Green energy driving ahead in Germany

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At 83 hydrogen filling stations in operation at the time of writing, the German hydrogen mobility infrastructure is a beacon showing the way to green energy and less transportation pollution. H2 Mobility is the organisation which operates all public hydrogen refuelling stations in Germany. It is supported by big names such as Daimler, Linde, OMV and Total. It is a collaboration of industrial gases suppliers, oil and gas majors as well as automotive OEMs. This multi-disciplinary model is currently being used as a template for the development of hydrogen mobility infrastructure in Japan and Korea.

H_2 FCEV Mercedes-Benz GLC F-CELL copyright H_2-MOBILITY Max Jackwerth

Hydrogen mobility infrastructure leads, auto makers follow

The pace of German hydrogen mobility infrastructure development is clearly world-class. However, when it comes to the production of fuel cell electric vehicles (FCEVs) – hydrogen powered cars, the story is very different. German car makers are famous for their top-tier luxury brands, but Toyota and Hyundai lead the international league table for sales of FCEVs with their Mirai and Nexo models. Their combined monthly sales of FCEVs regularly exceed 5,000 units. Whilst the Asians are ahead, parts of the German auto industry are beginning to follow. Presentation of the Mercedes GLC F-Cell, world's first electric vehicle featuring fuel cell and plug-in hybrid technology at the Frankfurt motor show in September of 2017 was a key milestone and two years later, BMW revealed their pre-production BMW i Hydrogen. Nevertheless, neither company yet has a production model in place.

In November of 2019, VW re-confirmed their strategic focus towards battery electric vehicle (BEV) production for the masses, so no FCEVs rolling off their production lines soon either. Whilst the German hydrogen infrastructure races ahead the German auto sector is investing heavily in BEVs. And to add to the competitive intensity in the BEV space, in November of 2019, Elon Musk announced that Tesla will build batteries, powertrains and the Model Y in the new 'Gigafactory 4', close to Berlin. An important move in the German electromobility scene.

Making the energy balance work

After several years of delays, it is hoped that Germany's new Berlin-Brandenburg airport will open in October. Cars and taxis delivering passengers to their flights and other airport vehicles will be able to fill up with hydrogen at the Total Multi-Energy fuelling station there.

The hydrogen electrolyser for this project utilises as many green energy principles as possible. Wind and solar energy are used to produce electricity for the local power grid, which feeds the electrolyser with power to produce hydrogen. Since these natural energy sources fluctuate with the weather conditions and the demand profile for hydrogen over a 24-hour period is variable, there is a hydrogen buffer storage system between the electrolyser and the hydrogen car fuelling station. Excess hydrogen can also be ad-mixed into to the local natural gas network. Alternatively, hydrogen can be fed to a combined heat and power plant at the site. There is also a collection point where excess hydrogen can be collected by the industrial gas company Linde in road tankers and delivered to users nearby. Furthermore, there are multiple outlets for the hydrogen to ensure that nothing goes to waste.

Electroyser heat recovery helps

Electrolysers generate low-grade heat as a natural part of their operation. To make the overall hydrogen production, storage and power regeneration energy balance greener, it is advantageous to re-use this warmth. It also makes economic sense: local factories and properties need heating energy at moderate temperatures which is exactly what the electrolyser produces.

This waste heat recovery is exactly what McPhy Energy Deutschland have implemented at their latest large hydrogen electrolyser project in Laage, northern Germany where a 2MW electrolyser will be installed. In the first phase, the gas will be used as P2P energy storage in combination with stationary fuel cells and a combined heat and power plant. In a second phase, a road-side hydrogen fuelling station for private cars and buses is planned.

H_2 filling copyright H_2-MOBILITY Max Jackwerth

The move from blue to green must surely come

Producing hydrogen via electrolysis powered with renewable energy for fuelling stations must be the scenario for the future. Consumers will pull for 'green' hydrogen. However, most hydrogen fuelling stations today are supplied with so-called 'blue' hydrogen produced from natural gas in a steam methane reformer. As a transition step towards full decarbonisation, this may be acceptable. At least it will ensure that fuelling stations can be operated reliably at a reasonable cost which might incentivise automotive OEMs to invest in the development and commercialization of FCEVs. Blue for now, green later… hopefully.