

Hydrogen, energy of the future



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With the Green Deal, Europe aspires to become the world's first climate-neutral continent by 2050. To achieve such a goal, it will be necessary to respond to major challenges and make careful choices to invest in an integrated, more efficient and interconnected energy system that can enhance the characteristics and advantages of each different energy carrier.

In this context, hydrogen, which as an energy carrier is considered essential to the energy transition process and the reduction of climate-changing emissions, has become the focus of the political, energy and industrial debate.

Last July, the European Commission launched the European hydrogen strategy with a dual objective: on the one hand, to support the use of hydrogen as a substitute for fossil fuels, and on the other to decarbonise its production by giving priority to green hydrogen (i.e. from renewables), but also considering other low-carbon production processes. Green hydrogen can contribute to cleaner and more sustainable industrial processes, extensive zero-emission mobility and reduced pollution from domestic heating, while also ensuring the flexibility and resilience of the energy system thanks to its capability to act as a link between the gas and electricity sectors.

According to the report "Hydrogen Roadmap Europe: a sustainable pathway for the European Energy Transition"¹, hydrogen will be able to bring significant socio-economic and environmental benefits to Europe since not only will it cover up to 24% of its final energy demand and create more than 5 million jobs by 2050, but it will also contribute to the reduction of 560 million tonnes of carbon dioxide.

In the proposal of the Italian National Recovery and Resilience Plan (NRRP), under the M2C2 Energy Transition and Sustainable Mobility mission €3 billion were allocated to promote hydrogen production, distribution and end use.

Italy can achieve a strategic position in all the economic sectors that contribute to the hydrogen value chain (production, logistics, transport and distribution, and end use in industry, mobility and residential sectors) since we can rely on a great manufacturing tradition, consolidated know-how, internationally renowned research centres and a geographical advantage that could make our country the future primary hydrogen hub in Europe and the Mediterranean area.

The national industrial chain involved in the development of hydrogen could be strengthened, which will entail some positive impacts in terms of production value and employment prospects, with between 300,000 and 500,000 more jobs expected in the next 30 years, depending on the level of technology implementation and the momentum of the transition process.²

Putting diverse technologies to their best use, according to the principle of technological neutrality, will prove crucial within a coordinated, integrated national initiative that promotes a horizontal approach through the **supply chain** and is able to convert the challenges ahead of us into positive actions.

The introduction of hydrogen as an energy carrier is a new development in energy system management, therefore an integrated and coordinated system approach that takes into account all different aspects is needed.

Some sectors are more technologically mature and ready, while others require further effort and investments in research and development. **Technologies, products, processes and solutions need to be developed to promote the establishment of a hydrogen-based ecosystem, while the supply of innovation, technology development and competence from the research sector is to be coupled with the demand for innovation and closed-loop management solutions from the operators of the production chain.**

However, **technology readiness alone is not sufficient. The concurrent implementation of legislation, regulations and incentives is needed to achieve the objectives set.** It is critical to reduce unnecessary bureaucracy, simplify and harmonise the formalities to be complied with for the construction of plants and infrastructure, and ensure definite and rapid schedules. It is also important to promote a closer and more stable relationship between research and the industrial system; to put a governance structure in place for strengthening the effectiveness and efficiency of the adopted strategies; to ensure the continuity and consistency of the policies introduced, with a view to a true paradigm shift for paving the way towards a sustainable future.

It would also be useful to develop and implement demonstrators on a significant scale (Hydrogen Valley). These could also act as technology incubators and service start-ups for the hydrogen industrial chain to create local ecosystems that could also be reproduced and expanded to other areas.

In this context, the world of research and innovation has a leading role to play to assist the recovery, within a competitiveness and sustainability perspective, aimed at measurable returns in terms of growth and development.

For over 30 years, ENEA has been carrying out research on and experimental development of the entire hydrogen supply chain, from production to end uses; we have competence, cutting-edge laboratories and infrastructure and can act as a link between research and industry. We have a comprehensive approach to hydrogen aimed at accelerating research and innovation and providing industrial chains with hi-tech infrastructure that can bridge the gap between laboratory and industrial scale.

We are active in national and international bodies for the promotion of the hydrogen economy; we have a number of partnerships with outstanding companies in the sector for technology development and transfer; we coordinate several European projects and fulfil prominent roles in an array of international initiatives.

Furthermore, ENEA assists the Italian Ministry of Economic Development, acting as a technical-scientific advisor within the hydrogen IPCEI (Important Project of Common European Interest), and works together with Confindustria, with which an out-and-out “pact for hydrogen” was signed to identify the potential for development of the Italian hydrogen industrial chains, cutting-edge technologies, innovative solutions and possible operational scenarios.

ENEA is not the only organisation in Italy that can provide support or offer valuable tools to achieve these objectives. Among companies, associations, and the scientific community and there are numerous entities whose contribution is also important, and whose experts authored some of the analyses and proposals that appear in this issue, which was designed to offer the broadest and most in-depth overview of the hydrogen scenarios, giving due space to research, innovation and national and international strategies.

I would therefore like to thank all those who contributed with their interesting articles and interviews, but also ENEA researchers, technologists and all the staff, because without their work, their ability to win calls for research funds and their daily commitment, we could not progress further in energy, towards new challenging achievements.



1. Fuel Cells and Hydrogen Joint Undertaking FCH JU
2. Ambrosetti study “H2 Italy 2050”