



Expert analysis
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Green hydrogen: a lever for decarbonising industry?

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France's National Hydrogen Strategy, unveiled in September 2020, provides for an investment of €7.2 billion in the hydrogen sector between now and 2030. The aim is to create a French carbon-free hydrogen sector with international scope by increasing production capacity and supporting innovation. In fact, when we say hydrogen, we are mainly talking about renewable “green” hydrogen produced using renewable electricity by water electrolysis, as opposed to “grey” hydrogen produced by steam cracking which emits CO₂. For the French industrial sector, green hydrogen is a

major lever driving decarbonisation – in the metallurgy, glass and microelectronics sectors, for example. What can we expect from it in the future?

What is the current state of the hydrogen for industry market?

According to France Hydrogène, 880,000 tonnes of hydrogen were produced in France in 2020, of which 40,000 tonnes – i.e. 5% – were green. We are currently at a technological watershed: with improvements being made in electrolysis techniques, green hydrogen can now be produced on a massive scale and so used in industry – something that was impossible until relatively recently.

Currently, almost all French hydrogen – be it grey or green – is produced for industrial purposes. New uses for hydrogen are emerging in the mobility sector – ENGIE already operates around twenty or so green hydrogen stations in France – but these are just the beginnings of what this market will become. As far as industry is concerned, hydrogen is currently mainly used in the refining sector (for removing the sulphur from crude oil) and in the

chemicals sector (producing ammonia, methanol, etc.), as well as – to a lesser extent – in microelectronics, agrifoods, pharmaceuticals and in metallurgy and for treating metal.

What are the future prospects for green hydrogen?

France Hydrogène predicts that we will be producing 1,345,000 tonnes of hydrogen annually in France by 2030, more than half of which (some 700,000 tonnes) will be green. That represents dynamic growth in the overall amount of hydrogen produced (53%), but most of all an exponential increase in the quantities of green hydrogen produced (1650%).

So one of the main growth levers for green hydrogen in France involves using it as a means of greening markets which previously used grey hydrogen. One of the main challenges is to balance the economic equation of these projects: green hydrogen is still comparatively more expensive than grey hydrogen*. This is a significant obstacle, particularly for those industrial sectors in which vast quantities of hydrogen are used. That is why the recovery plans in France and Europe are excellent opportunities to subsidise projects and give impetus to the initiative underway to decarbonise hydrogen.

An example of such greening: since 2018, we have been producing green hydrogen at the French atomic agency and alternative energies site in Grenoble for use in microelectronics applications.

The second growth lever for green hydrogen is the emergence of new uses. For example, in the metallurgy sector, major technical breakthroughs are in the offing which should make it possible to replace the current coal combustion process with one whereby the ore is reduced using hydrogen. This will result in completely carbon-free production (provided the hydrogen used is green). The same applies to the glass sector. ENGIE's R&D lab has launched the VERCANE project alongside its partners Fives Group, Saverglass and Verescence to investigate options for decarbonising the glass manufacturing process, replacing natural gas with green hydrogen in the combustion process. A final example in the fine chemicals sector: thanks to Adisseo, a producer of amino acids used for animal feeds, green hydrogen produced on site will replace methane in methionine synthesis. Needless to say, this is a highly efficient means to decarbonise the industrial process. Over ten years, this will ultimately result in 340,000 tonnes of CO₂ being saved at this plant.

What is the relationship between increased use of green hydrogen and the development of renewable energies in industry?

Renewable wind power and photovoltaic energies are intermittent: when there is no wind or sun, electricity cannot be generated. Too much of them, on the other hand, results in an overflow of energy. That's where green hydrogen comes in. A vector for storage, it can compensate for the intermittent nature of renewable energies, storing their energy so that its release can be smoothed out over time.

That's the whole reasoning behind the Hyflexpower project, the world's first "power-to-X-to-power" project which incorporates a hydrogen-powered gas turbine. ENGIE Solutions will launch it in April 2021 at the site of Smurfit Kappa PRF – a company specialised in producing recycled paper – alongside numerous other European stakeholders and with the support of the European Commission. The purpose of this project is to prove that hydrogen can be produced using renewable electricity and then stored, and can then completely replace the natural gas which is currently used with combined heat and power plants. For this project, an

existing Siemens industrial gas turbine will be upgraded to convert stored hydrogen into electricity and thermal energy. This will create fantastic opportunities for industry. The factory of the future could well be powered by renewable energies produced on site and stored using hydrogen. So hydrogen is a major, decisive lever used to green our industry.

How can ENGIE Solutions help its industrial clients to take action?

Currently, we have everything we need to give green hydrogen a major boost. ENGIE Solutions is among the pioneering companies on the green hydrogen market, with facilities that have been in operation for several years now. We are ready to share our feedback and support manufacturers in developing hydrogen uses, particularly for producing green hydrogen on site and incorporating it into their industrial processes.

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About ENGIE Solutions

ENGIE Solutions supports towns, industries and companies in the tertiary sector, providing them with solutions to the challenges posed by the energy transition in the form of turnkey and bespoke packages.

ENGIE Solutions' experts apply all their expertise in pursuit of three aims: optimising the use of energy and resources, greening energies and reinventing living and working environments.

ENGIE Solutions guarantees its clients a single point of contact and a combination of complementary offerings that go beyond energy. The company is committed to achieving results and its 50,000 employees which operate throughout France (900 sites) have expertise in an extremely diverse number of areas, ranging from the design and operation of infrastructure and services, to funding, installation and maintenance.

ENGIE Solutions is part of the ENGIE Group, one of the world's leading low-carbon energy and services groups whose purpose is to act to accelerate the transition towards a carbon-neutral world.

Revenue: €10 billion

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