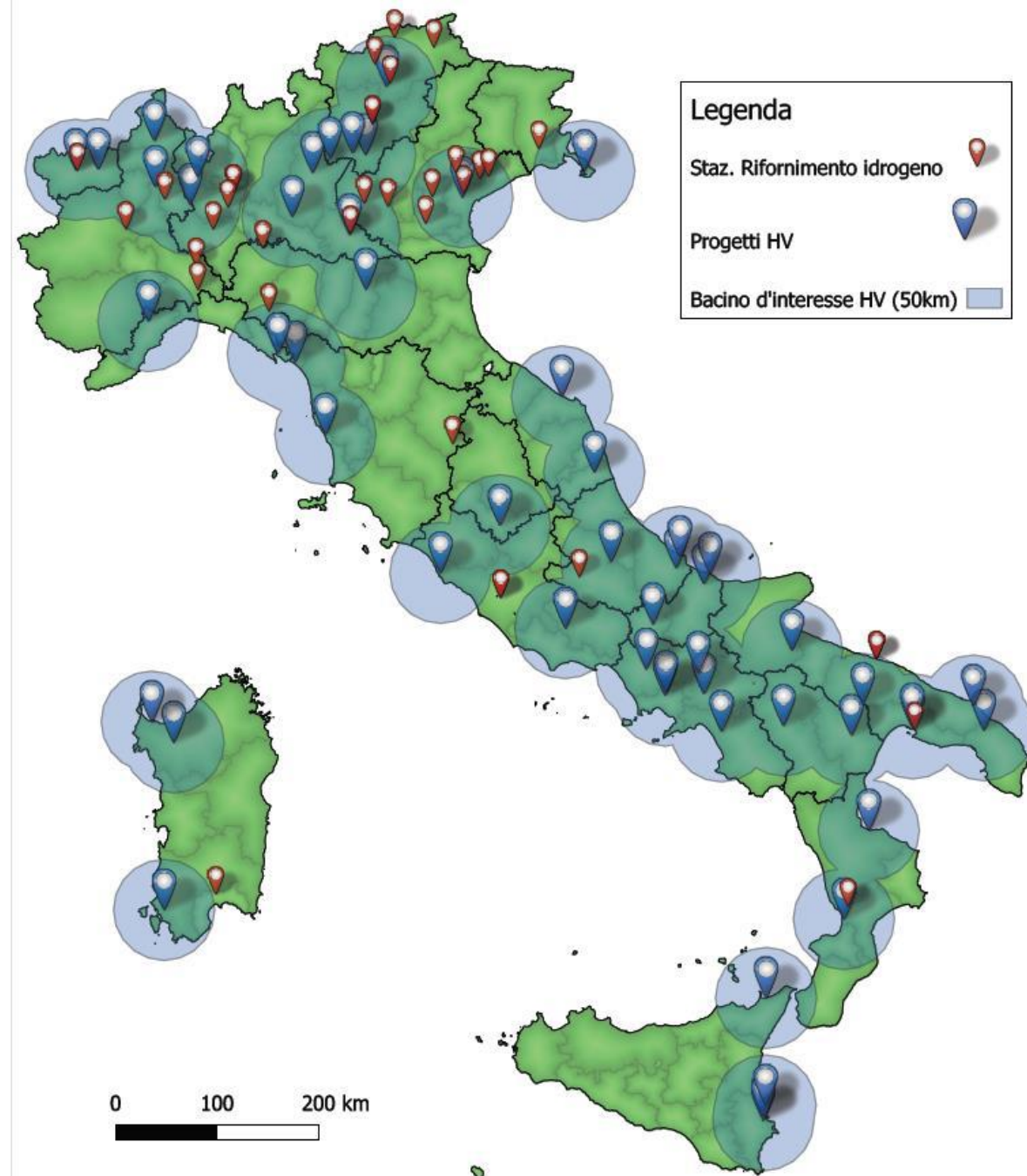
Hydrogen Valleys: €500 million allocated

**Current result: 54 Hydrogen Valleys
financed with PNRR.**

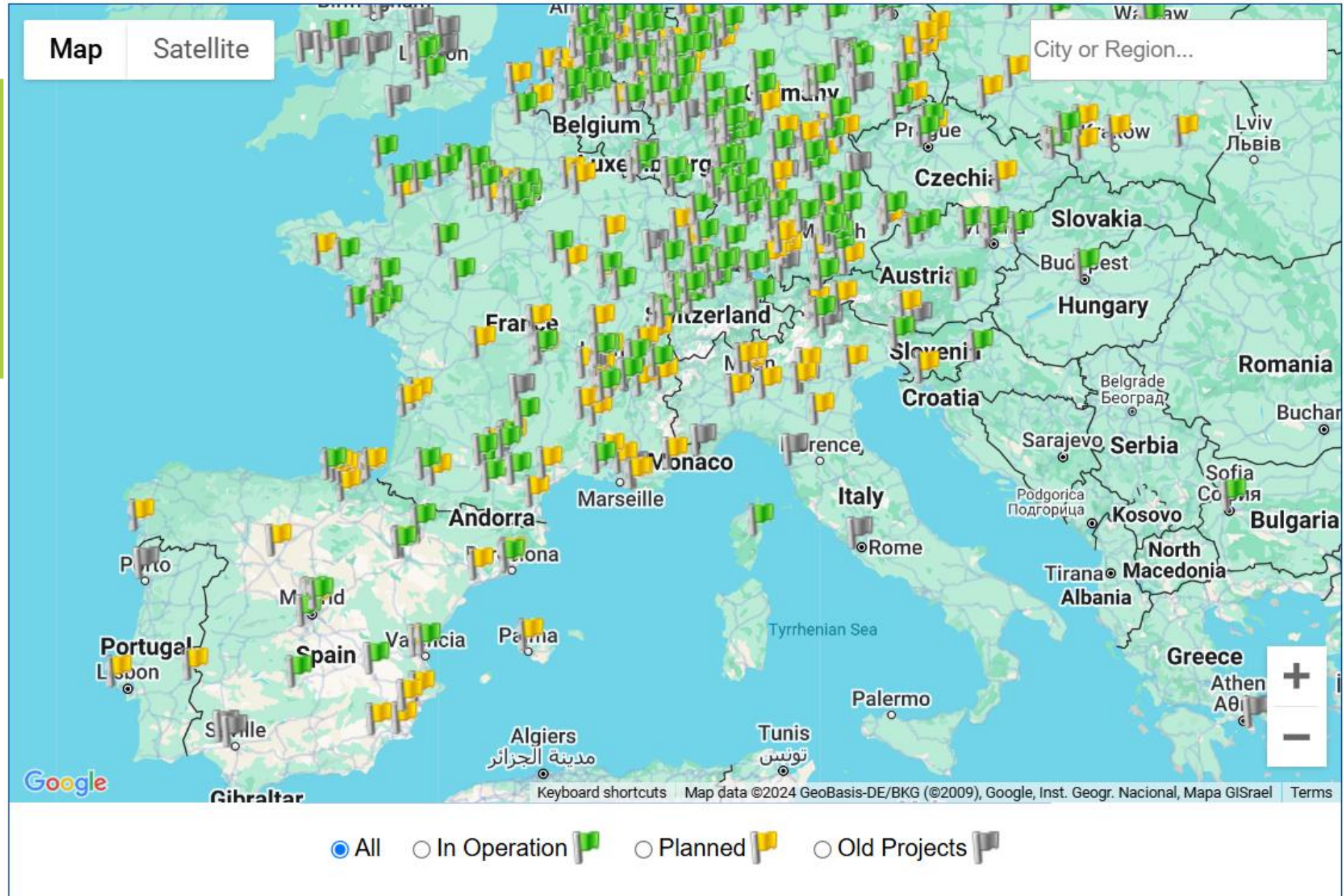
**Hydrogen Refuelling Stations (HRS):
€230 million allocated.**

**The goal is to make 2% of the national
long-haul truck fleet hydrogen-powered
by 2030.**

**Current result: 50 Refueling stations
(HRS) financed with PNRR.**



Public road hydrogen refueling stations



LIFE 3H: GENERAL PROJECT INFORMATION

PROPOSAL REFERENCE: LIFE20 ENV/IT/000575

FULL TITLE: Hydrogen demonstration in city, port and mountain area to develop integrated hydrogen valleys

ACRONYM: LIFE3H

CALL / PRIORITY AREA: LIFE2020 – Environment and Resource Efficiency

SECTOR: Air quality and emissions including urban environment

START DATE: 01/09/2021 - **END DATE:** 30/09/2025

BUDGET: € 6.339.853 – **EU contribution:** € 2.978.671 (47%)

LOCATION: Terni, Civitavecchia and Avezzano



Life3H OBJECTIVES & SCOPE

To set up, demonstrate and exploit 3 Hydrogen Valleys starting from the implementation of H2 buses fueled with surplus H2 coming from local industrial productions thus closing the economical circle locally

- Build up the first 3 Italian HVs laying the basis of one transregional HV
- Develop common & sustainable road LPT mobility reducing emissions based on 6 H2 buses (and 3 HRS) applied to 3 totally different areas and scenarios
- Implement integrated H2 local policies & regulatory approaches
- Increase circular economy → **utilization of by-product H2**
- Develop a HV implementation strategy and a standard smart sustainable mobility management system that allows extension and replication in other sites
- Raise citizens' awareness & improving policy commitment



The port of Civitavecchia

- It is the largest in the region and a multifunctional port, divided into two macro areas with different market dynamics: to the south, the one dedicated to tourism, pleasure boating and cruises; to the north, the area for commercial traffic, fishing and cabotage; Today it can count on about 1,900,000 m² of docks, 25 operational berths from 100 to 400 m in length, for about 13 km of berths; Approximately 11 million tons of bulk goods are handled every year - bulk cargo, cereals, forest products, steel products and chemicals - new cars and containers, as well as liquid bulk cargo; in recent years, the services of "Motorways of the Sea", i.e. scheduled services dedicated to the transport of passengers and goods on the Mediterranean routes, have grown; today is the **second cruise port in the Mediterranean**, with over 2.1 million passengers in 2023
- The LIFE 3H project envisages, in the Lazio Region, the operation of a Hydrogen Valley that is articulated using 2 hydrogen buses used for special scheduled transport dedicated to cruise passengers, as well as scheduled public transport within the areas of the Port of Civitavecchia.
- **The line between the port and the station is 2.5 km long, covered in about 15 minutes, with an average speed of 10 km/h.** The service is active in conjunction with the docking of cruise ships, from 08.30 to 18.30. The number of passengers using this service is around 550,000 per year (2019 data).



Il porto di Civitavecchia



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RAMPINI 8M FCB

- 3 storage tanks @350 bar, 10.8 kgH₂, positioned at the back on the roof + 175 kWh LiFePo₄ batteries with BMS. Continuous monitoring for greater safety, reliability over time and performance.
- 30 kW FC stack, operating at 60-70°C and providing fuel @8.5 bar.

Operational modes

Range Extender: range maximization by optimizing the use of H₂ and batteries. The energy for the journey is supplied in a 40% / 60% ratio between batteries and hydrogen

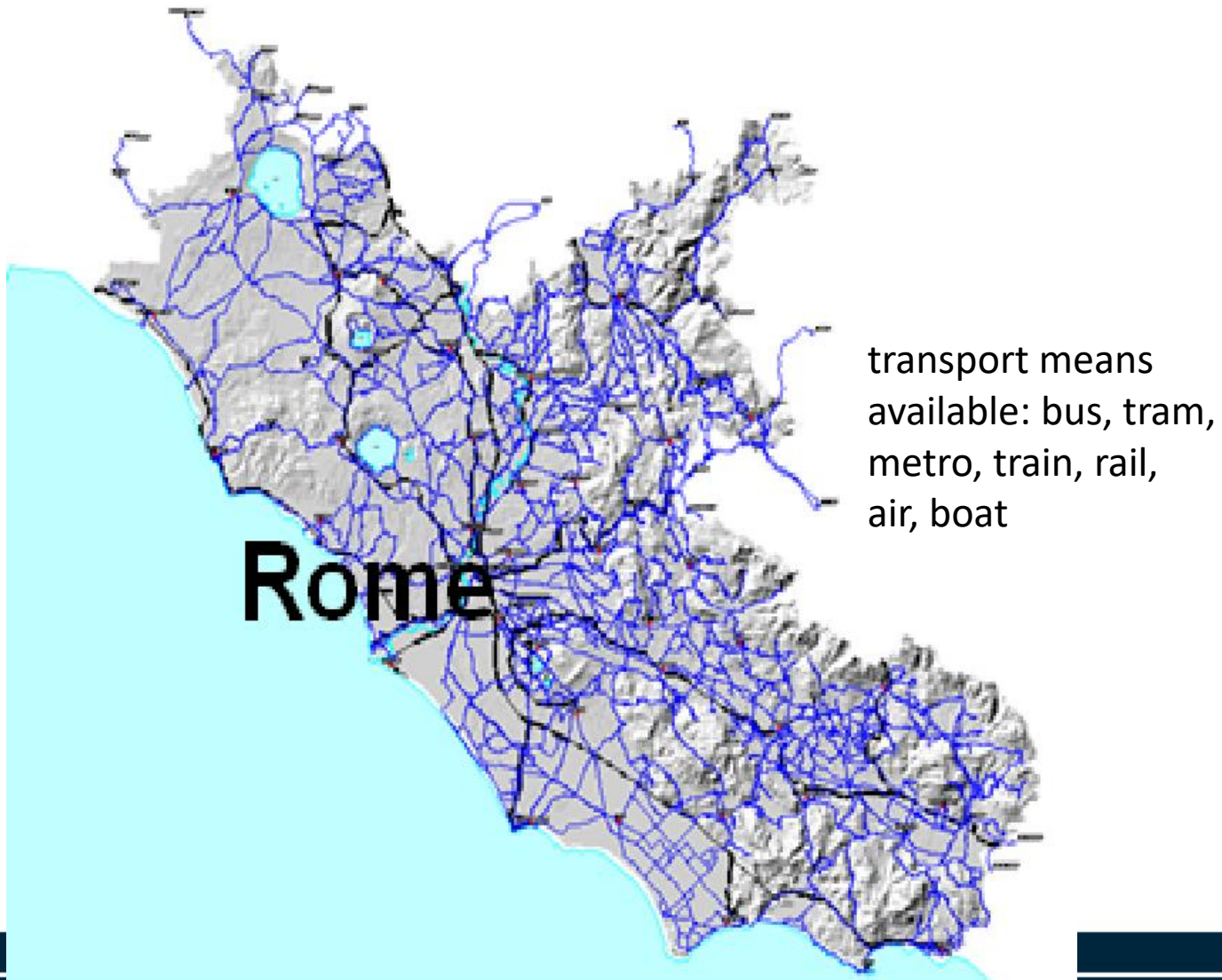
Pure Hydrogen: H₂ as the only fuel. The batteries have a "peak shaving" function during acceleration and accumulator function during regenerative braking; The batteries are kept around SOC=90%.

Pure Electric: Pure EV, the FC is never on.

Hybrid Custom: customization of the percentage of energy coming from batteries or H₂.



Further development (2026-2030)



Site LAZIO	
Location (sq km)	Italy, Lazio Region (17,232 km ²)
Amount of inhabitants	5,886,156 (2014)
Name bus operator	COTRAL (TRANsport COmpany of Lazio)
N. of buses	1,577
N. of drivers (employees)	2,342
N. of bus lines (daily trip/line)	226
Lines total length	8,370



Local public transport organization in Lazio

- COTRAL is the first bus transport carrier at regional and national level (about 100 million of annual passengers)
- The sole shareholder is the Region of Lazio
- COTRAL connects all the municipalities of Lazio
- The Service Contract with the Lazio region defines the program guidelines and minimum standards, in terms of both quality and quantity
- Currently 60% of maintenance is outsourced and 40% is made in-house into the maintenance workshops of COTRAL depots



The choice for hydrogen (2026-2030)

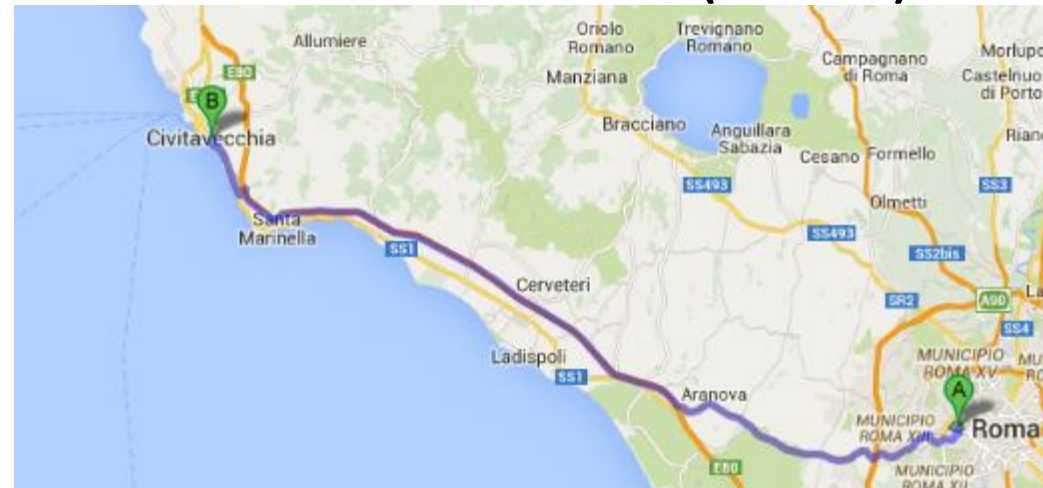
- COTRAL is one of the largest bus transport companies in Europe
- Lazio and Rome are fundamental point of the north-south hydrogen route
- Lazio Region has invested and is interested in new environment friendly technologies
- Italian bus sector crisis (investment decrease, buses average age increases)
- Great traffic flows to and from Rome where it is difficult to move (small roads, historical buildings and archaeological underground sites)
- The public transport have a low average (commercial) speed and a great social and environmental impact
- Great visibility and concrete project to implement zero emission transport in congested and historical routes
- Develop European industries and decrease European energy bill



Future developments (2026-2030)

- The fuel cell buses can operate :
 - on specific lines
 - expected daily range
 - Low average speed
 - service type sort 3 (UITP “Project Sort” ed.2009)

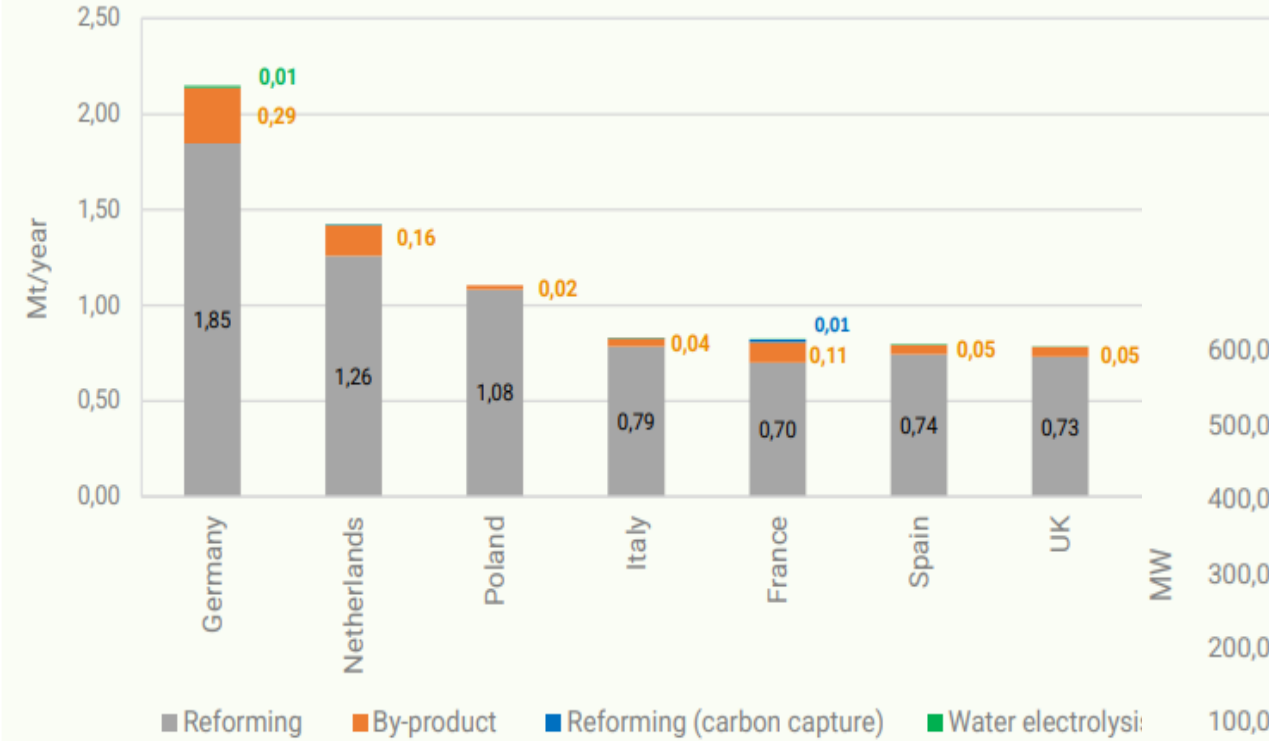
Civitavecchia-Vaticano Line (70.7 km)



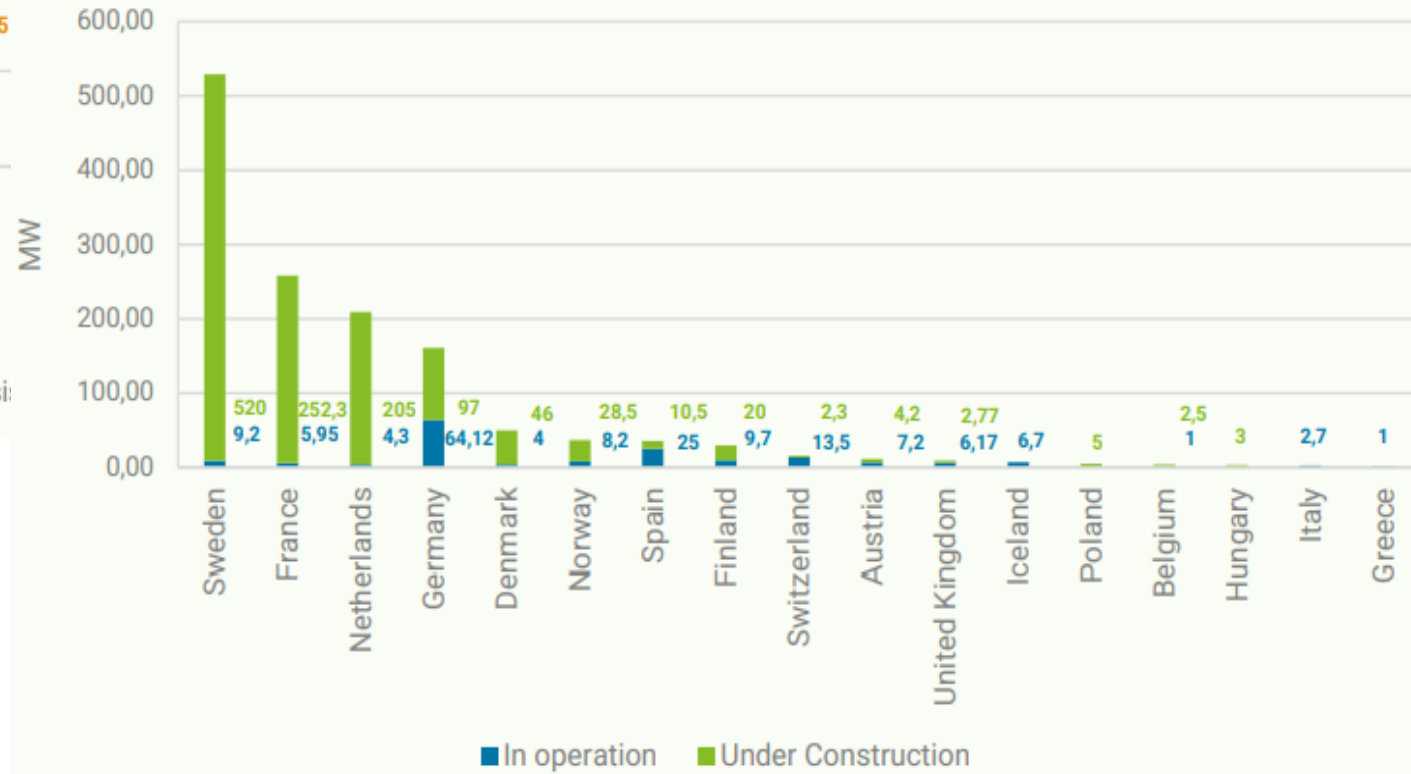
Fiumicino – Rome Line (30 km)



Top 8 EU countries in hydrogen production capacity by production process



Total capacity (MW) of water electrolysis projects by country



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Collaboration between regions to cross barriers

- Integration, synchronisation, and visibility appear to be the cornerstones of hydrogen deployment and scale up across the whole hydrogen value chain
- The Mediterranean is the sunniest region in Europe and therefore the most suitable for providing green energy to produce hydrogen. On the other hand, the factors that allow the development of green hydrogen production are availability of renewable sources, low-carbon grid electricity at low cost, R&D and collaboration, ambition and support from the government and availability of buyers (off-takers)
- With the development of the renewable hydrogen market, collaboration between the Mediterranean regions will be very important to ensure balanced, sustainable, participatory growth, which takes into account the interests of the regions

(from 2021 Clean Hydrogen Alliance Report on barriers and mitigation measures)



Work in progress

The Lazio Region has a MoU with the **Saxony-Anhalt** State of Germany and is a member of

- the **Clean Hydrogen Alliance**
- the Conference of Peripheral Maritime Regions (**CPMR**)

The Lazio Region is

- promoting the establishment of a task force on hydrogen among the Mediterranean regions of the CPMR
- looking for partners to participate in European projects





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LUIGI PALESTINI

Dirigente

AREA TRANSIZIONE ENERGETICA

Direzione Regionale Ambiente,
Cambiamenti Climatici, Transizione
Energetica e Sostenibilità, Parchi
Via di Campo Romano, 65
00173 Roma

Telefono: +39.06.51.68.64.03

E-Mail: lpalestini@regione.lazio.it

www.regione.lazio.it

Thank you for your attention!



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