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The hydrogen role for the clean energy revolution

Giovanna Pozzi

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The needs of the system require us to address the energy trilemma…

SYSTEM NEEDS

Security of Supply

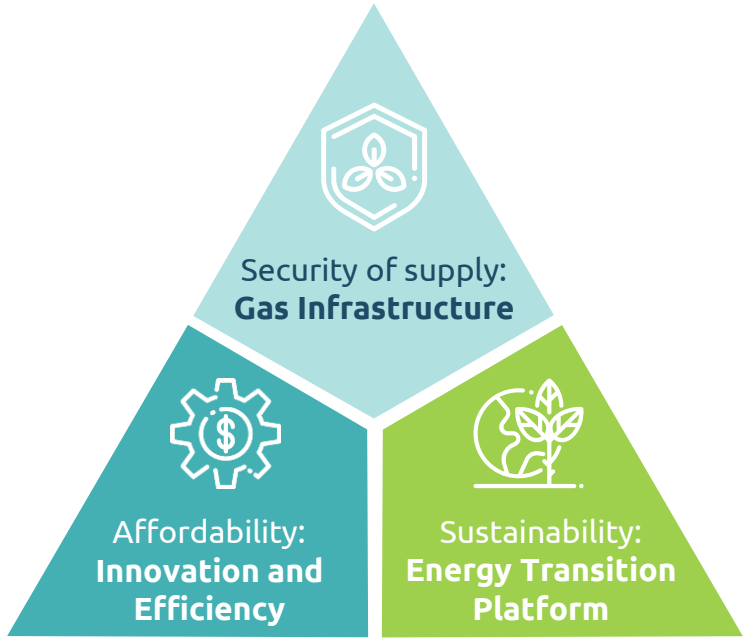
Develop the **gas value chain infrastructure** to enhance resilience through flexibility and adequate sizing

Sustainability

Accelerate **energy transition** through green and low-carbon gases development

Affordability

Ensure energy cost-competitiveness through **innovation efforts and efficiency initiatives**



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Note: Reference to article 194 of the Treaty on the Functioning of the European Union.

… and this implies the achievement of a number of objectives and priorities

- **Ensuring the provision of the energy content necessary to support the energy transition**
- **Maintain and optimize the sector's infrastructure and configuration**

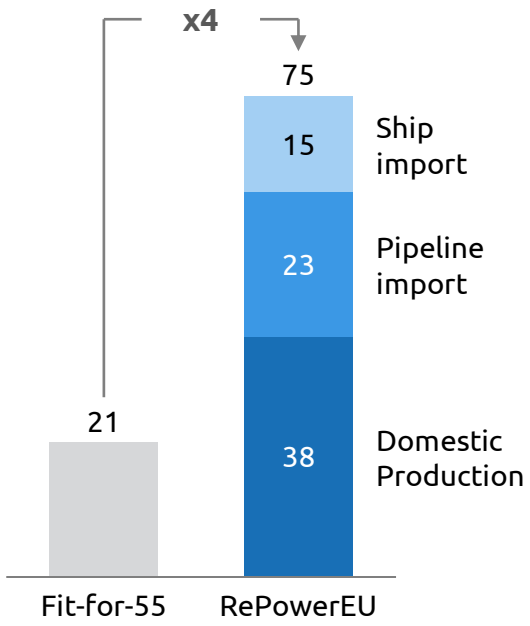
- **Reducing energy poverty** (~9% in Italy)
- **Preserving the cost competitiveness of** European industry

- **Meeting European decarbonisation targets for 2030 and supply diversification targets:**
- 55% emissions reduction
  - 40% RES share in the energy mix
  - 39% primary energy consumption savings
  - 20 Mt EU H2 demand target

Target REPowerEU for H2

Infrastructure and import essential to achieve hydrogen targets

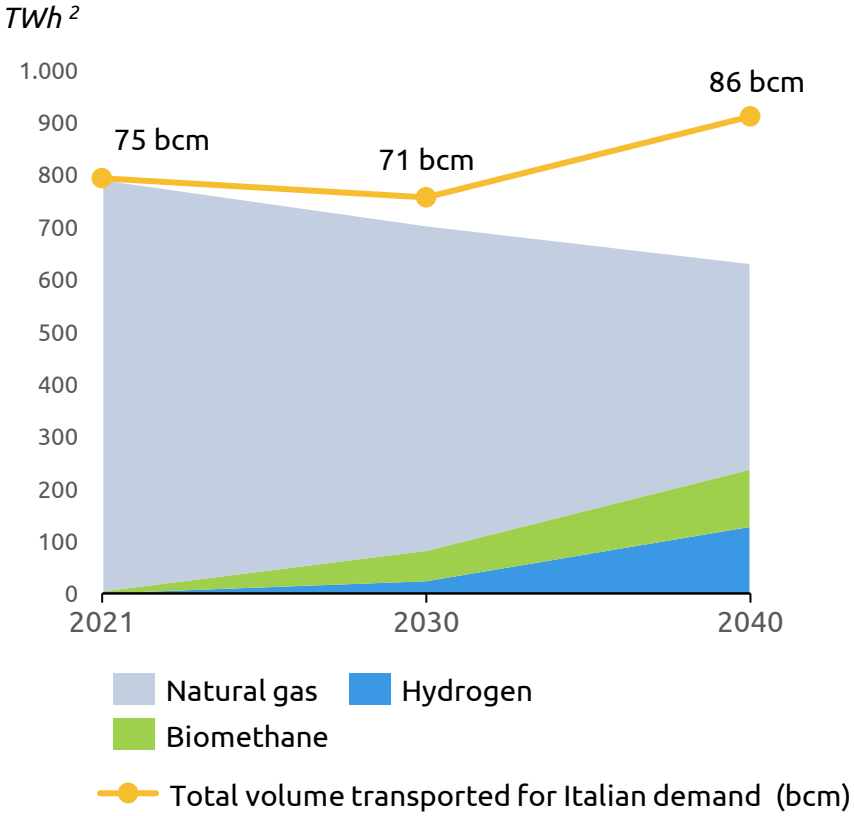
EU H2 demand targets by 2030, bcm eq



Repower EU H2 import corridors by 2030

Potential impact of green gases on volumes shipped

Italian demand & gas shipped[1]



Source: European Commission "Implementing the RePowerEU action plan: investment needs, hydrogen accelerator and achieving the bio-methane target".

1. Snam Terna - Global Ambition scenario. 2. Conversion factor: 1bcm eq of natural gas equal to 10.6 TWh.

Snam is leading the energy transition focusing on hydrogen

Snam has built in 2019 the **hydrogen business unit (BUH2)** focused on the **development** and **exploitation** of **hydrogen environment – today evolved into the Decarbonization Projects Unit**, which includes also CCS projects. It has been focusing on several areas:

- Technology scouting
- Design of innovative business models
- Identification of business cases for the use of hydrogen in various sectors

The «colours» of hydrogen

«Grey» Hydrogen

Natural gas is separated into hydrogen and carbon dioxide (CO_2)

CO_2 is emitted into the atmosphere

«Blue» Hydrogen

Natural gas is separated into H_2 and carbon dioxide (CO_2) and the CO_2 produced is not emitted in the atmosphere

CO_2 is captured and reused

«Green» Hydrogen

Water is separated into hydrogen and oxygen molecules thanks to the use of electricity from renewable sources

No CO_2 emitted

H_2 for Sector coupling and RES integration

Solutions for innovative utilities and sector coupling:

- Power-to-X
- H2 Islands

H_2 for Industry

Supply for green industrial processes:

- Feedstock
- High temperature processes

H_2 for Transportation

Solutions for sustainable mobility :

- Trains
- Public transport
- Heavy-duty trucks
- Internal logistic

H_2 for Commercial Use

Supply for green industrial processes:

- Power supply
- Internal heating systems

Hydrogen: the new decarbonised energy carrier

Hydrogen to contribute to:

Integrate highly variable energy sources (solar and wind) into the energy system

Decarbonising hard-to-abate sectors

Making Italy the European hydrogen hub

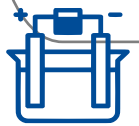
A supply chain to decarbonise energy consumption

Production

Wind and solar energy production

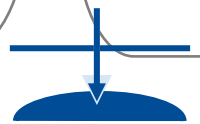
Conversion

Conversion to hydrogen
(near the plants or connected to the grid)



Storage

Underground storage



Transport

Dedicated pipelines

Blending with NG

Final users

Source of energy (buildings and industry)

Fuel (for the transport)

Feedstock (for the industry)

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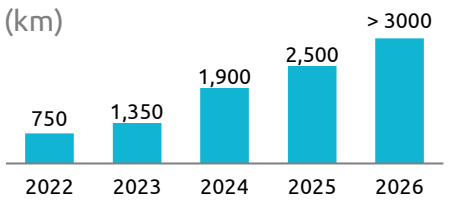
nave

Asset transition: From hydrogen asset readiness…

~ 33k km of H2 ready pipelines

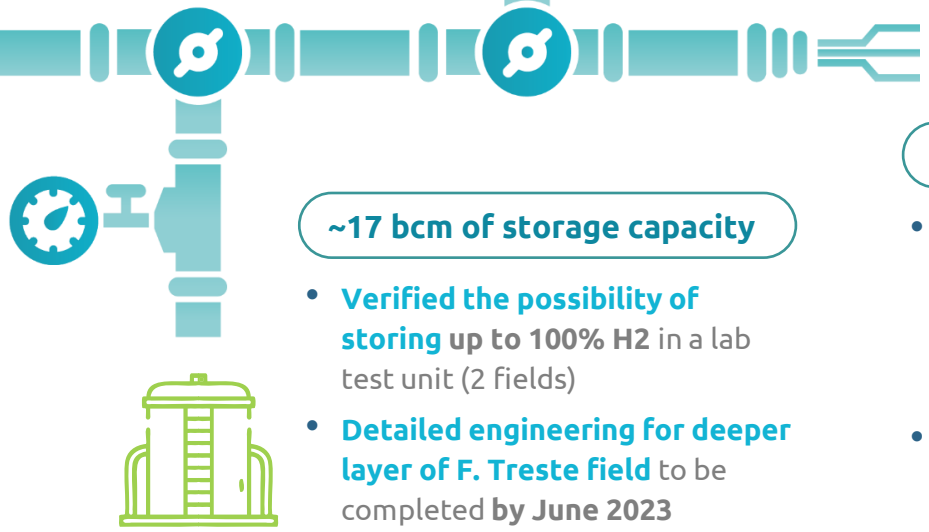
- **99%** of the **network** is ready to transport 100% H2 [1] **o/w 70%** with **no or limited reductions** on max operating pressure
- **Roadmap** to obtain certification by

RINA Model completed and validated



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.

…to Snam's future multi-molecule Energy System

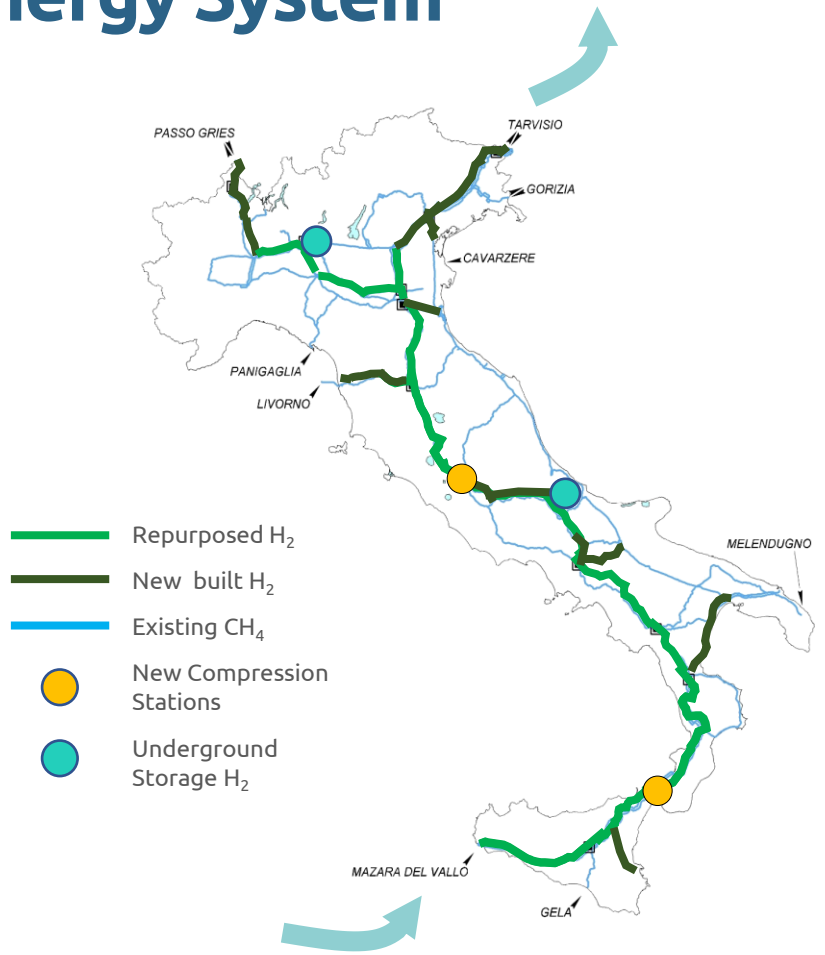
H2 BACKBONE

- **€4bn** cumulated capex throughout 2030-32 to serve Italian market demand (+ upside from export)
- **2300 km** of H2 network o/w 70% repurposed
- **Up to 500 MW** compression stations to enable export

H2 STORAGE

- **€3bn** cumulated capex to 2030-35 (seasonal and intra-day)
- **1.5 bcm** of capacity
- One new site and reconversion of one existing field

Decarbonized gas and H2 package promoting a regulated model



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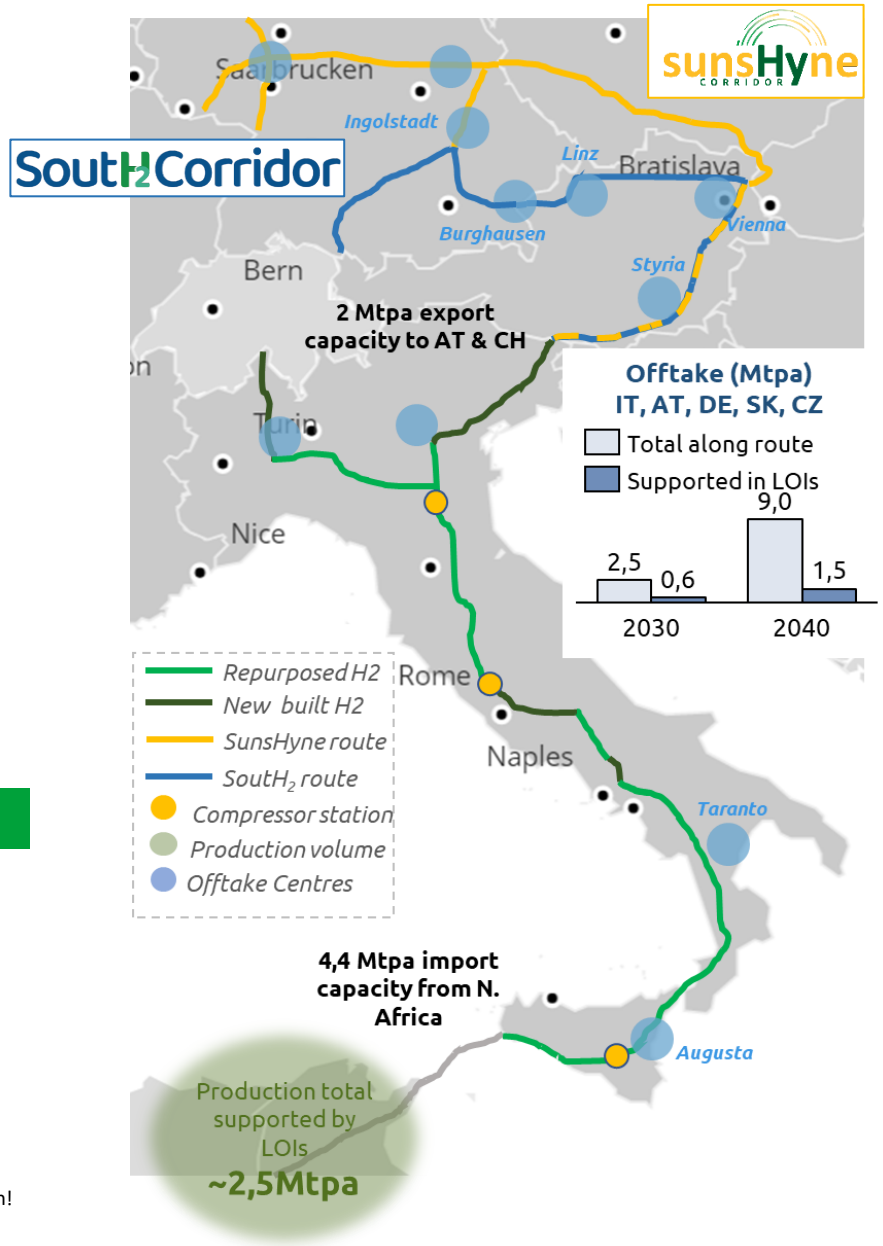
Snam infrastructure is core for the SouthH_2 Corridor

Snam key role in the European hydrogen ecosystem: the Italian H2 Backbone & Corridor

Snam is the key enabler of the Italian H2 Backbone & Corridor, promoting sustainability, competition and market integration

1. **Wide commitment** across all parts of the **value chain** with ongoing collaboration & working groups (already established by LOIs), from hydrogen production players to final users
2. **Identification of key projects** to enable the EU renewable hydrogen import targets at 2030
3. **Strategic infrastructural investment:** high proportion (70%) of repurposing



Involved parties

SouthH2Corridor

GAS CONNECT AUSTRIA, snam, TAG Trans Austria Gasleitung, bayernets, OMV, Verbund, SeaCorridor, ABO WIND, snam, CWP GLOBAL, TUNUR, TOTAL eren, axpo, AKER HORIZONS

www.south2corridor.net

sunsHyne CORRIDOR

SeaCorridor, snam, TAG Trans Austria Gasleitung, OGE, eustream SLOVAK GAS TSO, NET4GAS

www.sunshynecorridor.eu coming soon!

Hyaccelerator

powered by Snaminnova

The worldwide first corporate accelerator for startups 100% focused on hydrogen technologies

Vision

Snam aims to **drive the energy transition** and **discover and empower hydrogen enabling technologies** along the entire hydrogen value-chain

Acceleration model

Snam selects up to:

- **2 winners** that will access a **6 months acceleration** program to **co-develop a prefeasibility study**
- **1 winner** with **lower TRL** that will be awarded the **"Tech of the Future Award"**

Focus areas

Focus areas of the "On Our Way to Zero" challenge are:

- **Production**
- **Transport**
- **Storage & carriers**
- **Mobility end-users**
- **Industry end-users**
- **Alternative fuels**

Timeline

The **3 winners have been announced** during **HyAccelerator Day** on March 23rd, 2023 in Munich

Snam's collaboration with the winners will start **from April**

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HySET - Hydrogen Systems and Enabling Technologies

HySET
Erasmus Mundus
Joint Master

Joint Master Program completely dedicated to hydrogen and developed **thanks to the collaboration between several European universities and industrial partners**

Project duration: 74 months

Academic Partners

POLITECNICO MILANO 1863

POLITECNICO DI TORINO

UNIVERSITAT POLITÈCNICA DE CATALUNYA BARCELONATECH

NTNU

TU/e Technische Universiteit Eindhoven University of Technology

Industrial Partners

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REPSOL

SINTEF

SAFETEC

+ 19 other supporting **partners** from universities, industries and associations

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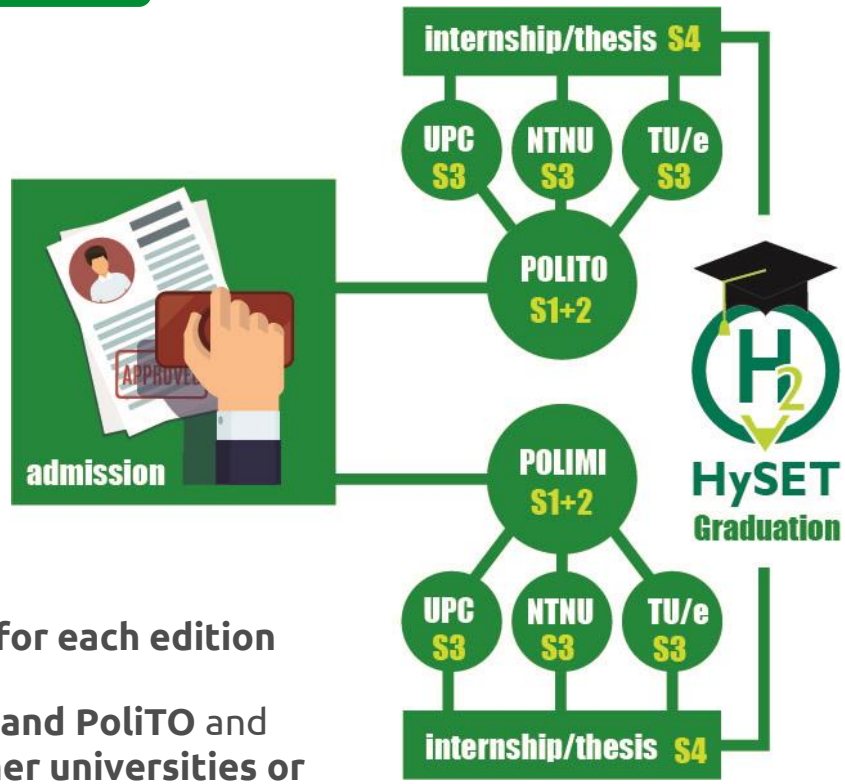
Program Structure

- First edition **launch September 2023**
- Duration 2 years



- About **25 students for each edition**
- **Entrance at PoliMI and PoliTO** and **continuation** at **other universities or industrial partners**

Detail of a cooling unit
of a vaporizer.
Snam regasification
plant, Panigaglia, 2022.

Photograph by
Carlo Valsecchi

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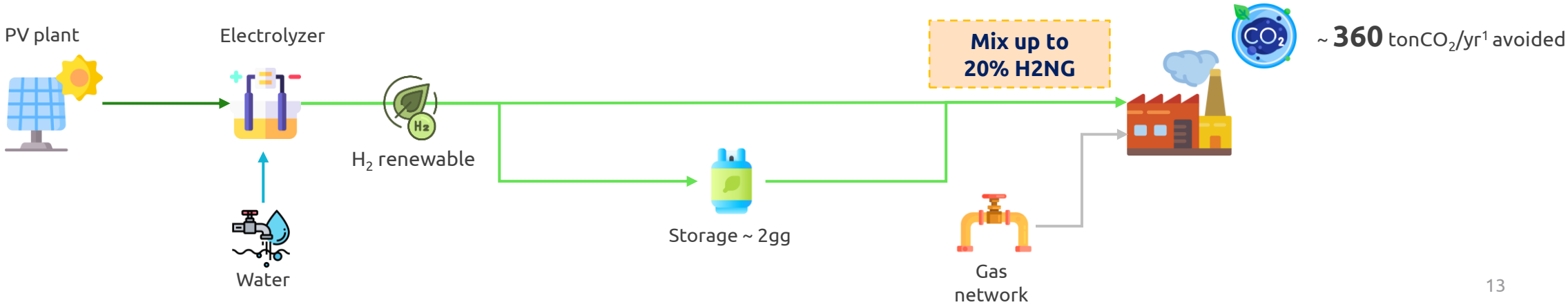
Example of the dimensioning of an industrial project

Step	Activity
RES plant design	• PV/Wind power estimation (**MW**) and expected production (**MWh/yr**) • Quotation analysis and **identification of the technology provider**
H2 integration analysis within the plant	• **Analysis of H2 ready burner providers on the market** • Identification of the **client strategy and opening of technical table with suppliers** • Identification of **max %H2** manageable by the plant
Definition of the H2 production plant	• Definition of the **H2 requirement** and detailed **H2 plant sizing** • **Optimization of the PV–electrolyzer integration** • Analysis of **plant configurations for H2 production and other components** (compressor, storage, ...) • Requests for **quotations** for each plant component
Business Model Definition	• **Definition of the Business Model** within all the different counterparties involved



1) *CO2 savings calcolate considerando fattore emissivo di 200 kg/MWth da gas metano e consumo 42,0 GWh/anno vs 43,8 GWh/anno*

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