

Hydrogen turns Europe green. And more

What are the strategies that have already been adopted internationally for the development of hydrogen? Which countries are at the forefront of investments and policies aimed at making this vector more widespread? Some of the most interesting cases are illustrated in this article, which also offers a current snapshot of what is being done in Italy.

Quali sono le strategie già adottate a livello internazionale ed europeo per lo sviluppo dell'idrogeno? Quali sono i Paesi all'avanguardia per investimenti e politiche volte alla diffusione di questo vettore? Alcuni dei casi di maggiore interesse sono illustrati in questo articolo che scatta anche una fotografia aggiornata di quanto si sta facendo nel nostro Paese.

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Lightweight, energy-intensive, efficient and able to produce “clean” energy on a large scale. Hydrogen, one of the cornerstones of the energy transition, is a necessary step towards carbon neutrality by 2050, the topic that today dominates the agendas and recovery and development plans of the European Union and its Member States.

In July 2020 the European Hydrogen Strategy was launched, crowning a journey that began years earlier with initiatives such as Fuel Cells and Hydrogen Joint Undertaking (FCH JU), the Clean Hydrogen Alliance, the EU Roadmap and the European Parliament Report. It is an ambitious plan that has taken shape in initiatives for an increasingly interconnected, decarbonised and efficient energy sector, for a transition that can create competitive development and relaunch the economy in line with the Next Generation EU package and the European Green Deal.

For the Member States the watchwords are investment, research&development&innovation, regulation and the creation of a hydrogen market in sectors such as industry, transport, electricity production and construction. Last but not least, the integration of energy systems and consumer sectors through designated carriers and infrastructure. The Clean Hydrogen Alliance was created with this specific objective in mind, bringing together representatives of industry, civil society, national and European institutions, the European Investment Bank and research bodies – including ENEA – to develop the hydrogen value chain and facilitate the implementation of the new European strategy and the 2030 investment agenda. Objectives that are also shared by the International Energy Agency, which aims to hasten the decarbonisation of hydrogen by 20 years (from 2070 to 2050) through four areas of intervention: the use of industrial

hubs, the exploitation of infrastructure assets, the involvement of the transport sector and the opening of new global commercial routes. But what are the strategies that have already been adopted internationally for the development of hydrogen?

Japan has certainly been a pioneer, with a long history of developing hydrogen technologies, including fuel cells. Its first research dates back to the 1970s. To maintain its leading role, Japan was among the first countries to adopt a “hydrogen strategy”, as early as 2017. Today, the Japanese government has identified hydrogen as the game changer of climate change, so much so that it is looking to create the world's first supply chain with a production of 3 million tonnes in 2030 and 20 million tonnes in 2050, and a reduction in costs estimated at €0.24 per m³ within 10 years and €0.16 per m³ by the middle of the century for transport and electricity generation. According to a study con-



ducted in 2019 by Fuji Keizai, by 2030 the hydrogen market in Japan is expected to grow 56 times, reaching 408.5 billion yen (about €3.2 billion). Examples of some cutting-edge projects include SeaEra, for the production of green hydrogen on a “floating” infrastructure, to be used as a fuel for maritime transport; a high-purity hydrogen and oxygen generator; a network of hydrogen refuelling stations; and the development of an innovative technology for the production of hydrogen from ammonia for use in fuel cell vehicles.

But Europe has not sat idly by. Indeed, some countries like France and Germany have put the pedal to the metal, seeking to consolidate a Franco-German energy axis: after joint projects launched in the field of batteries, the two nations are now looking for a point of contact on the new energy vector by allocating important investments to the new green gold.

In fact, **France**, while being one of the 13 States that according to the European Environment Agency (2019 data) has not yet reached the target of a 23% share of renewable sources in gross final consumption by 2020 (currently below 17%), when it comes to hydrogen it has adopted a national strategy that allocates investments for over €7

billion divided as follows: 54% to accelerate the production of hydrogen, 27% to decarbonise the heavy transport sector and 19% for research, innovation and development. **Hydrogen is part of the €100 billion “France Relance” plan, which consists of some 70 measures linked to the European Recovery Fund. The French strategy is focused in particular on the development of “green” – low-carbon – hydrogen with a target of around 6.5 megawatts by 2030 to avoid six million tonnes of CO₂ and to create up to 150,000 new jobs at full capacity.** Furthermore, in April 2021 SnCF Voyageurs, the French rail operator, ordered the first 12 dual-mode electric-hydrogen trains (plus two optional trainsets) of the Coradia Polyvalent range for a regional line, for a value of almost €190 million. On the horizon there are also maxi-projects such as “Masshylia”, an investment of over €100 million, the largest ever in France, which brings together the energy giants Total and Engie within the biorefinery of La Mède in Provence for the production of green hydrogen from water powered by electricity from a 100 megawatt photovoltaic system.

For **Germany**, integration and cooperation are the mantra for pursuing the objective of being the main supplier

of green technologies for hydrogen in the global market. The national strategy launched in July 2020 aims to strengthen cooperation with the other States of the European Union, in particular in the North Sea, Baltic and Southern Europe areas. An agreement with Canada to produce green hydrogen using Canadian hydropower was also recently signed.

Hydrogen will receive €9 billion of the €130 billion appropriated by the 2020-2021 Relaunch Plan, of which €2 billion for partnerships with other countries. The top priority of Angela Merkel's government is to support the creation of a green hydrogen market along the entire value chain, developing the needed infrastructure, which also includes the conversion of part of the unused gas infrastructure, for a total production of 5 GW by 2030 and 10 GW by 2040, making it a world leader. With regard to key technologies, the German strategy focuses in particular on electrolysis, bio-based processes, methane pyrolysis, artificial photosynthesis and fuel cells. A 25-member National Hydrogen Council has also been set up with representatives of industry, the scientific world and civil society to advise the government.

And then there are the countries of the North Sea that have the possibility of

producing green hydrogen from electrolysis that exploits wind energy, largely with offshore wind farms. Great Britain and the Netherlands are the prime movers in this region.

Great Britain, a pioneer in the study of hydrogen, is now a leader in the Old Continent both in terms of research and funding for the development of a dedicated supply chain. **In the 10-point plan of the “Green Industrial Revolution” launched on 18 November 2020, which provides for public investments of €12 billion by 2030, Boris Johnson’s government focuses on “low-carbon” hydrogen (not necessarily green) and 5 GW of production capacity.** Through projects funded by the Department for Business, Energy and Industrial Strategy, the path towards the promotion and diffusion of hydrogen includes several stages starting from verification of the feasibility of introducing mixtures into networks that are increasingly rich in hydrogen, up to 100%, to the analysis of the impacts along the value chain, to the construction of the first “hydrogen city” by the end of 2030, with hydrogen-heated homes and residential districts that distribute hydrogen produced by electrolysis powered by wind energy. The Tees Valley area in the north-east part of the country, on the other hand, saw the launch of a project that brings together research, industry and public institutions to create a “**pioneering hydrogen hub**” that will be an template for the development of projects promoting the widespread use of hydrogen as an alternative fuel.

The Netherlands, one of the first countries in Europe to approve a hydrogen strategy, is more determined than ever to become Europe’s Hydrogen Valley, among other things building 4 GW of electrolyzers by 2030. To meet the target, a group of 31 companies and local authorities – including Gasunie, Shell, Rwe, Engie, Equinor, Eneco and Vattenfall – launched a €9 billion plan for the production of 100 million gi-

gajoules of hydrogen (75% green and 25% blue) per year by 2030, capable of satisfying a quarter of north-west Europe’s needs. With its unique location, the presence of industrial nodes and a dense network of gas transport and storage infrastructure connected to ports, the country would thus host the world’s largest green hydrogen plant, which will exploit the electricity produced by an offshore wind farm in the North Sea. The facility is expected to start operating in 2030 with an annual production of 800,000 tonnes of hydrogen. The roadmap for the development of the hydrogen supply chain is based on four pillars: legislation and regulation, reduction of green hydrogen costs (through a research and development plan and incentives of up to €300/tonne) and supporting policies. For the transport of hydrogen, the objective is to promote the use of the existing gas network and to identify possible opportunities for maritime transport to also create and promote the development of a market in this sector.

The countries of the Mediterranean area have responded with their own strategies that aim to create a Mediterranean hydrogen hub, representing an infrastructure bridge connecting northern Europe. Among these countries, Spain and Italy are ready to invest in hydrogen. Indeed, Italy could become the infrastructure bridge between Europe and the African continent (Italy could in fact import hydrogen produced in North Africa through solar energy at a cost that is 10-15% lower than domestic production, exploiting the greater availability of land for the installation of renewable energy, a high level of irradiation and at the same time decreasing seasonal variability).

Spain intends to invest almost €9 billion in green hydrogen over the next 10 years and to become a major player in production and export. In October 2020, the Sanchez government presented its Hoja de Ruta del Hidrógeno, with 60 measures, three macro-targets

and a roadmap for the development of the sector. The plan outlined by the Ministry for the Ecological Transition sets a 2030 target of 4 GW of electrolyzers, equal to 10% of the power proposed by the European Commission for the entire EU. The 2030 timetable calls for 25% of industrial hydrogen consumption from renewable origins and a fleet of at least 150 fuel-cell buses, 5,000 light and heavy vehicles and two commercial train lines. Hydrogen networks will also be developed at ports and airports. Overall, the government estimates that achieving the 2030 targets should enable Spain to reduce greenhouse gas emissions equivalent to 4.6 million tonnes of CO₂. The package of 60 measures envisaged by the Ministry includes the promotion of R&D, the design of financial instruments to support industry, the creation of Hydrogen Valleys and the development and mass production of high-power electrolyzers (100 MW).

In **Italy**, last November the Ministry of Economic Development published and opened the “National Hydrogen Strategy - Preliminary Guidelines” for consultation to promote the development of a hydrogen supply chain in our country. It is an objective that is also considered a priority by the Minister of Ecological Transition Stefano Cingolani, for whom it is critical to create the conditions to make it the main carrier at a reasonable price, in line with international trends. To date, with over 160 projects and 120 beneficiaries, alliances between top Italian manufacturers and international research institutions and a strategic geographical position, Italy is among the sector’s leaders in Europe, making it a prime candidate to become a European and Mediterranean hub. H2it, the Italian Hydrogen and Fuel Cell Association, has more than 70 members, and many companies – Enel, Eni, Snam and even Rete Ferroviaria Italiana, to name just a few – have undertaken an array of projects in this field. This is also confirmed by partici-

pation in global initiatives such as Mission Innovation with investments of €18 million, and the commitment laid out in the **National Recovery and Resilience Plan (NRRP)** with €3.6 billion in investments as part of the M2C2 “Energy Transition and Sustainable Mobility” mission. Key points of the Italian roadmap include: the exploitation of abandoned industrial areas for the creation of hydrogen valleys, the use of hydrogen in energy-intensive sectors such as the chemical, steel and oil refining industries, the conversion to hydro-

gen of at least six railway lines among those with considerable use of diesel trains in regions with high passenger traffic, and the creation of a network of 40 hydrogen refuelling stations. Finally, the strengthening of R&D resources for the production of green hydrogen, the development of technologies for the storage and transport of hydrogen, the transformation into other derivatives and green fuels and fuel cells as a technology of choice for an efficient and clean use of hydrogen. ENEA plays a leading role in this area:

after the launch of the Hydrogen Valley in the Casaccia Research Centre and the coordination of European projects including Prometeo for the production of green hydrogen through innovative high-temperature systems, it signed an agreement with Confindustria to identify the development potential of industrial chains and is providing technical and scientific support to the Ministry of Economic Development for the establishment of the first hydrogen IPCEI (Important Project of Common European Interest).

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