Is Hydrogen the new LNG?

26° October 2020

Agenda

- ***About Us***
- European view on infrastructure
- Snam's pillars on Hydrogen

Europe's largest natural gas utility

€ 22.6 bn
RAB + affiliates (2019)

~ € 25 bn
Enterprise Value

~ € 1,093 mln
Net Profit Adj. (2019)

~ € 13 bn
Market Capitalization

cdp 59%

国家电网公司 STATE GRID CORPORATION OF CHINA 35%

National Banking Foundations 6%

cdp reti 30.3%

Free float 69.7%
~80,000 investors

snam

SNAM acquisition in the recent years - SME vertical integration for energy transition

cuboGas — bio-CNG /L-CNG compressor producer for refuelling stations solutions

IES a Snam company — Biogas and biomethane plants leading EPC player

RENERWASTE — Leading Italian urban waste and agri biogas and biomethane producer

Iniziative Biometano

ENERGY SOLUTION TEP a Snam company; **EVOLVE**; **MIECI** — Energy efficiency solution provider across residential, industrial and PA sector

Snam's presence along the value chain of natural gas and renewable gas

TRANSPORT AND DISPATCHING

~41,700 km

STORAGE

~20 bcm capacity

REGASIFICATION

~21* bcm/y capacity

SMALL SCALE GNL

Aim: **3** in Italy

HYDROGEN

~600 km of H_2 ready pipeline under assessment

BIOMETHANE/BIOGAS

+220 biogas plants designed and installed
+300 plants in operation

MOBILITY

2200 CGN/LGN stations in Italy - **300** SNAM (@2026)

*Total regasification capacity: Panigaglia (100% Snam); Rovigo Adriatic LNG (7.3% Snam); Revithoussa (DESFA) e OLT (49.07% Snam)

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Hydrogen: a «new» source of energy

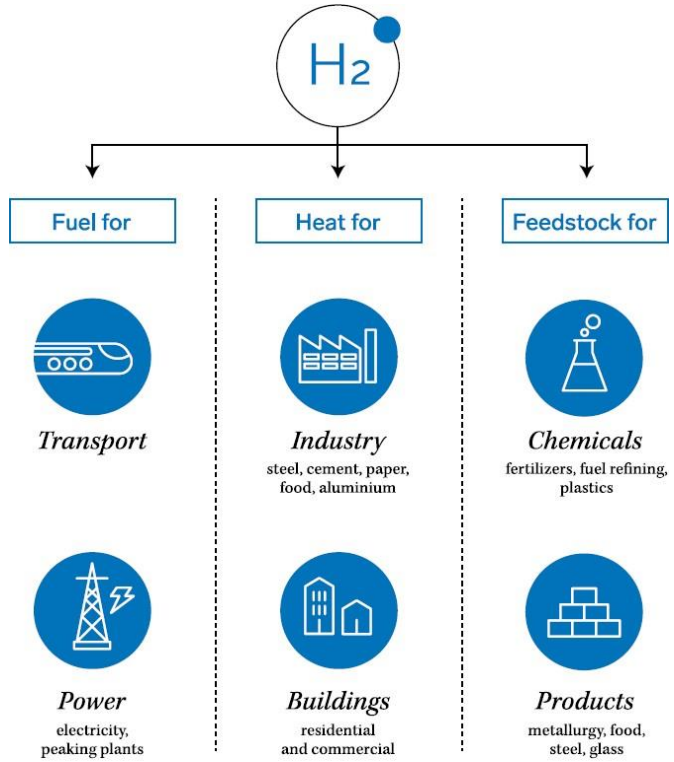
MAKE IT

«Grey» Hydrogen	«Blue» Hydrogen	«Green» Hydrogen
Natural gas is separated into hydrogen and carbon dioxide (CO2)	*Natural gas is separated into hydrogen and carbon dioxide (CO2). The carbon dioxide is stored and reused*	*Water is separated into hydrogen and oxygen molecules thanks to the use of electricity from renewable sources*
CO_2 emitted into the atmosphere	CO_2 captured and reused	No CO_2 emitted
Approx. 95% of the volumes today	*Uses in the beverage industry*	*Energy carrier for renewables storage*

MOVE AND STORE IT

- Hydrogen can be sent through existing pipelines or carried in tanks as a compressed gas or a liquid
- Unlikely electricity hydrogen is cheap and easy to store

USE IT



source: BloombergNEF

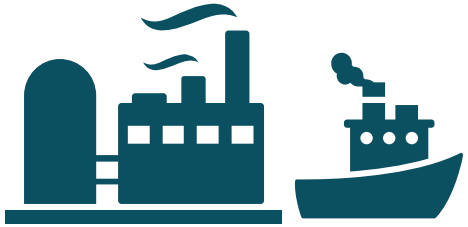
Hydrogen as been touted as energy solution before. Why we think this time will be different?

Hydrogen supply, demand, and policy trends are leading to rapidly improving prospects for affordable low-carbon hydrogen

Hydrogen production capacity is ramping up rapidly

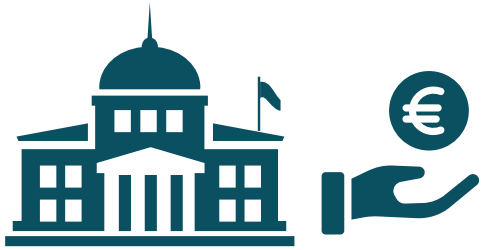
- Rapidly declining costs for renewable electricity
- Planned global investments in electrolysers increased from 3.2 to 8.2 GW between Nov 2019 and Mar 2020[1]
- Various industry initiatives: Hydrogen Europe, Hydrogen Council, Clean Hydrogen Alliance

Rising demand as sectors look to fully decarbonise



- Decarbonisation of heavy industrial processes (steel, cement, chemical)
- Complement electrification in hard-to-abate parts of the transport system (aviation, shipping, heavy duty trucking)
- Long-duration storage to support an electricity system with a large share of wind and solar.

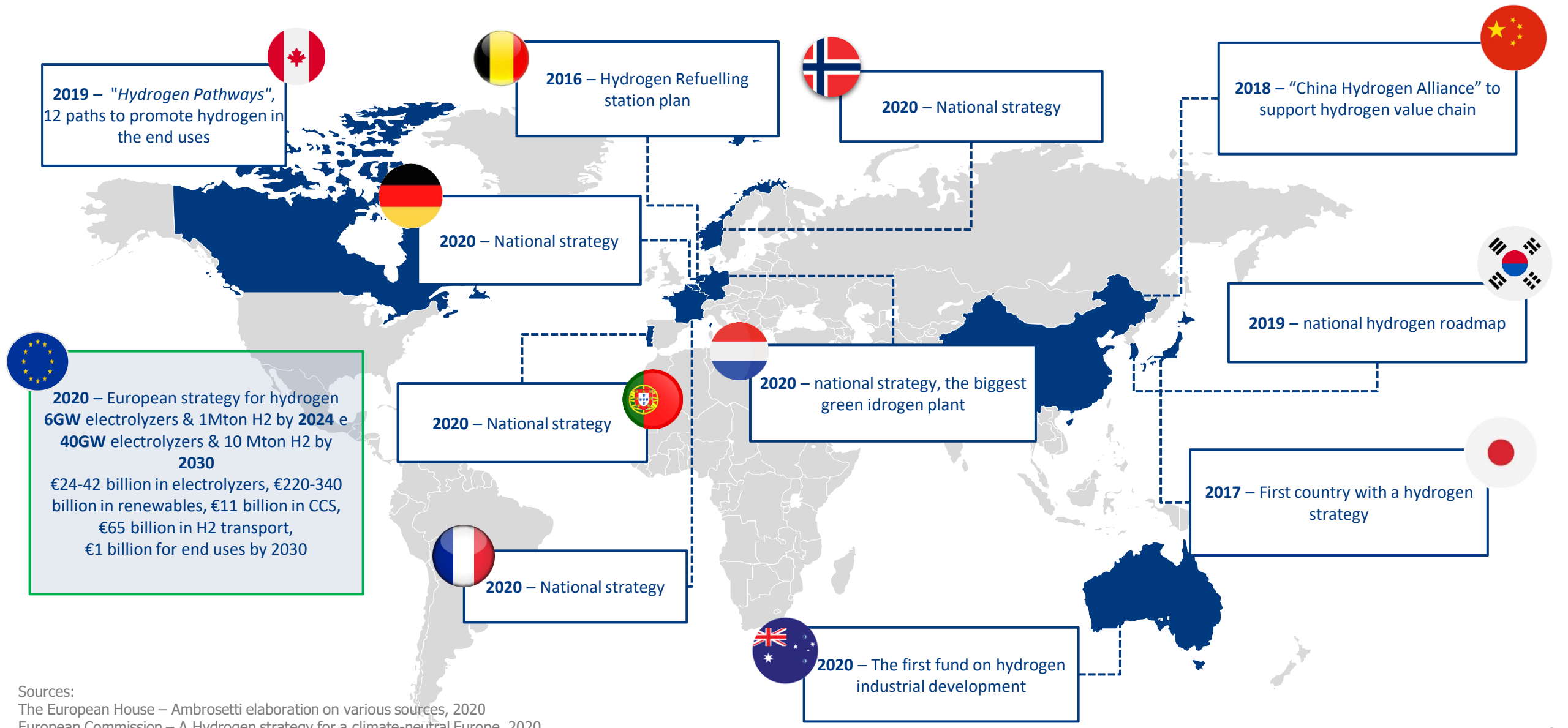
Supported by a clear policy direction at EU-level



- Renewable fuels are one of three central pillars of the EU's Energy System Integration Strategy[2]
- EU's Hydrogen Strategy launched in July 2020 targets 1 Mt green hydrogen by 2024 and 10 Mt by 2030[3]
- Various financing mechanisms and funds have been announced.

1. Source: Wood Mackenzie; 2. Source: European Commission, COM(2020)299; 3. Source: European Commission, COM(2020)301

National Hydrogen strategies worldwide



2019 – "*Hydrogen Pathways*", 12 paths to promote hydrogen in the end uses

2016 – Hydrogen Refuelling station plan

2020 – National strategy

2018 – "China Hydrogen Alliance" to support hydrogen value chain

2020 – National strategy

2019 – national hydrogen roadmap

2020 – European strategy for hydrogen
6GW electrolyzers & 1Mton H2 by **2024** e **40GW** electrolyzers & 10 Mton H2 by **2030**
€24-42 billion in electrolyzers, €220-340 billion in renewables, €11 billion in CCS, €65 billion in H2 transport, €1 billion for end uses by 2030

2020 – National strategy

2020 – national strategy, the biggest green idrogen plant

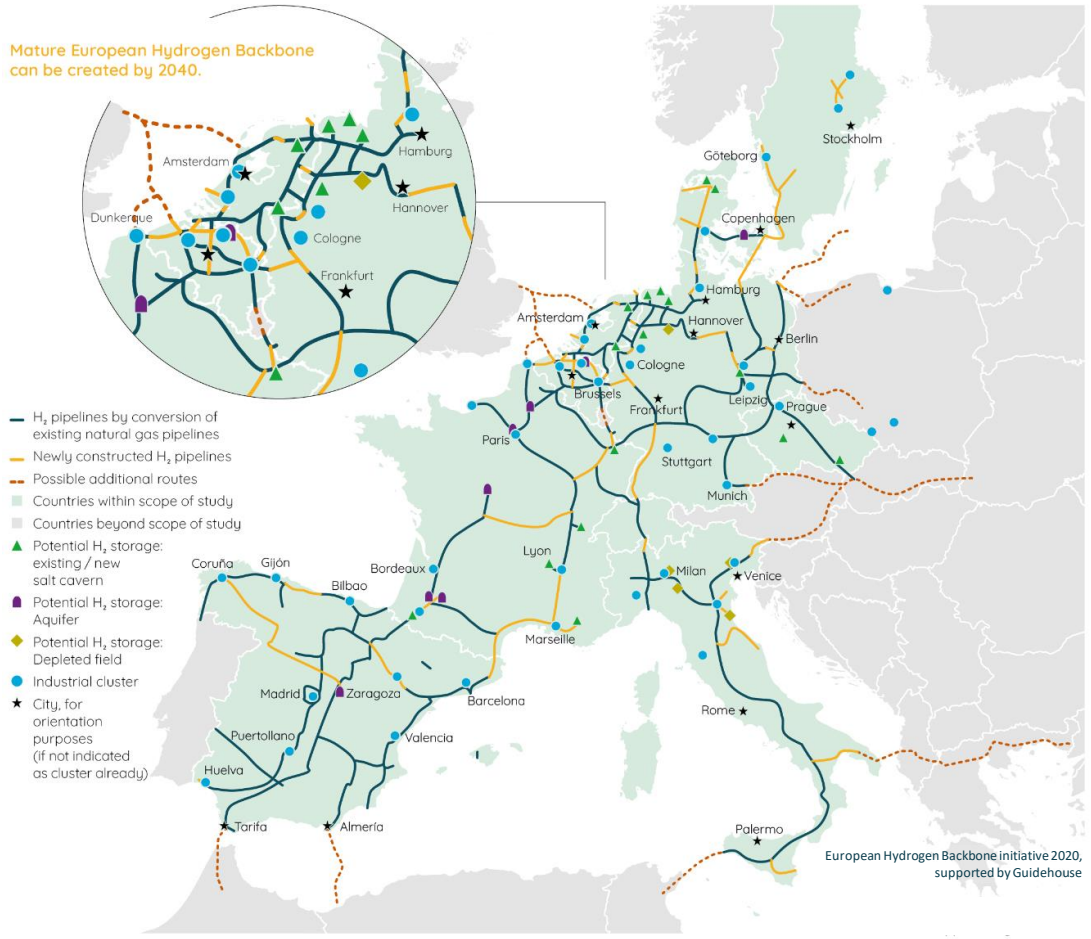
2017 – First country with a hydrogen strategy

2020 – National strategy

2020 – The first fund on hydrogen industrial development

Sources:
The European House – Ambrosetti elaboration on various sources, 2020
European Commission – A Hydrogen strategy for a climate-neutral Europe, 2020

The EHB is a shared vision from eleven TSOs to engage in a truly European undertaking



- A proposal for a **dedicated hydrogen transport infrastructure**, connecting supply and demand from north to south and west to east.
- Starting with an emerging 6,000 km pipeline network connecting hydrogen valleys by 2030; then stretching into all directions with a length of about **23,000 km by 2040**, with expected further expansion up to 2050.
- Converted 36- and 48-inch hydrogen pipelines, commonly used for long-distance gas transport in the EU, can provide **7 and 13 GW** (at LHV[2]) of hydrogen capacity per pipeline, respectively.
- The proposed backbone requires an estimated total investment cost of **€27-64 billion by 2040**, based on using 75% repurposed natural gas pipelines connected to 25% newly built dedicated hydrogen pipelines.
- Levelised transport costs amount to 0.09-0.17 €/kg per 1000 km, enabling **cost-effective long-distance transport** across Europe.
- The EHB is an **open initiative** – gas TSOs from adjacent geographies, associations GIE and ENTSOG, gas storage operators, DSOs, and other market players are encouraged to join in the thinking, to further develop this pan-European undertaking.

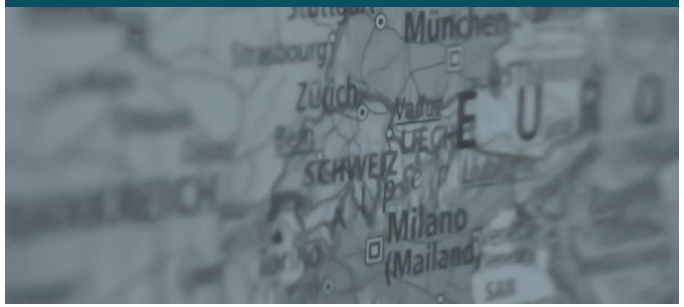
1. Includes Enagás, Energinet, Fluxys Belgium, Gasunie, GRTgaz, NET4GAS, OGE, ONTRAS, Teréga, Snam, Swedegas; covering Germany, France, Italy, Spain, the Netherlands, Belgium, Czech Republic, Denmark, Sweden, and Switzerland (indirectly through Fluxys Belgium); 2. LHV: Lower heating value, the energetic value of a gas, after subtracting the heat of vaporisation from the higher heating value.

A dedicated infrastructure can pave the way to large-scale competitive hydrogen for the European market

A hydrogen network can emerge from the mid-2020s onwards to an initial **6,800 km** pipeline network by 2030.

By 2040, a hydrogen network of **23,000 km** is foreseen, 75% of which will consist of converted natural gas pipelines, connected by 25% of new pipeline stretches.

A pan-EU hydrogen backbone



The backbone has an estimated cost of **€27 to €64 billion**, which is relatively limited in the overall context of the European energy transition.

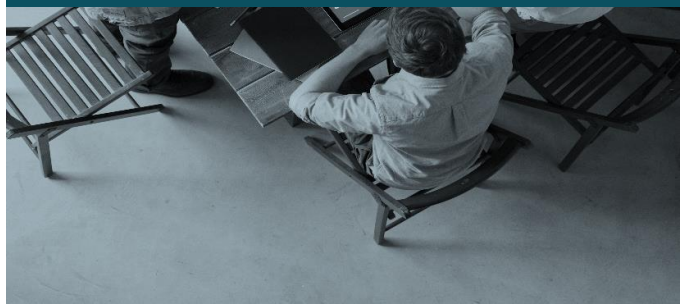
The levelised cost is estimated to be between **€0.09-0.17 per kg per 1000 km**, allowing hydrogen to be transported cost-efficiently over long distances across Europe.

At affordable cost

The group of gas infrastructure companies is convinced that the hydrogen backbone will eventually cover **the entire EU**.

The group **invites** other European gas infrastructure companies to join in the thinking to further develop the backbone plan.

An open initiative



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European leadership in hydrogen development

Ranked #1

In 2019 Snam has been the **first company in Europe to experiment the introduction of a mix of hydrogen and natural gas with H_2 up to 10% in volume** in its transmission network and involving two industrial companies, a pasta factory and a bottling of mineral waters. Additional pilot projects for industrial clients are already under development.

8 FCHJU calls

In April 2020 **Snam submitted project proposals for 8 different Fuel Cells and Hydrogen Joint Undertaking calls**, in partnership with the major players of the H_2 sector, both of the industrial and of the research areas.

~1.5 GW RES

Snam took part to the Strategic Forum on **Important Projects of Common European Interest** (IPCEI), established by the EU Commission. Under the IPCEI Snam the development of an **H_2 Valleys (for about 1.5 GW RES) i**n the southern part of Italy.

Key Roles in 3 associations

Snam has **key roles in the main H_2 associations** both at national and European level: Vicepresidence of H_2IT, Supporting Member of Hydrogen Council and Technical Committee leader of Hydrogen Europe.

https://www.nytimes.com/2020/05/27/business/hydrogen-fuel-climate-change.html

Snam and the Hydrogen opportunity: 3 streams of action

1. Asset Readiness

- **Pipelines:** network is largely hydrogen ready, key reason to underpin replacement
- **Components**: gas chromatographs and other minor instruments would need replacing (<1% RAB)
- **Gas compressor units**: testing the impact of a 5-10% blend.
- **Geological storage sites:** ongoing analysis and research
- Ongoing assessment of use of **membranes to separate NG and H2** out of NGH2 blend

Negligible investment to reach 5-10% NGH2 readiness
Ongoing investment in the grid «Hy-ready»

2. System design

- **Long-term scenarios:** Expected key role of hydrogen in the energy mix
- **Grid evolution:** Development of pathway analyses with increasing share of green gasses
- **Technical standards:** involvement in focus groups to develop common rules on H2 in Italy and Europe

Ongoing work
to support
long-term grid planning

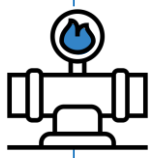
3. Value chain development

- Evaluating potential opportunities/pilot projects to scale up clean H2 production and use
- **Potential partnership** with other operators of the value chain
- Scouting for promising **technologies**

Scouting the market
for investment opportunities and partnership

Snam as an Enabler; Hydrogen BU created

Snam is assessing H_2 readiness on its infrastructure through a variety of actions



On pipelines :

- **injection tests** of a mixture of H_2NG up to 10 % of volume in the network (to check compatibility of current infrastructure) have been successfully carried out
- new SNAM's **internal standards** for 100% Hydrogen compliant Piping and Pipeline have been issued
- studies are going on existing pipelines to **validate H_2 readiness**, and confidence has been reached that only a small portion (10-15%) of the existing network needs to be replaced

On compressing stations :

- collaboration with gas turbine suppliers is ongoing to assess (i) the **maximum H_2 percentage** that can be mixed without major modifications and (ii) the extent of the modifications in case of higher percentages
- tests are planned to verify **readiness to accept 5% (potentially up to 10%) H_2NG mixtures** without changes

On underground storage :

- feasibility study has been launched to **investigate and simulate** physical, chemical and microbiological phenomena associated with H2NG storage
- The study will last two years but we do not expect major constraints to the use of H2NG mixtures

Thanks for your attention

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