

# A new player at the service of the environment and the economy

Owing to a continuous European support to research, development and innovation, hydrogen technologies have transitioned from highly specialized applications to commercially available products. As a result, Europe is currently leading in several hydrogen technologies. However, many other countries and regions are equally ambitious about hydrogen and it is by no means guaranteed that Europe can maintain its leading position. The rapid development of a domestic market is therefore crucial to achieve climate neutrality by 2050 but also for preserving and enhancing EU industrial competitiveness, securing jobs and value creation in this new sector.

*Grazie al costante sostegno dell'Unione Europea alle attività di ricerca, sviluppo e innovazione tecnologica le tecnologie dell'idrogeno, si sono evolute da applicazioni altamente specializzate, a prodotti disponibili sul mercato. Di conseguenza l'Europa è ormai leader in diverse tecnologie dell'idrogeno. Tuttavia, altri Paesi ed aree del mondo perseguono la stessa ambizione e non è affatto scontato che l'Europa potrà mantenere questa posizione di vantaggio. È quindi cruciale che il mercato interno cresca velocemente, non solo per raggiungere la neutralità climatica entro il 2050, ma anche per preservare e rafforzare la competitività dell'industria europea, garantendo posti di lavoro e valore aggiunto a questo nuovo settore.*

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by Laurent Antoni, President of Hydrogen Europe Research

In this new era of energy transition, Europe expects profound changes to achieve a climate-neutral Europe by 2050. In addition to the support and development of renewable energies in Europe over the last decades, **hydrogen is now recognised as a new player at the service of the environment and the economy.** Renewable electricity is expected to play a vital role in decarbonising the EU's energy consumption. However, it will not do it all through direct electrification, or battery solutions. **Hydrogen, as a versatile energy carrier and chemical feedstock, offers advan-**

**tages that unite all of Europe's energy resources — renewables, nuclear, and fossil fuels — and enables innovations in energy production and end uses that can help decarbonise the most energy intensive sectors of our economy.**

The potential of hydrogen is being recognised worldwide, with strategies, plans and investments by government and industry ramping up in many countries, in particular in Europe. The year 2020 has seen the emergence of hydrogen strategies in many European countries and for the European Union as a whole. On 8 July 2020, the Europe-

an Commission released the Hydrogen Strategy for a Climate-neutral Europe as part of the European Green Deal. It sets out an ambitious vision of how Europe can turn clean hydrogen into a viable solution to decarbonise different sectors over time. It identifies the challenges to overcome and provides a concrete policy framework for the European Clean Hydrogen Alliance to develop an investment agenda and a pipeline of concrete projects. The strategy defines a target of 1 million ton of hydrogen and an electrolyser capacity of 6 GW by 2024, and 10 million tons of hydrogen and 2x40



GW by 2030 and aims to create an enabling environment for the development of a secure, safe, affordable and just hydrogen economy in Europe.

**Five main topics: technological and societal aspects**

Over the past decades, owing to a continuous European support to research, development and innovation, hydrogen technologies have transitioned from highly specialized applications to commercially available products. This could not have been achieved without a strong commitment from industry, research and the public sector in Europe, in particular within the two FCH and FCH 2 Joint Undertakings. These private-public partnerships have been ensuring coordinated activities based on a common understanding and vision of

the European industry represented by Hydrogen Europe (200+ members and 25 national associations), the European research represented by Hydrogen Europe Research (90+ members) and the European Commission with clear, quantified and focused objectives. As a result, **Europe is currently leading in several hydrogen technologies, and European companies and research institutions can be instrumental in advancing technological developments and industrial scale-up, contributing to cost-competitive renewable and low-carbon hydrogen.**

However, many other countries and regions are equally ambitious about hydrogen and it is by no means guaranteed that Europe can maintain its leading position. **The rapid development of a domestic European market is therefore crucial not only in terms of achieving**

**climate neutrality by 2050 but also for preserving and enhancing EU industrial competitiveness, securing jobs and value creation in this new sector.**

Achieving the European hydrogen strategy will require significant additional research and innovation efforts with several research and innovation challenges to be addressed in the short and medium term, in particular in the next RTD framework Horizon Europe and the Clean Hydrogen JU. These challenges might be covering five main topics divided in two aspects: a technological aspect and a societal one.

Regarding the **technological aspect**, one could mention three main challenges:

- **Technology Readiness Levels (TRL),**
- **Manufacturing Readiness Levels (MRL)**
- **Preparation of the future.**
- **Technology Readiness Levels (TRL)**

Research needs to help industry to progress further in TRLs by bringing research results into commercial solutions while improving performance, durability and decreasing costs. It is aimed, in particular, at achieving @scale demonstrations and deployments in clean hydrogen production and in new applications of hydrogen as heavy-duty transports and industrial uses.

- **Manufacturing Readiness Levels (MRL)** - Research needs also to help industry to progress in MRLs ensuring its competitiveness at a global scale. Indeed, an enormous challenge lies ahead in upscaling currently available technologies to GW-scale factories of electrolyser and fuel cells required to drive forward the energy transition. This can be achieved by fostering cross-border RD&I collaboration and supporting a European RD&I ecosystem approach along strategic value chains, by connecting EU Hydrogen laboratories and infrastructures, setting clear performance standards and monitoring performance of subsidized pilots. These outcomes will be valorised in the setting up of several GW-scale factories in the frame of the Important Project of Common European Interest (IPCEI) under discussion.
- **Preparation of the future** - Finally Research needs to prepare the future through technological breakthroughs with new materials, new concepts, and at the same time to get rid of critical raw materials (CRM). Industry needs the continuous development of disruptive technologies and advanced materials all along the value chain. **Research and Innovation will be**

**a key element for Europe competitiveness.** Among these challenges, three strategic research challenges can be mentioned: (i) low or free precious metals catalysts and critical raw materials for electrolysers and fuel cells, (ii) advanced materials for hydrogen storage (e.g. carbon fibres, hydrogen carriers...) and (iii) advanced understanding of the mechanisms of electrolysers and fuel cells performance/durability.

**Regarding the societal aspect, two main topics appear:**

- Education and training
- Increase of the public and policy stakeholders knowledge and acceptance or the Societal Readiness Levels (SRL).
- **Education and training.** There is a need in structuring interdisciplinary education and cross-sectoral training. **Europe needs to ensure a high skilled European workforce all along the hydrogen value chains: production, installation, operation and maintenance.** The first deployments are showing that this last point is of particular criticism. Trainers have to be trained and reskill or upskill an educated manpower the European industry will need in the coming years. This may also represent an opportunity to reemploy current workforce from declining industries and sectors.
- **Increase of the public and policy stakeholders knowledge and acceptance or in other words the Societal Readiness Levels (SRL).** This can be done by (i) intensifying the research on a better knowledge on all safety aspects, e.g. underground parking, crossing tunnel (ii) contin-

uing pre-normative research to ensure scientifically based standards and regulations and (iii) leveraging the increasing demand of information and expectation from the society towards a carbon-neutral Europe. **Carbon content becomes a pivotal parameter.**

**A comprehensive, comparable classification and certification framework**

These different points go beyond the only hydrogen technologies and cover the whole energy system. To give consumers the choice, by disclosing the origin of energies, there is a strong demand to develop a comprehensive, comparable classification and certification framework. It has to include information on sustainability as well as CO<sub>2</sub> and other greenhouse-gas footprints across the whole life cycle as well as their production and transport modes and the overall fuel mix and to ensure traceability. The carbon footprint needs now to take into account and not only the CO<sub>2</sub> emissions. Research is looking forward to continuing to contribute to ensure a scientific base approach.

In conclusion, clean hydrogen technologies have already reached a technological maturity allowing first commercial deployments. The high expectations put on hydrogen, in order to significantly contribute towards a climate-neutral Europe as well as towards an energy sovereign Europe, **request to scale-up and speed up massive production and deployments to show impacts at short term.** Hydrogen Europe Research and Hydrogen Europe are ready, fully mobilised and engaged to solve together with the European Commission and the members states these exciting and ambitious challenges.