Hydrogen: science fiction made real?

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Fourteen member states of the European Union (EU) have already included a strategy for the use of hydrogen as part of their plans to support the post COVID lockdown economic recovery plans. David Czupryna, Head of ESG Development at Candriam, writes that the recent investment package of EUR15bn by the German and French governments is a serious step but only one of many required, with a lot of investment and opportunities still to come.

The EU is now looking to create a leverage effect for the private sector by combining national and European funding. For some time now, the European Commission partnered with over 160 companies and about 80 research organisations through Hydrogen Europe, the European Hydrogen and Fuel Cell Association. The EU has also supported the Fuel Cells and Hydrogen Joint Undertaking (FCH JU), a public-private partnership in the field of hydrogen energy research and development[1].

German and French governments have recently earmarked about EUR15bn for hydrogen technology. Hydrogen is also a key recipient of support under the Recovery Plan for Europe plans because it is seen as a key tool for achieving the EU Green Deal's targets and other objectives relating to Europe's climate-neutrality and strategic autonomy. Across the various funding programmes outlined under Next Generation EU, hydrogen industry could benefit from extra funding support, especially through the Strategic Investment Facility, the Recovery and Resilience Facility, and the reinforced Just Transition Fund[2].

The European Commission is working on the proposals to increase hydrogen-based energy generation, in stages, to 6 gigawatts (GW) by 2024 and 40 GW by 2030. These are ambitious targets: 40 GW is the maximum capacity of 20 Hoover Dams[3], which can also equal to the electric consumption of about 20 million homes. The EU Commission estimated that, by 2050, this will require a remarkable investment of between EUR180bn and EUR470bn.

This investment will help hydrogen technologies to gradually become commercially viable in two main areas: energy production and fuel for transport.

Energy production

Hydrogen technology has a synergetic relationship with renewables. When renewable energy production is higher than demand, excess power can be fed through an electrolyser for the production of green hydrogen, which in turn can be stored and then reconverted to electricity when renewable electricity production is low. This creates a strong opportunity for accelerating energy transition in the power sector.

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While hydrogen has long been talked about as an "ideal" pollution-free energy source, only recently has there been a concerted push to kick-start this supply chain. For example, earlier this year in France, a consortium of European companies, research institutes and universities launched the world's first integrated power-to-hydrogen-to-power plant. The steam, a by-product of hydrogen power generation will be used by a paper mill to dry pulp from recycled paper to produce cardboard[4]. Other recent examples include a 1GW green-hydrogen power plant, a USD1.8bn project due to be completed in Australia in 2027[5] and three projects in the US that include the first green hydrogen packages for power balancing and energy storage, with the combined initial investment of over USD3bn[6].

The conversion to hydrogen is helped by the fact that this type of power generation can use existing energy distribution resources, without having to depend on the construction of major new electricity transmission lines.

Planes, Trains and Automobiles (and Ships)

Once some hydrogen power plants are in place, that can supply hydrogen to re-fuelling stations for various types of transport. The transport sector will be a major target for the Paris Agreement-related innovation drive as it is responsible for a quarter of all direct CO2 emissions on our planet.

The European Union (EU) imposes very ambitious intermediate targets aimed at encouraging manufacturers to explore alternatives to the polluting combustion engines. For light vehicles, the choice will be between those powered by an electric battery (the current favourite) and a hydrogen fuel cell. Deploying the latter will require, first, access to large quantities of hydrogen produced through electrolysis and, second, the development of a distribution network. It is unclear at this stage whether such deployment would represent the most efficient use of euros earmarked towards the energy transition.

As for "heavy" mode of road transport, hydrogen providing three times more energy per kg than diesel, and even though the tanks are heavier, this could be a solution. Projects for hydrogen-powered semi-trailers are already well advanced. For example, there is an EU project to build a refuse track for the City of Gothenburg in Sweden. According to the manufacturer PowerCell Sweden AB[7], hydrogen fuel cell trucks have a comparable driving range, refuelling time and payload capacity to diesel-powered trucks while producing less noise and emitting only water vapour which are welcome advantages for refuse trucks driving in residential areas around during morning hours.

Hydrogen-based liquid fuels could offer an alternative to aircraft fuel. And while Airbus is already working on a hydrogen plane, its planned launch in 2035 remains uncertain[8] whilst the project is at a very early stage.

As for ships, the Maersk shipping company was the first to strive for carbon neutrality by 2050[9]. This will require zero-carbon ships to be available by 2030. Hydrogen seems to be an interesting option to power large vessels.

Rail is already one of the most energy-efficient modes of transport, accounting for 8% of motorised passenger movements and 7 % of freight worldwide, but only 2 % of transport energy consumption. Rail is responsible for only 0.3% of CO2 emissions. Hydrogen-powered locomotives could be used as an alternative to coal- or diesel-powered ones on rail lines not yet electrified.

Despite technological advancement and some government support in the recent years, deployment of hydrogen remains dependent on many factors. They include a favourable environment for reducing CO2 emissions, the price of renewable energies, and a European recovery plan that places a special emphasis on hydrogen in achieving carbon neutrality by 2050. One thing is for certain – it is set to become one of the most exciting investment stories of the century. To take advantage of this new trend, investors will need expert help to identify financially viable projects worth investing in for the long term.

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FOOTNOTE
1 https://hydrogeneurope.eu/about-us-2 | 2 https://hydrogeneurope.eu/sites/default/files/Hydrogen%20Europe_EU%20Recovery%20Plan%20Analysis_FINAL.pdf | 3 https://www.climatecentral.org/blogs/helpful-energy-comparisons-anyone | 4 https://www.powermag.com/worlds-first-integrated-hydrogen-power-to-power-demonstration-launched/ | 5 https://www.rechargenews.com/transition/plans-unveiled-for-1gw-green-hydrogen-power-plant-fuelled-by-wind-and-solar/2-1-812928 | 6 https://www.powerengineeringint.com/hydrogen/mitsubishi-power-launches-green-hydrogen-standard-package-projects/ | 7 https://www.powercell.se/en/newsroom/press-releases/detail/?releaseId=C1B2E4F360E806FD | 8 https://www.dw.com/en/at-airbus-a-hydrogen-powered-aircraft-takes-shape/a-55051579 | 9 https://www.maersk.com/news/articles/2020/05/26/leading-danish-companies-join-forces-on-an-ambitious-sustainable-fuel-project