Hydrogen

Solutions for hydrogen

Pietro Fiorentini

Hydrogen: the ideal ally for the energy transition

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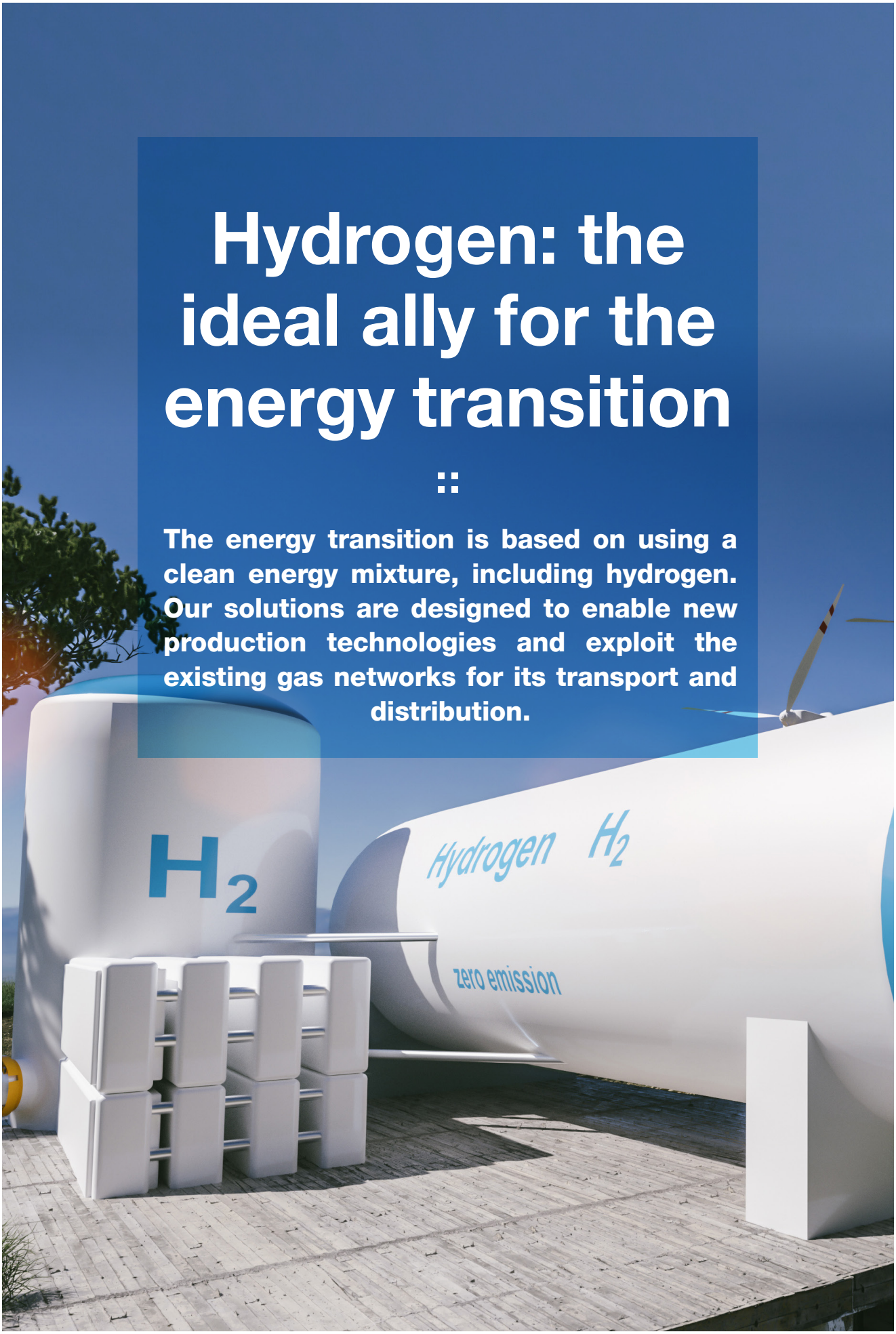
The energy transition is based on using a clean energy mixture, including hydrogen. Our solutions are designed to enable new production technologies and exploit the existing gas networks for its transport and distribution.



Pietro Fiorentini **hydrogen journey**

2019

JULY

Development of new products:
Hy4Heat project:
startup meter project 100% H_2

2020

MARCH

Compatibility analysis of materials
Research project with PoliMI

SEPTEMBER

Compatibility test
Tests on materials in certified laboratories

DECEMBER

Preliminary tests
Leak test on products in portfolio with He e H_2

2021

FEBRUARY

Field test
h21 project: pressure reducing station for 100% H_2

JULY

M&A
Hyter: hydrogen production technology

2022

AUGUST

In the field
Commissioning of the blending station (Chile)

OCTOBER

Test in-house
New laboratory dedicated to H_2

Pietro Fiorentini **hydrogen value stream**

The need of a large scale use of hydrogen is pushing gas infrastructure to drastically evolve. We are applying our international 80 years experience on gas networks to face this exciting challenge: from designing and testing hydrogen ready solutions up to developing new hydrogen blending stations, our purpose is to **exploit the full potential of existing gas networks to accept and deliver hydrogen**.
Our set of solutions spans from hydrogen generation through electrolysis up to the end users metering, passing through storage, pressure control and blending with natural gas.

ELECTROLYSIS

Electrolysis is the chemical reaction between electrical power and water where all starts, the birth of an efficent, clean and safe energy source.
Thanks to Hyter, the company who joined Pietro Fiorentini Group in 2021, we can provide a complete range of electrolysers up to 250 Kw.

STORAGE

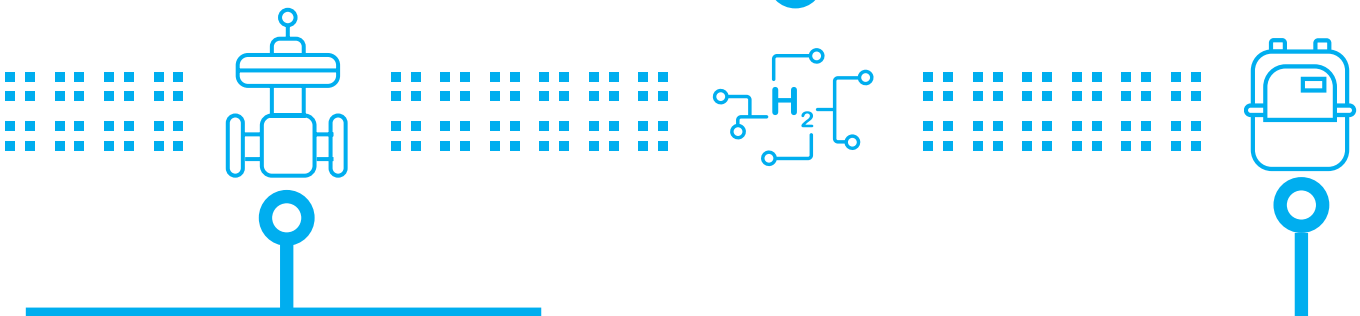
One of the great advantages of gases over other energy sources such as wind or photovoltaics is that it can be stored at times of low demand and used when it is needed most.

VALVES

Valves are a fundamental element of any transport and distribution pipeline. We provide a range of valves for every need in the hydrogen value stream: from customized ball valves designed for special uses, to slam shut and butterfly valves for a safe and reliable distribution.

BLENDING AND INJECTION

Hydrogen networks are on the rise, and expecially in the first part of their path, they will have to work together with traditional natural gas transmission and distribution grids.
Depending on various factors, end users may need several degrees of blending, from 20% up to pure hydrogen.



PRESSURE CONTROL

We define the standard of the pressure regulator with the main purpose of allowing the gas to flow smoothly to the utilisation point, always in total safety. We are bringing our decades long experience with natural gas in the hydrogen field to provide a complete range of reliable pressure regulators.

METERING

Accurate gas metering is a primary requirement for the energy sector. We provide a complete range of gas meters for residential, commercial and industrial applications.

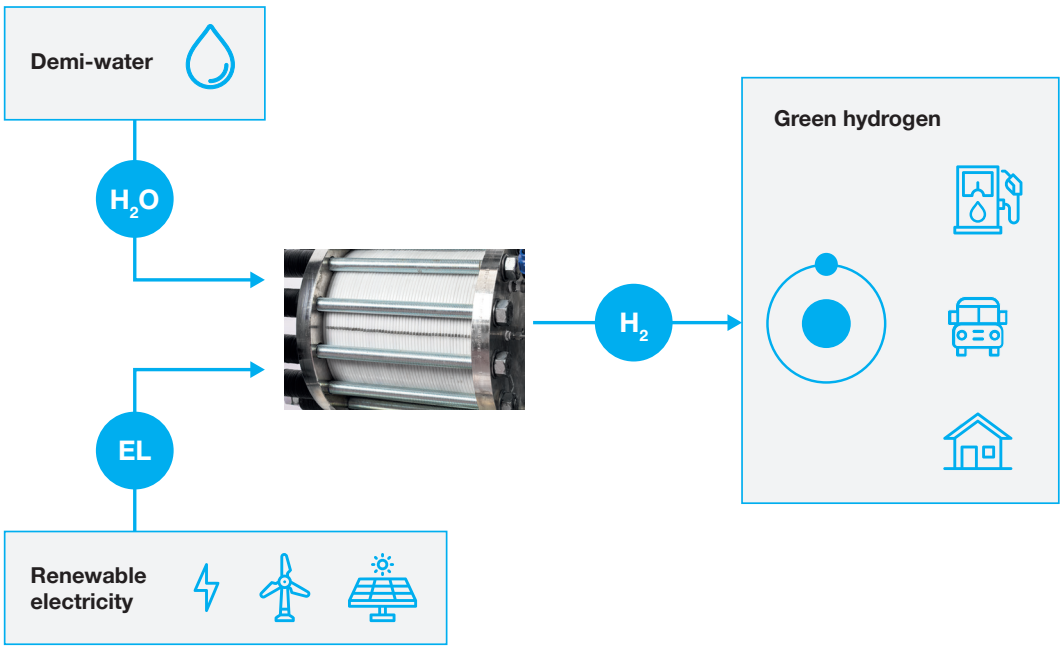
HYTER
NEW ENERGY ROUTES

AEMWE electrolysers

Hyter is a company operating in the hydrogen sector since 2011. It joined Pietro Fiorentini Group in July 2021. The company develops **solutions to generate green hydrogen through the electrolysis of water**, using a process based on anionic exchange membrane technology (AEMWE).

Using these technologies satisfies multiple needs in the energy transition process. For example, it enables **storing and consuming the hydrogen produced**, thus stabilising the variability of the production of electricity from renewable sources, very often not aligned with consumption. There are also umpteen potential applications, like sustainable mobility, sector coupling or solutions to satisfy residential uses.

Hyter | How it works



Scope	Size	Main features	Time to market
Small-mid scale electrolyser	Up to 20 stacks (10 kW in parallel)	• Few rare metals • Efficiency 85% • Up to 2.5 MPa | 25 bar output pressure • H_2 purity 99.95% • 3% of electrolyte • Process water: demi water	Available
Large scale electrolyser	Multiple stacks in parallel (80 oz 250 kW)		1Q 2024

Hyter | Main features

- Working with direct renewable source
- Compression up to 70 MPa | 700 bar
- Demi water in the process
- Purification up to 99.999%
- Using 3% of electrolyte
- Minimum usage of rare metal
- Modular solution
- 85% of efficiency
- Fuel cell integration
- Easy maintenance

Hyter | Reference list

Scope	Size	Customer	Country	Year
Refueling station	0.5 m^3/h	Redam Srl	Italy	2014
Storage PV	1.5 m^3/h	Aquacell GMBH	Germany	2015
Refueling station	1.5 m^3/h	Caldoa GMBH	Germany	2020
Laboratory	0.25 m^3/h	Enea	Italy	2018
Laboratory	0.5 m^3/h	Edison Spa	Italy	2019
Pilot	0.5 m^3/h	Electrohydro BV	Netherlands	2020
Pilot	0.5 m^3/h	Bareau BV	Netherlands	2020
Storage PV	2 m^3/h	Enphos Srl	Italy	2021
Biomethanation plant	4 m^3/h	Micropyros GMBH	Germany	2021
Micro-grid	2 m^3/h	PLT energia	Italy	2021
Refueling station	6 m^3/h	Sera GMBH	Germany	2021

Pressure vessel tanks
for hydrogen storage

One of the great advantages of gases over other energy sources such as wind or photovoltaics is that it can be stored at times of low demand and used when it is needed most. Moreover, it allows the transportation of gas without expensive pipeline interventions.

Thanks to the expertise of our team, all these traditional advantages of natural gas are applicable to hydrogen on a wide range of pressure vessel tanks, tailored on every customer's need.

Features	Values
Individual vessel capacity	Up to 30 m^3
Material	Stainless steel or carbon steel
Design pressure*	8 MPa 80 bar
Design temperature*	from -20° C to +50° C from -4° F to +122° F

(*) NOTE: Different functional features and/or extended temperature ranges available on request. Stated temperature ranges are the maximum for which the equipment's full performance are fulfilled. Standard product may have a narrower range.

Vessel tanks certifications

EN13445

ASME VIII Div. 1

CE-PED

Valves

TIV Valves, part of Pietro Fiorentini Group since 2019, is an Italian manufacturer of high quality ball valves striving to be your most valuable partner for oil and gas, sustainable energy, green and industrial applications, offering on-time delivery of engineered technical solutions thanks to its specialized team of experienced managers and engineers and the 25,000 m^2 production area.

Pietro Fiorentini guarantees the all the current manufactured natural gas valves in the following range are suitable for 20% hydrogen blending service.

- Sizes: 1” to 48”
- Pressure class: up to ANSI 900
- Design temperature: from -29° C to +150° C | from -20.2° F to +302° F

Upon request all valves can be manufactured for **100% hydrogen service**

- Custom engineered product to fit process conditions
- Material selection and valves design based on operating pressure, temperature and fluid composition

Class 600# valve for 100% Hydrogen service (h21 project)

Pressure control
for hydrogen networks

We define the standard of the pressure regulators with the main purpose of allowing the gas to flow smoothly to the utilisation point, always in total safety. Thanks to our many decades of experience in the natural gas field, we can provide a complete range gas pressure regulators suitable for all applications, from transmission to residential.
These devices are now being tested to work with hydrogen blends and pure hydrogen, in order to be ready for the future of gas networks. **Pietro Fiorentini guarantees the all the current manufactured pressure control products are suitable for 20% hydrogen blending service.**

Hydrogen ready pressure control devices range


Pilot operated regulators


Direct action regulators


Double stage regulators


Governors


Slam shut valves

Main application field covered

- Compression / booster stations
- H_2 storage
- H_2 liquefaction plants
- Electrolyzer plant
- Compressed hydrogen tube trailers
- Electrolyzers downstream applications
- City gates
- Heavy industries
- Regasification plants
- District stations
- Commercial users
- Power generation
- Gas reverse-flow
- Blending units
- Medium/small industry
- Residential users

Pressure regulators available for **100% hydrogen service** and typical applications

Range	Model	Main applications
Transmission	Reflux 819 H	
Transmission	Reflux 819/FO H	
Transmission	Staflux 187 H	
Distribution MP	Reval 182 H	
Distribution MP	Norval H	
Distribution MP	Dival 600 H series	
Distribution LP	Dival 500 H series	
Distribution LP	FE H	
Distribution LP	Governors H	

NOTE: All optionals available with each pressure regulator (i.e. monitors, slam shut valves, silencers) have the same compatibility degree of the device they are equipped to.

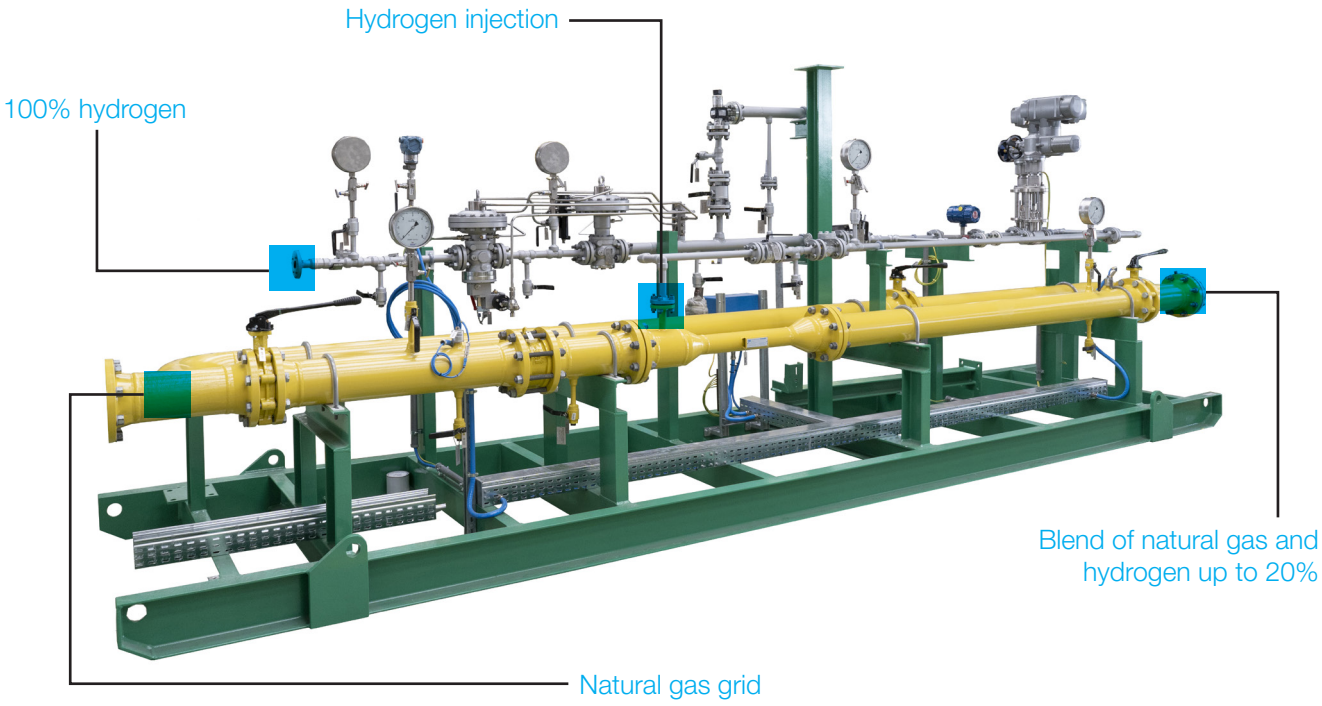
Slam shut valve available for **100% hydrogen service** and typical applications

Range	Model	Main applications
Transmission	SBC 782 H	
Transmission	SBC 187 H	
Distribution MP	Dilock H	
Distribution MP	SCN H	

Blending & Injection

Hydrogen stations

Hydrogen networks are on the rise, and expecially in the first part of their path, they will have to work together with traditional natural gas transmission and distribution grids. Depending on various factors, end users may need several degrees of blending - up to 20% hydrogen. This means that a reliable, fast-responding system is needed to blend, analyse and control hydrogen flow in the grid.



We provide tailor designed station for blending & injection, featuring a full scale industrial design that can be easily adapted from low pressure districts up to high pressure transmission networks and industrial applications.

Pietro Fiorentini hydrogen test laboratory

In order to field test our products in a safe and reliable environment, we created a brand new hydrogen test laboratory.
Based in our headquarter in Arcugnano (Vicenza, Italy), our hydrogen test laboratory is the place where we **test the readiness of our products** and **develop new projects** for both transmission and distribution networks.

Grand opening: October 2022

Main features: Inside our laboratory we are able to **test our products with pure hydrogen** and with **natural gas blends from 0 to 100%**, with a blend volume up to 4 Sm^3 accumulation, 0.2 m^3 at 2 MPa | 20 bar.
We are able to test with **flow rates up to 40 Sm^3/h in closed loop and up to 25 Sm^3/h in continuous discharge**, with a pressure up to 10 MPa | 100 bar static. To test our residential meters we apply a pressure variation from 2 to 50 kPa | 20 to 500 mbar, while 400 to 600 kPa | 4 to 6 bar to test our regulators.
The **purity of the hydrogen** produced by our electrolysers **reaches up to 99.95%.**

Click here or scan the QR code to see our hydrogen laboratory video presentation.

Our lab in **numbers**

99.95%
Hydrogen purity

Up to
10 MPa | 100 bar
Max static test pressure

40 Sm^3/h
Flow rate in closed loop

25 Sm^3/h
Flow rate in continuous discharge

Metering
for hydrogen networks

Accurate gas metering is a primary requirement for the energy sector. Pietro Fiorentini provides a complete range of gas meters for residential, commercial and industrial applications.

Pietro Fiorentini guarantees the all the current manufactured gas meters are suitable for 20% hydrogen blending service.

Hydrogen ready meters range

Turbine meters

Rotary meters

Ultrasonic meters

Ultrasonic smart meters

Full hydrogen smart meters

Main application field covered

- Compression / booster stations
- H_2 storage
- City gates
- Power generation
- Heavy industries
- District stations
- Medium/small industry
- Commercial users
- Residential users

Meters available for **100% hydrogen service** and typical applications

Range	Model	Main applications
Turbine	IM-TM H	
Rotary	IM-RM H	
Ultrasonic	FioSonic H	
Ultrasonic	H2-SSM-iCON	

Zero emissions target in the United Kingdom with **H2-SSM**

Our first step in the hydrogen world was taken in the **Hy4Heat** project, wanted by the United Kingdom to achieve the target of being a **zero emissions Country by 2050**. More specifically, the project aims to check the safety and technical-economic feasibility of **replacing methane gas with 100% hydrogen** in the domestic/industrial networks. Working packages were assigned to us in the Hy4Heat project. These include the supply of a **residential meter** and all the upstream and downstream components. The result is **H2-SSM**, the first static, ultrasonic meter developed to measure up to 100% of hydrogen, currently in its preliminary test phase with the Hydrogen Home in the United Kingdom.

Click here or scan the QR code to take a tour of Hydrogen Home (Northern Gas Networks project).

Pietro Fiorentini

www.fiorentini.com

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Hydrogen

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