Snam is one of the main global energy infrastructure company

Key figures

- € 24 bn
  RAB + affiliates (‘20)
- € 31 bn
  Enterprise Value
- € 1.218 m
  Net profit Adj. (‘20)
- ~ € 17 bn
  Market Cap
- 1%
  Debt cost
- BBB+
  Rating

New companies for energy transition

- Integration of H2 & CCS initiatives
- Decarbonization Projects Unit

International associates and presence

- Snam4 Mobility
- Snam4 Environment
- Snam4 Efficiency
- Headquarters in New York City and New Delhi

Natural gas

- ~41,700 km
  Transport
- ~17 bcm capacity
  Storage
- ~20 bcm/y capacity
  Regasification

30.3%
CDP CDP Reti

69.7%
Free float
~80K investors

30.3% CDP CDP Reti

energy to inspire the world

1% Debt cost

~80K investors

Headquarters in New York City and New Delhi

~41,700 km

~17 bcm capacity

~20 bcm/y capacity

~17 bcm Capacity
SNAM - An Italian and European leader in gas infrastructures

**Integrated operations in Italy**

**TRANSMISSION**
- 32,767 km of gas transmission pipelines
- 13 compressor stations (973 MW installed power)
- 75,77 Bcm injected into the network

**STORAGE**
- 9 storage fields (each with a compressor station and a treatment plant)
- 17,0 bcm of total storage capacity (including strategic storage)

**LNG**
- 3 small regasification terminals
- 2 RFSU under construction (adding 5+5 bcm)

**International associates**

- [Interconnector](#)
- [GAS CONNECT AUSTRIA](#)
- [TAG](#)
- [Trans Austria Gasleitung](#)
- [ADNOC](#)
- [Trans Adriatic Pipeline](#)
- [DESFA](#)
- [TERÈGA](#)
Asset readiness: an overview
Asset transition: From hydrogen asset readiness...

~ 33k km of H2 ready pipelines
- 99% of the network is ready to transport 100% H2 1 o/w 70% with no or limited reductions on max operating pressure
- Roadmap to obtain certification by

Compression stations
On field tests with H2-NG blending mix up to 10% on key Gas Turbines (>50% installed GT)

~17 bcm of storage capacity
- Verified the possibility of storing up to 100% H2 in a lab test unit (2 fields)
- Detailed engineering for deeper layer of F. Treste field to be completed by June 2023
- Industrial-scale tests on tubular material, wellhead & downhole valves planned in 2023

Gas Metering & other component
- Coordinating a project focusing on the metering ability to accurately measure H2NG mixtures
- H2 ready gas chromatographs to be installed from Q1-23 at key foreign interconnections

Final users
- Joint initiative with ENEA and DSOs to assess the H2 blend readiness of the whole infrastructure chain, down to residential users
- HyTecHeat, EU research project aimed at adopting hybrid heating technology (based on NG with progressive H2 utilization) in downstream

Plan on track for assets repurposing

1. Based on Option A of ASME B31.12.
Snam pipelines are verified for H2 transport

100% of Snam network verified for H2 transport

<table>
<thead>
<tr>
<th>(km, cumulated)</th>
<th>Q4 '20</th>
<th>Q1 '21</th>
<th>Q2 '21</th>
<th>Q3 '21</th>
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<tbody>
<tr>
<td></td>
<td>20.600</td>
<td>26.439</td>
<td>32.276</td>
<td>32.693</td>
</tr>
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</table>

≈ 99% of the network is ready¹ to transport 100% H2 70% with no or limited reductions on max operating pressure. Future revisions of the technical standards are expected to overcome limitations

Setting standards for H2 transport

First example in EU of network H2 readiness certification

Co-operation with other European TSOs to share test results, analysis, studies

Collaboration with fire department and universities to develop technical standards for H2 transport

¹. Based on Option A of ASME B31.12.
Longer term potential for H2 backbone…

**H2 backbone**

- **Ca 2,700km** of H2 network to bring production from north Africa and Southern Italy to consumption areas
  - 75% of km from repurposing
  - 50MW for compression stations to ensure suitable pressures on the network

**Key figures**

- Cost of repurposing **ca €0.6m** per km
- Cost of new build **ca €2m** per km

Our project for an Italian H2 backbone
The European Hydrogen Backbone – a vision for a truly interconnected H2 market for Europe

• The European Hydrogen Backbone (EHB) is a pan-European dedicated hydrogen pipeline transport network, connecting hydrogen supply and demand at an international level and create a EU market.

• 23 gas infrastructure companies from 21 countries (19 European Member States, UK and Switzerland).

• The backbone has expanded in length: the updated network covers a total distance of around 40,000 km.

• The extended backbone requires an estimated total investment cost of €43-81 billion by 2040, based on using 69% of repurposed natural gas pipelines and 31% new pipeline stretches.

• Levelized transport costs amount to 0.11-0.21 €/kg per 1000 km.
Asset readiness: case studies
In 2019, Snam successfully completed two injection campaigns injecting H2NG blend into the network, with percentages of 5% and 10% by volume. The campaigns were aimed at verifying the readiness of existing assets with respect to these blending percentages.

These H2NG blends were used by two industrial offtakers (a pasta factory and a water bottling plant) for the production of heat within their factories.

With this experimentation, Snam has initiated the transition for the transport of ever-increasing volumes of hydrogen in its assets, even creating an internal standard for the transport of hydrogen in pipelines.
Turbocompressors – Full scale Factory/Field Tests

Factory test - TC BHGE, model NOVA LT12 (New Supply) for Istrana Compressor Station BHGE
• factory test in Florence to verify gas turbine operation fueled with H2NG mixture (H2 up to 5% in volume and variable over time)

<table>
<thead>
<tr>
<th>ID</th>
<th>Phase</th>
<th>FUEL</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Start</td>
<td>Natural Gas (NG)</td>
</tr>
<tr>
<td>2</td>
<td>Warm up</td>
<td>NG</td>
</tr>
<tr>
<td>3</td>
<td>Operation</td>
<td>NG</td>
</tr>
<tr>
<td>4</td>
<td>Full load</td>
<td>NG</td>
</tr>
<tr>
<td>5</td>
<td>Full load</td>
<td>NG + 3% H2</td>
</tr>
<tr>
<td>6</td>
<td>Full load</td>
<td>NG + 5% H2</td>
</tr>
<tr>
<td>7</td>
<td>Partial load  (75%)</td>
<td>NG</td>
</tr>
<tr>
<td>8</td>
<td>Partial load  (75%)</td>
<td>NG + 3% H2</td>
</tr>
<tr>
<td>9</td>
<td>Partial load  (75%)</td>
<td>NG + 4% H2</td>
</tr>
<tr>
<td>10</td>
<td>Partial load  (50%)</td>
<td>NG</td>
</tr>
<tr>
<td>11</td>
<td>Partial load  (50%)</td>
<td>NG + 3% H2</td>
</tr>
<tr>
<td>12</td>
<td>Partial load  (50%)</td>
<td>NG + 4% H2</td>
</tr>
<tr>
<td>13</td>
<td>Partial load  (50%)</td>
<td>NG</td>
</tr>
<tr>
<td>14</td>
<td>Stop</td>
<td>NG</td>
</tr>
</tbody>
</table>

Factory test - TC BHGE, model PGT 25 for Sergnano Compressor Station (Storage plant)
• Test procedure to verify gas turbine operation (H2 up to 5% in volume and variable over time)

Field test – NOVA LT12 and PGT 25
• Test procedure for a field test to verify gas turbine operation (H2 up to 10% in volume and variable over time)
Storage: tests confirm the possibility to store H2 in depleted fields

**Test Results**

**Mineralogical Analysis**
Exposure of reservoir & cap-rock samples to gas mixture with increasing H2 blend

- No risk of dissolution / alteration of reservoir & cap rock minerals in **100% H2 environment**

**Diffusivity Tests**
Gas diffusion measurements for cap rock samples representative of Stogit fields

- Confirmed gas-tightness of reservoir for blends **up to 100% H2**

**Microbiological Analysis**
Microbiological reservoir characterization based on bio-chemical kinetics

- No risk of H2S production or methanation in the reservoirs by microbial activity

**Test on Well Specimens**
Testing on wells material

- No impact on cements **up to 100% H2** and to elastomeric up to 20% H2*

**Tests with multi-reactor**

**Ongoing tests in a reactor** on microbiological activity with **up to 50% H2 blending** (up to 100% in 2022) at reservoir pressure & temperature conditions

**Pilot test**

Development of a pilot test in Snam storage sites to confirm test results in the long-term behavior

Tests confirm it is possible to store H2 in our natural gas depleted fields

* Ongoing test on 100% H2.
Snam Italian H₂ projects

**The collaboration with Iris Ceramica Group**

Snam and Iris Ceramica Group have signed a MoU in order to develop a the first H₂-based factory ceramic factory. The company is responsible for 90% of the national ceramic production and the new factory will be 100% hydrogen ready.

**Airports decarbonization**

The agreement between Snam and Sea Milano for supplying green H₂ for the refuelling of vehicles used for internal and external transport at Malpensa Airport

Snam and Sagat (Turin Airport) have signed a termsheet for the installation of 1.2 MW FC to decarbonise the production of electricity and heat consumed at the airport

**Decarbonization of steel making sector**

On may 2021, within the Forgiatura A. Vienna plant, the first global NG-H₂ blend test composed by 30% of H₂ has been performed in forging processes employed in industrial scale steel manufacturing.

**Valcamonica project**

On 9th December 2020 FNM, a2a and Snam signed an MOU for the conversion from Diesel to Hydrogen of the railway service on the section Brescia - Iseo - Edolo. The project foresees the commissioning of 14 llintr-coradia hydrogen trains from Alstom by 2024

**Tenaris, Edison and Snam** will collaborate to implement the most suitable solutions for the production, distribution and use of green H₂ at the Tenaris mill, contributing their skills to invest in the best available technologies.
THOTH2 project

novel meTHOds of Testing for measurement of natural gas and H2 mixtures

The project (G.A. n. 101101540) is supported by the Clean Hydrogen Partnership and its members