Enagás H_2 Technical Day

11 · 06 · 2025

Highlights

- There is a need for **infrastructure to be developed** that incorporates **all the technological advances** required to **connect production and demand and to scale up hydrogen**.
- **Efficiency improvements** are being achieved through **better system integration** and **more sophisticated designs**.
- The **GREENH2PIPES project** demonstrates how digitalisation can be applied across the entire hydrogen value chain using tools such as CFD (Computational Fluid Dynamics), modeling, digital twins, and machine learning.
- **Integrating Information Technology (IT) and Operational Technology (OT)** is essential for the development of truly effective digital twin systems.
- **A new technological cycle is being promoted**, aimed at **building the hydrogen infrastructure** of the future. In this context, a pivotal moment is being experienced, where technology serves as a key ally.
- With **appropriate material selection and risk management, hydrogen storage solutions are technically viable** and **increasingly feasible**.
- **R&D projects are essential for the development of the green hydrogen economy**. **Europe has funded more than 700 projects** with a total budget exceeding €3.3 billion, placing emphasis on collaboration and impact across the entire hydrogen value chain. These projects will undoubtedly serve as a catalyst for green hydrogen.

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The second edition of **Enagás H2 Technical Day** brought together key figures from the main actors of the energy and technology sectors that addressed the latest developments and challenges in the deployment of hydrogen in Europe.

One of the main conclusions was that a **European hydrogen market cannot be established without infrastructure**. "60% of the awarded projects in the European Hydrogen Bank second auction require pipelines to connect production and consumption, with an average of 384 km long" stated Enagás CEO, Arturo Gonzalo. The EU's support for such developments is also evident in the recent signing of the grant agreement with the European Agency CINEA for the necessary funds to develop the Spanish hydrogen backbone and it was announced during the event.

In his keynote speech on **the state of the art of hydrogen technology, the Director of the Spanish National Hydrogen Center (CNH2), Emilio Nieto**, mentioned that there are already nine Spanish hydrogen production projects in operation and six FIDs have been already taken, bringing the total number of projects this year to 60. He highlighted the specific technologies used or proposed by these projects, as well as the general and technical issues involved in integrating renewable hydrogen into the existing energy framework.

AEM (Anion Exchange Membrane) and SOEC (Solid Oxide Electrolysis Cell) electrolysis technologies are progressing toward reversible operation, enabling both hydrogen production and its use. Investment and operational costs are decreasing thanks to standardization and increased installed capacities.

Efficiency improvements are being achieved through better system integration and more sophisticated designs.

Rountable 1

Digitalisation is a transformative pillar for the entire life cycle of new hydrogen infrastructures

The panellists identified that current projects demonstrate how digitalisation can be applied throughout the entire hydrogen value chain with tools such as CFD modelling, digital twins, and machine learning being used.

Three main challenges were identified in **achieving real efficiency in the transformation of the economy using hydrogen: building models such as digital twins**, doing so in a timely manner, and the importance of the human factor.

Digitalisation improves the technical design and operation of infrastructure, as well as transforming organisational processes and the way work is performed. **Integrating Information Technology (IT) and Operational Technology (OT) is essential to creating truly functional digital twins**, as stated by the representative of Siemens Digital Industries Software.

BIP Consulting Spain explained that a different approach is needed to build these digital twins, which are essential for increasing predictability and accelerating the implementation. Their representative also stated that **computational models incorporating uncertainty need to be developed**, and that **building information models (BIM) is set to transform the design, construction, and operation of hydrogen infrastructure**.

Artificial intelligence plays a decisive role in the evolution of these solutions, **enhancing efficiency and predictive capabilities**. As a professor and researcher from the Universitat Rovira i Virgili mentioned, there is an urgency of the transformation which implies that trial and error approach is no longer the solution.

Rountable 2

The role of Original Equipment Manufacturers is key to build a European Hydrogen Network

All panellists acknowledged the significant progress that has been made in terms of equipment and materials. However, challenges remain, such as ensuring the durability of materials under high-pressure conditions. As the materials are used in high-pressure environments, energy efficiency, regulatory and standardization are required.

- Burckhardt Compression mentioned that **compression technologies** are evolving towards **more efficient, modular, and oil-free solutions**, backed by over 50 years of industry experience.
- Endress + Hauser Sick pointed out that the aim is to **avoid over-instrumentation and reduce costs by tailoring sensors** to each measuring point.
- SLB stated that **valves face challenges in terms of sealing and material compatibility with hydrogen**, which has led to the development of standards.
- Baker Hughes highlighted how the NovaLT16™ turbine is a validated, available solution that operates fully with 100% hydrogen and low NOx emissions.
- Mannesmann emphasised that long-term investments require **political stability, production commitments, and predictable hydrogen pricing.**

Rountable 3

H2Gar Project: A collaboration among TSOs to ensure integrity of hydrogen midstream infrastructures

The speakers on this panel, all members of the **H2 Gas Assets Readiness (H2Gar) initiative**, mentioned that collaboration among TSOs and other companies is key to promote the energy transition, with regards to the challenges and opportunities of integrating hydrogen into the existing transmission systems.

The session was focused on the work and progress of H2Gar's six working groups:

- **Pipelines** (WG1): The Enagás representative mentioned that they initially assessed the impact of pure and blended hydrogen on existing carbon steel pipelines, and are now moving towards harmonised design, qualification, and repurposing criteria. The standards are now less conservative.
- **Compressor Stations** (WG2): NaTran mentioned that they are focusing on gaining an in-depth knowledge of hydrogen compressor technology, especially with regard to high flow rates. The working group is now exploring the opportunity of adopting hydrogen compressor powered by electric motors.
- **Separation Systems** (WG3): The importance of hydrogen purity was emphasised not only in this WG. Snam explained the importance of separation and purification, which are essential processes. The feasibility of using polymer membranes for hydrogen separation and purification in existing infrastructure, especially near storage sites, is being explored.

Rountable 3

H2Gar Project: A collaboration among TSOs to ensure integrity of hydrogen midstream infrastructures

- **Metering and other instrumentation** (WG4): Enagás representative stated that a national, common approach to hydrogen metering has been developed. However, the availability of certified equipment and accredited laboratories remains challenging.
- **Safety** (WG5): National Gas mentioned that safety is the core of the activities of any TSO and future HTNO, and that it is crucial to work towards the practical implementation measures, especially in operations and maintenance. Safety is a cross-cutting priority, promoting a technical and operational culture aligned with net-zero targets.
- **Underground Storage** (WG6): Snam explained the main aspects related to purity specifications, given the microbiological risk due to the potential for chemical reactions. They are leading the development of EU-wide purity standards, monitoring systems and pilot-scale demonstrations. The good news is that developing hydrogen storage is feasible with proper material selection and risk management.

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The Hydrogen Technology Observatory (OTH)

The Hydrogen Technology Observatory presented an overview of the progress and milestones achieved during the first year of the initiative, launched by Enagás April 2024.

The OTH is **a facilitator for the exchanges of technical knowledge across the hydrogen value chain, promoting technological advances in the use of hydrogen as an energy vector.**

More than 60 leading companies and institutions have joined the Observatory and some of them actively participated in this event. As announced at the event, the first collaborative report, focusing on hydrogen as a marine fuel (LIC 5), will be published shortly, as well as the organization of a workshop on July 16th, which will address the decarbonization of maritime transport through hydrogen and other green molecules.

More information here

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Observatorio
Tecnológico
del Hidrógeno

CONCLUSIONS

Rountable 4

R&D is the catalyst for green hydrogen across the value chain

The speakers from Hydrogen Europe, GERG and the Plataforma Tecnológica Española del Hidrógeno (Pte H2) all agreed that research and development (R&D) acts as an accelerator and the catalyst for green hydrogen across the value chain. It was also mentioned that the **European Union has funded over 700 hydrogen-related projects, with a total investment exceeding €3.384 billion**. A key takeaway was **that public-private collaboration is essential to maximise the impact and scalability** of these projects.

Both Spain and Europe have demonstrated a strong commitment to advancing hydrogen as a future energy vector and the research for it. **Germany, France, Italy and Spain**, in that order, **are the European countries with the most R&D projects**. These projects will provide reliable data on which to base political decisions. It is important to focus on safety, cost efficiency, and value for shareholders. We cannot afford to lose time, leadership or technology.

The speakers stated that, although there are still some challenges related to cost efficiency and regulatory uncertainties, the continued research endeavor by all the sectors in innovation concludes that **technology maturity exists throughout the value chain in order to implement the infrastructure projects and drive the hydrogen economy forward.**

Key takeaways and call to action

1. **Spread awareness and knowledge**. We need to speak up and talk about the progress that we are making in the hydrogen ecosystem.
2. **Continue in collaboration mode**. It's impossible to deliver what we need to deliver alone, so cooperation is essential and should be encouraged.
3. **Build the hydrogen value chain based on our legacy business but also boosting innovation and new technologies**. We are creating, together, a new energy system.