Hydrogen, the future is Green

Hydrogen is often regarded as the "silver bullet" of decarbonisation, one element that can truly guarantee a sustainable future for our planet. Its best use is to decarbonise those sectors of the economy that cannot be easily or economically electrified. While all hydrogen molecules are identical, the production process of such molecules can vary widely, each with a specific impact in terms of carbon emissions. Each production process is identified by a different colour, with three main hydrogen "colours" available to the industry: **grey**, **blue** and **green**. However, only **green hydrogen** is truly sustainable as it is the only one that does not generate additional CO_2 in its production process.

Grey hydrogen is generated from fossil fuels through processing methods that are highly carbon-intensive, and still accounts for the vast majority of global hydrogen production. **Blue hydrogen** is generated through the same processes, but emissions are then partially captured through CCS, or carbon capture and storage, which requires the construction of complex, expensive facilities exposed to environmental and social acceptance issues. **Green hydrogen** is for Enel the only 100% sustainable solution. It is produced through electrolysis of water in special electrochemical cells powered by renewable energy. As a result, not only is it carbon-free in terms of output, but also of production process.

Salvatore Bernabei
CEO of Enel Green Power

The strength of green hydrogen is to act as a complement to the decarbonisation and electrification processes that the Enel Group is carrying out. The continued development of photovoltaic and wind technologies, alongside the expected cost reduction of electrolysers, will make green hydrogen competitive with grey or blue hydrogen. As recently confirmed by Bloomberg New Energy Finance (BNEF)[1], green hydrogen is set to become cheaper than blue hydrogen by 2030, providing a cost-effective solution to decarbonise hard-to-abate sectors that cannot be electrified. These sectors include cement, fertiliser, steel, refining, chemical, pulp and paper, alongside maritime transport and aviation. At the same time, we clearly restate the importance of keeping electrification as the preferred option to decarbonise all other sectors, such as home heating or road transport, that can be decarbonised at a lower cost with existing solutions.

Enel's business model envisages the production of hydrogen near its consumption points. The ideal scheme is to transport electricity and minimise the transport of hydrogen. The co-location of renewable-fed electrolysers and hydrogen consumption points represents today the best alternative to grey hydrogen, reducing the reliance on fossil fuels and the need to build new pipelines, or to repurpose those originally designed for natural gas transport, hence minimising the risk of creating new stranded assets and the costs associated to blending. Furthermore, while electricity networks carry electrons, which can travel both forwards and backwards, all gases, including hydrogen, can only travel in pipelines from production to consumption points. As a result, gas pipelines tend to create relationships of "dependence" between the countries they connect, whereas electricity networks generate greater "integration" between cross-border states in terms of alignment of regulatory frameworks alongside sharing of increasingly sophisticated digital protocols.

The Enel Group plans to grow its green hydrogen capacity to over 2 GW by 2030. Alongside providing green hydrogen to industry offtakers, Enel will also deliver to the grid the electricity generated by renewable plants not exclusively dedicated to hydrogen production and will provide ancillary services to electricity grids in order to support system stability and further renewable penetration. Following this strategic approach, the Group is already implementing a number of projects for the production of green hydrogen worldwide.

In **Italy**, Enel and energy company Eni are jointly developing a green hydrogen initiative aimed at decarbonising two Eni refineries. Each of the two projects will feature an electrolyser of around 10 MW and are expected to start generating green hydrogen by 2023. In February this year, Enel Green Power and the Italian energy company Saras signed a memorandum of intent to develop a green hydrogen project in Sardinia.

In **Spain**, the Enel Group's Spanish company Endesa recently notified the country's Ministry of Ecological Transition of its interest in developing up to 23 renewable hydrogen projects, involving the construction of electrolysers for an overall capacity of around 340 MW, powered by 2,000 MW of renewable energy.

In **Chile**, the Enel Group is participating in the partnership HIF (High Innovative Fuels) with Chilean groups AME, a power company, and ENAP (Empresa Nacional del Petróleo, the country's national oil company), together with Siemens Energy and Porsche. The Enel Group will contribute to HIF's innovative pilot project for the production of sustainable fuels by focusing on wind power and on the installation of an electrolyser for the production of green hydrogen. The electrolyser will be fuelled by wind energy and will feed the pilot project located in Cabo Negro, north of Punta Arenas, Magallanes region. The facility is expected to be commissioned in 2022, making it the largest plant of its kind to produce green hydrogen in Latin America.

In the **United States**, the Enel Group, through its renewable subsidiary Enel Green Power North America, and industrial group Maire Tecnimont's subsidiary NextChem, signed a Memorandum of Understanding to support the development of green hydrogen via electrolysis in the country. The project, which is expected to be operational by 2023, will convert renewable energy from an Enel Group solar plant in the United States into green hydrogen to feed a biorefinery.

Enel is also part of several international initiatives promoting the development of green hydrogen, and participates in different policy consultations issued by the European Commission as well as in international roundtables and working groups, such as the Clean Hydrogen Alliance, the Renewable Hydrogen Coalition and the CEO Alliance. These initiatives share the common goal to promote a clear definition and taxonomy on hydrogen and a proper regulatory framework for a prompt scale-up of the technology.

Green hydrogen offers a great opportunity to decarbonise hard-to-abate sectors. Nevertheless, dedicated policy actions and plans to support upfront investments will be crucial in order to help this new, promising technology accelerate our pathway towards a net zero emission future.

1. BNEF April 2021: "1H 2021 Hydrogen Levelized Cost Update".