

The ongoing hydrogen revolution

Business cases for Power-to-Gas

By **Wouter Vanhoudt, Thibaut De Lacroix and Vanessa Vivian Wabitsch, Hincio**

On the way to realising the much-discussed COP21 climate goals, decarbonising transport is key. Hydrogen offers promising opportunities for driving forward sustainable mobility and energy whilst being profitable – as recent findings affirm.

The energy transition is on the way. Multiple technologies are already maturing to help reach the emission reduction objectives set by the Paris Agreement. Hydrogen technologies are one of them.

As an energy carrier, it allows for the decarbonisation of transport, for heating, and the storage of energy from intermittent renewable energy sources. One of the biggest challenges to enhance the energy transition is to find profitable business cases to integrate these technologies into the wider energy system.

The EU goal to cut greenhouse gas emissions by 80-95% implies reducing transport emissions by 60% by 2050. In fact, the mobility sector is particularly difficult to decarbonise in Europe. Hydrogen mobility is an important part of the solution but it is, however, facing the chicken or egg problem. On one side, investors are not ready to invest in hydrogen refuelling stations (HRS) yet because there is only a small amount of cars on the road; on the other side, car manufacturers do not want to deploy vehicles in regions with a low density HRS network. Currently, stations are financed mostly by public-private partnerships.

Profitable today

So how can hydrogen innovations be lucrative today and in future? A study

by Hincio – an international strategy consultancy specialised in sustainable energy and transport – and Tractebel Engineering, financed by the Fuel Cell and Hydrogen Joint Undertaking, examines the conditions under which Power-to-Gas can be economically viable today (2017) and in 2025.

One of the key findings is that cost-effective business cases of hydrogen refuelling stations already exist today. Therefore, the chicken or egg problem could potentially be solved more easily than expected.

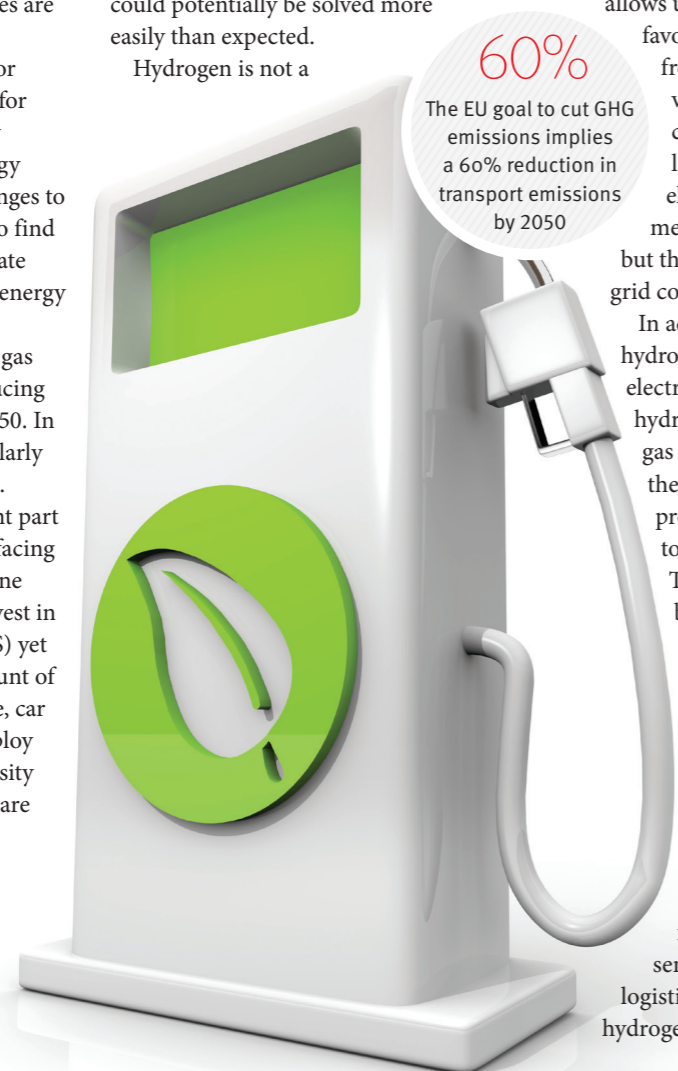
Hydrogen is not a

primary energy source that is naturally available. One way to produce it is via water electrolysis, the decomposition of water into hydrogen and oxygen through electricity. In order to achieve low emissions from 'Well-to-Wheel', the life cycle analysis of transportation fuels, electricity must come from renewable sources with low carbon emissions. As electricity cost is the most influential part in the overall cost of hydrogen, it needs to be as low as possible. Modelling

allows us to spot the most favourable places in Europe from an electricity point of view. Discount electricity can be received where a large amount of curtailed electricity is available, meaning electricity is produced but the grid cannot take it up, and grid congestion happens.

In addition to producing hydrogen for the mobility market, electrolyzers could also inject hydrogen into the natural gas grid, thereby 'greening' the heating network whilst providing balancing services to the electrical grid operator. The study showcases that the business case of providing hydrogen to a HRS, combined with revenue streams from gas grid injection and flexibility services, enables us to de-risk the investment in a hydrogen production plant.

Especially interesting for this business case is the semi-centralised hydrogen logistics model, with regional hydrogen production hubs. These



electrolyser plants can be strategically located in areas with locally curtailed electricity available at discounted prices, low grid charges, and positioned close to the gas grid in order to avoid expensive connectivity costs.

Europe: Realising hydrogen mobility


Hincio has been developing a unique competence centre in the field of hydrogen energy within Europe since 2007. The region has ambitious plans for a future Hydrogen Economy.

Many countries have demonstrated an ambitious hydrogen mobility roadmap, with Germany, France, Denmark and Great Britain, for example, having plans to deploy hundreds of HRS' over the next decade. The Hincio-Tractebel study shows that the electrolysis

market with the described conditions of profitability in these four countries provides 1,300MW in 2017 – sufficient to produce the planned amount of hydrogen. For creating more 'sweet spots' the study recommends developing a clear regulatory framework of access to curtailed electricity from renewables.

Furthermore, grid charges exemption has to be extended to other EU member states, while hydrogen injection into gas grids should benefit from the same rules and tariffs as biomethane injection and system services (especially Frequency Containment Reserves) also accessible for electrolyser plants.

One step at a time, hydrogen technologies are demonstrating that they are an integral part of the energy transition and have great potential to

become an important cornerstone of our future energy ecosystem. The evolution of the regulatory environment is now crucial for developing this niche market into a publicly recognisable market, and making this silent revolution ever louder in the near future. 

ABOUT THE AUTHOR

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HINCIO is a strategy consulting firm specialised in sustainable energy and mobility with a competence centre on hydrogen and fuel cells and offices in Europe, Latin America and Asia.

DESIGNING THE FIRST EU-WIDE GREEN HYDROGEN GUARANTEE OF ORIGIN

The CertifHy Project successfully launched its Stakeholder Platform with over 100 members from industry, policymakers, standardisation and issuing bodies, associations, SMEs, research and academia on 20th November 2017 in Brussels, Belgium.

This Stakeholder Platform will contribute to design the first EU-wide Green Hydrogen Guarantee of Origin (GO) system that will contribute to creating a new and transparent hydrogen market – allowing EU-wide transferability and consumption of 'green hydrogen' with a business case.

Global demand for hydrogen is expected to reach 50 million tonnes by 2025, mainly used in industry and transport. It is predicted to grow by 3.5% per year, with the potential for 50-60% of all hydrogen for the growing transportation market set to originate from renewable or low carbon sources

“Global demand for hydrogen is expected to reach 50 million tonnes by 2025...”

by 2030.

In order to create a market pull for green hydrogen, a Guarantee of Origin scheme is essential to label the origin of a product and provide information to customers on the source of their products.

CertifHy's aim is to define the scheme's governance, as well as its processes and procedures, over the entire GO lifecycle: from auditing hydrogen production plants, certification of green or low carbon hydrogen production batches, through to issuing, trading and 'usage' of GOs. It is undertaken by a consortium led by Hincio, composed of ECN, GREXEL, Ludwig Bölkow System Technik (LBST), and TÜV SÜD and financed by the FCH2JU.

“Whereas the first phase of CertifHy built a solid foundation with 14 industries and already more than 500 followers, I am greatly satisfied we can take up the discussions for the roll out with more than 650 stakeholders, therefore creating a de facto European harmonised system,” stated CertifHy's Project Coordinator Wouter Vanhoudt

(Hincio).

Four pilot projects are showcasing different hydrogen production pathways and testing the first GO scheme for green hydrogen at four hydrogen production plants located throughout Europe. Air Liquide is demonstrating a hydrogen production plant using steam methane reforming with CCS/CCU unit in France. Chemicals company AkzoNobel and Air Products are presenting hydrogen production using a chlor alkali process in the Netherlands. As a retailer, Colruyt Group is demonstrating onsite hydrogen production for its forklift fleet in Belgium, and the German energy storage company Uniper is showcasing hydrogen production from water electrolysis for injection into the gas grid.

In order to develop the first EU-wide Green and Low Carbon Hydrogen scheme, the CertifHy stakeholder platform brings together all European stakeholders interested in green and low carbon hydrogen GOs. It is a forum of discussion on the issue of green hydrogen GOs and the channel to shape the ongoing CertifHy project.