

TRANSPORT



Hydrogen prospects

The European Union (EU) is taking a hard look at hydrogen as a low carbon option to help make Europe the first climate-neutral continent by 2050. This is a key policy goal at the heart of policy-making within the new European Commission, under its President, Ursula von der Leyen. However, the need to make hydrogen-vehicles and renewables-based hydrogen fuel cheaper is a major challenge.

EU institutions have a head start, having partially funded two ongoing research projects – H2ME1 and H2ME2 – which are designed to both encourage the supply of hydrogen vehicles to European markets and ensure there are enough refilling stations to make this nascent market a practical proposition. Some €67mn from the Horizon 2020 research programme budget has been dedicated to the two projects. Together, H2ME1 and H2ME2 aim to ensure an additional 49 hydrogen filling stations are in place across EU member states, as well as seeing 1,400 cars, vans and trucks run on hydrogen on EU roads by 2022.

H2ME1, expected to be completed by May 2020, will cost €70mn in total, while H2ME2 should be finalised by June 2022 at a cost of €100mn. The funds in addition to those from the Horizon budget are covered by 40 project partners, some of which are the most influential transport, hydrogen and energy companies in Europe – including Audi, BMW, Engie, H2 Mobility Deutschland, Hyundai, Michelin, OMV and

European institutions and governments are working hard to promote hydrogen vehicles and refuelling systems, but are still struggling with high costs, writes Diana Yordanova, in Brussels.

Renault. Their participation in the projects should see them benefit directly or indirectly from the expansion of a network that, while today is nascent, could become very significant in the future.

'Today there are less than 200 hydrogen refuelling stations across Europe, not spread equally geographically,' according to EU Policy and Communication Manager of industry association Hydrogen Europe, Sabine Skiker. Germany is a leader, she says, with 77 stations open as of today and another 100 stations scheduled for opening by the end of 2020. An additional 30 stations will be rolled out by the end of 2021. The German government has earmarked €23.5mn to support the development of hydrogen vehicles, according to a letter signed in October 2019 between the German Transport and Digital Infrastructure Minister Andreas Scheuer and H2 Mobility, the joint venture building and operating the fuelling stations.

When it comes to advancing hydrogen solutions, automakers have been setting up joint ventures in order to share the financial risks associated with this emerging market. H2 Mobility, backed by Air Liquide, Daimler, Linde, OMV,

Shell and Total, is responsible for establishing a nationwide hydrogen infrastructure to supply cars with fuel-cell drives in seven key German metropolitan areas – Hamburg, Berlin, Rhine-Ruhr, Frankfurt, Nuremberg, Stuttgart and Munich – along with the connecting roads and motorways. Sybille Riepe, the company's Communication Manager, says the biggest obstacle for hydrogen mobility has been the availability of affordable cars. 'CleverShuttle, the biggest ride pooling company in Germany, has one of the world's largest fleets of fuel-cell electric vehicles (FCEVs). But they have had to turn to battery-electric vehicles (BEVs) because of availability [issues],' Riepe notes. Speaking about pricing, Hydrogen Europe's Skiker reports that a Toyota Mirai, for example, which is being sold for €80,000 today – well above the price affordable for most motorists – will cost less in the near future as the Japanese automaker and other producers are working on developing platinum-free fuel cells that would not be made with other precious metals.

Hydrogen new-car registrations in the EU doubled in the first half of 2019, to 209 compared with 102 in 2018, reports Kasper Peters, Senior Communications Manager at the European Automobile Manufacturers' Association (ACEA). The greatest new take-up has been in the Netherlands, where 65 Dutch drivers registered FCEVs in the first six months of 2019 compared to zero registrations the year before. Having the most advanced fuelling infrastructure, 100 Germans registered their hydrogen cars in 2019. Norway, a non-EU country popular for having the most electric cars per capita, registered 29 FCEVs in the same timeframe.

Knowing well that high vehicle cost is the main barrier to unlocking the potential of the new fuel, 17 EU member states already offer tax benefits or other fiscal incentives to consumers that are buying FCEVs, Peters explains. Austria, for example, offers VAT deductions and exemption from ownership registration taxes for zero-emission cars. Until the end of 2019, companies in Belgium offering lower emission vehicles (including vehicles using hydrogen made from renewable energy) to their employees were offered corporate tax deductions of 120%, which will be 100% this year.

Meanwhile, French regions

A Toyota Mirai filling up at a hydrogen refuelling station in Saratoga, California, while the station itself is being refilled from an Air Products SmartFuel Hydrogen delivery truck

Photo: Dicklyon

are authorised to provide an exemption from registration tax (either total or 50%) for alternative-fuelled vehicles. Luxembourg citizens are offered tax deductions of €5,000 for purchasing zero carbon emission vehicles. And in Italy, drivers of alternative-fuelled vehicles are exempt from the annual circulation tax, or ownership tax, for five years after initial registration, with 75% reductions in these taxes thereafter.

There is scope for more tax benefits in Europe, with smaller eastern European states, such as Croatia, Estonia and Lithuania, yet to implement any fiscal measures or incentives boosting the take up of hydrogen or other zero-emission vehicles.

As for the UK, although officially having departed from the EU on 31 January 2020, it has benefited from the first phase of the EU-funded project, H2ME1, gaining six new hydrogen filling stations, although there are no scheduled further payments under phase two. It has also been encouraging the purchase of low emissions vehicles – including hydrogen-fuelled cars. Until March 2021, UK citizens can receive a grant of up to £3,500 (€4,190) for cars that have CO₂ emissions of less than 50g/km and can travel at least 112 km without any emissions at all, with the amount automatically deducted from the price by the dealer. Purchasers of environment-friendly taxis can receive a grant of 20% of the purchase price, up to a maximum of £7,500 (€8,980).

Such encouragements are not just being offered in Europe. A US Department of Energy note stressed how California, Connecticut, Maine, Maryland, Massachusetts, New Jersey, New York, Oregon, Rhode Island and Vermont signed a memorandum of understanding back in 2014 to support the deployment of at least 3.3mn zero-emission vehicles. The states have also promised to set up refuelling infrastructure supporting the roll-out of hydrogen vehicles by 2025, adopting the California zero emission vehicle

(ZEV) regulations as their state policies. In the state of New York, for example, the Department of Environmental Conservation's (DEC) Municipal ZEV rebate programme offers a rebate of \$250,000 for the installation of public ZEV fuelling infrastructure. If being more proactive than others, a single municipality may receive up to 75% of the total available funds needed to set up hydrogen fuelling infrastructure.

More recently, in November 2019, Australia released a National Hydrogen Strategy that underlines the country 'has the resources and the experience as one of the world's great energy exporters and renewable energy pioneers to be a clean hydrogen powerhouse'. In the paper, the government agrees to complete an inaugural National Hydrogen Infrastructure Assessment by 2022, which will consider hydrogen supply chain needs such as electricity and gas networks, water supply networks, refuelling stations, roads, rail and ports.

Back in Europe, the Hydrogen Roadmap for Europe, developed by the Fuel Cells and Hydrogen Joint Undertaking (formed by the European Commission, Hydrogen Europe and the Hydrogen Europe Research group), has said that 3,700 hydrogen refuelling stations will be needed by 2030 to give hydrogen-vehicle drivers fuel security. Renault spokesperson Isabelle Behar, however, has underlined that building such a dense network would not be cheap, given the substantial financial investments required of nearly €1mn per charging station.

Furthermore, the price of fuel itself could vary, depending on its means of production. Most production today comes from steam reforming of natural gas, which is termed 'grey' hydrogen, and is not carbon neutral, notes Skiker. 'Though this way of hydrogen production produces hydrogen with zero tail-pipe emissions, the process is quite CO₂ intensive,' she admits.

A cleaner version is 'blue' hydrogen, for which the carbon

emissions are captured and stored or reused. The cleanest one of all is 'green' hydrogen, which is generated by renewable energy sources without producing any carbon emissions. Today, grey hydrogen is cheaper than the other two, and is estimated to cost about €1.5/kg, versus €3.50–5/kg for green hydrogen for example. The main cost driver for grey and blue hydrogen is the price of natural gas, which varies around the world. But blue hydrogen has higher cost because of the need for carbon capture, storage or re-use. The current price of blue hydrogen in Europe is above the price of grey hydrogen, but the gap will shrink if the price of CO₂ emissions increases further in coming years.

Despite this expense issue, hydrogen fuel cells provide three times more range than 100% electric vehicles (EVs), with a charging time of only five to 10 minutes, Renault's Behar highlighted. And it can be made safe, she stresses, saying: 'Any risk has to be mitigated with appropriate technical solutions.' Skiker adds that fuel cell vehicles are more suitable for long distance, heavy payload and high energy operations, noting taxi fleets as examples of where FCEVs can be very convenient. Skiker also notes the positive social impact of hydrogen vehicles – the creation of jobs. If you compare an FCEV with a battery electric car (BEV), FCEVs have many more components and they can be produced in Europe, whereas for BEVs, only 3% of the batteries are made within Europe, she explains.

Nonetheless, given the need to find a way towards a carbon neutral future, the future reputation of hydrogen will depend on a solid pathway and constant evolution towards clean or green hydrogen.

The European Commission's Dutch Executive Vice President Frans Timmermans, who has been in charge of drafting the European Green Deal policy that will move Europe towards this carbon-neutral goal, has pointed out that clean hydrogen is a building block of a zero-emission EU: 'The transition to climate neutrality also requires smart infrastructure. Increased cross-border and regional cooperation will help achieve the benefits of the clean energy transition at affordable prices,' he says in a Green Deal policy paper. However, cheaper technical solutions for both hydrogen vehicles and clean fuel production are first needed to make this policy viable. ●

Prototype hydrogen refuelling station in Paris, France

Photo: Roel Wijnants

