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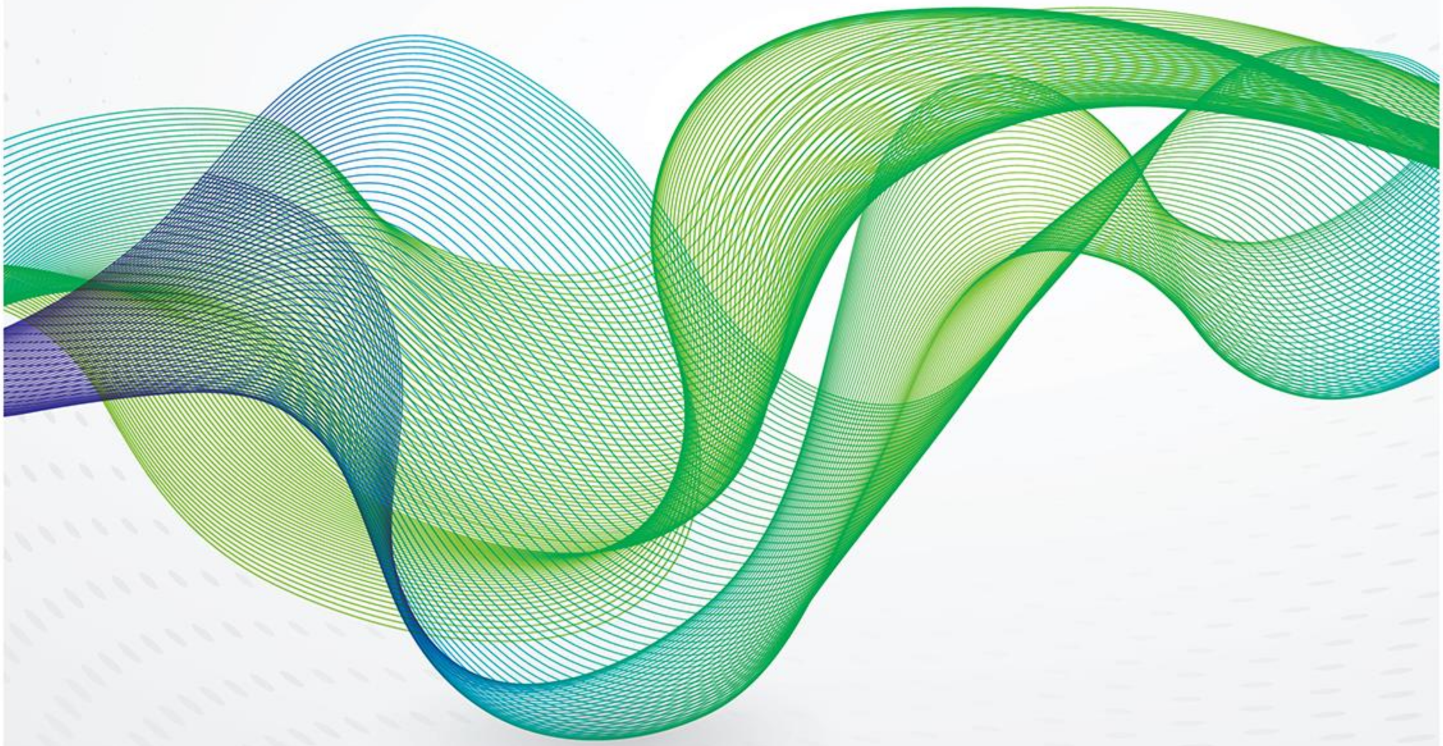
EU Hydrogen Strategy

A case for urgent action towards implementation



OXFORD ENERGY COMMENT

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Introduction

In the context of decarbonisation of the energy system, there has been a very rapid increase in interest among industry, government, and other stakeholders over the past 12 months regarding the potential for hydrogen. This has been covered in detail in two recent OIES papers.[1] The main focus on decarbonisation in general and hydrogen in particular remains in Europe, but other countries are also increasingly considering the potential of renewable hydrogen.

There has been a proliferation of published national hydrogen strategies, starting with Japan in 2017, and subsequently followed by South Korea (2019), New Zealand (2019), Australia (2019), Netherlands (2020), Norway (2020), Portugal (2020), Germany (2020) and, most recently on 8th July 2020, from the European Union. The latter will be an important document for driving the hydrogen agenda in Europe, so this short comment provides a brief review of the EU Hydrogen Strategy and consideration of the way forward.

Highlights of the Strategy

The full text of the EU Hydrogen Strategy can be found on the European Commission website.[2] It was published on the same day as the Energy Sector Integration Strategy[3], which highlights the need to change from the current situation, where different energy sectors are largely in independent silos, to a future state with coordinated planning and operation of the whole energy system. Hydrogen is seen as playing a key role in this Integration Strategy.

We highlight here the elements we judge to be key aspects of the hydrogen strategy, further details of which can be found in the full publication:

- It sets an ambitious vision for 40GW of electrolyser capacity within Europe by 2030 to produce "renewable hydrogen" (also known as "green" hydrogen), plus an additional 40GW electrolyser capacity in the southern and eastern neighbourhoods of Europe (e.g. Ukraine or Morocco) from which Europe could import renewable hydrogen. This vision is clearly based on an earlier report[4] from Hydrogen Europe, the industry trade body.
- Perhaps even more ambitiously, it sets a target for 6GW of electrolysers by 2024. It also notes that the list of potential global investments in electrolysers planned to be operational by 2030 grew from 3.2GW to 8.2 GW over the 6 months to March 2020. 57% (or ca. 4.5GW) of that capacity is in Europe.
- It recognises that there is a need to build a clear pipeline of viable investment projects, and the European Clean Hydrogen Alliance has been established to promote creation of that pipeline.
- It recognises that renewable ("green") hydrogen is the priority as the end game, but acknowledges that "in the short and medium term" other forms of low carbon hydrogen (presumably mainly fossil-based hydrogen with carbon capture and storage, also known as "blue" hydrogen") will play a role. To illustrate their view of the relative importance, it suggests that by 2050 cumulative investments in renewable hydrogen could be €180-479 bn, but for low-carbon fossil-based hydrogen only €3-18bn.
- In the shorter term, up to 2030, it envisages that investments in electrolysers could range between €24 bn and €42 bn. This appears to be just the electrolyser cost (at a mid-range cost

[1] Lambert (2020) https://www.oxfordenergy.org/publications/hydrogen-and-decarbonisation-of-gas-false-dawn-or-silver-bullet/ and Dickel (2020) https://www.oxfordenergy.org/publications/blue-hydrogen-as-an-enabler-of-green-hydrogen-the-case-of-germany/

[2] https://ec.europa.eu/commission/presscorner/api/files/attachment/865942/EU_Hydrogen_Strategy.pdf.pdf

[3] https://ec.europa.eu/energy/sites/ener/files/energy_system_integration_strategy_.pdf

[4] https://hydrogeneurope.eu/sites/default/files/Hydrogen%20Europe_2x40%20GW%20Green%20H2%20Initative%20Paper.pdf

of €900/kW) to which would presumably need to be added the cost of infrastructure and other balance of plant costs. By 2030, it also envisages 80-120 GW of solar and wind energy and a cost of €220-340bn.

- It provides indicative costs for the various forms of hydrogen production today:
- 1.5 €/kg (38 €/MWh) for current (high carbon) production;
- 2 €/kg (50 €/MWh) for "blue" fossil-derived hydrogen with CCS;
- 2.5-5.5 €/kg (65–135 €/MWh) for "green" renewable hydrogen
- (We note that in practice the costs for blue hydrogen will be very location specific, depending on the complexity of and distance to carbon sequestration. The lower end of the cost range for green hydrogen seems rather optimistic at present, although may well be achievable in future)
- It recognises that, initially at least, the priority uses of hydrogen will be close to the point of production in existing carbon-intensive industrial applications such as refineries and production of ammonia and methanol. It envisages that hydrogen use would then grow in local clusters (which could then expand into "valleys") around those industrial hubs, and longer distance transmission of hydrogen would happen over the longer term. It also notes that for trading of low-carbon/renewable hydrogen to become established a certification system and guarantees of origin will need to be developed.
- It recognises that hydrogen can play a role in some transport applications where electrification is more difficult, and potentially to manufacture synthetic fuels for aviation and maritime transport. It notes, however, that further work is required for this, and the EU intends to publish its Sustainable and Smart Mobility Strategy later in 2020.
- It touches on the need for government support schemes so that private sector investors can justify the necessary investments to scale up both low carbon and renewable hydrogen demand and supply. Details of these support schemes are sketchy, but could include quotas, revisions to and expansion of the EU Emissions Trading Scheme (ETS), use of Carbon Contracts for Differences (CCfD) and competitive tenders for direct support for renewable hydrogen.
- Finally, the need for significant support for research and innovation is well recognised, together with the benefits of international collaboration, both for technology development and for cross-border trading of hydrogen.

Commentary

Overall, the document is a great step forward for establishing hydrogen as a mainstream part of the decarbonisation of the European Energy system. Over the last 2–3 years momentum had already been building for hydrogen's role, but the new strategy provides major confirmation of high level support from policy makers and provides a framework for more detail to be established, ideally in the next few months. The setting of specific numerical targets by certain dates is also to be welcomed.

The urgency for action to be taken is clear from the scale of the ambition. The stated numbers for renewable hydrogen production (6GW capacity by 2024 and 40GW by 2030) are small in the context of the overall energy system. 40GW capacity (assuming around 4000 running hours per year) equates to production equivalent (in energy content) to around 12-15 bcm of natural gas, while in 2030 total natural gas demand in Europe is likely to still be in excess of 400 bcm. Having said that, the largest electrolyser under construction in Europe today has a capacity of 10MW. The report also notes that current electrolyser production capacity in Europe is well under 1GW per year. Achieving 40GW by 2030 (even without the further 40GW to supply the EU from neighbouring countries) will require a very rapid scale up in electrolyser production capacity and / or strong reliance on imported electrolysers, most likely from China.

There will need to be a rapid increase in the development of specific projects to manufacture renewable hydrogen in the quantities envisaged. As noted in the strategy document, recent months have seen several announcements of GW scale renewable hydrogen production, for example NortH2 [5] (Shell/Gasunie in Netherlands, up to 4GW by 2030) and a Danish 1.3GW project[6] (Orsted, Maersk, DSV, DFDS, SAS, although only at 250MW by 2027)). However, the report records a total of only around 4.5GW of projects currently under development with potential to be onstream in Europe by 2030. Assuming a typical success rate of 20-30% for large infrastructure development projects to progress from feasibility to a positive investment decision, achieving 6GW by 2024 would require 20–30GW of projects to be in the pipeline already, or certainly by early 2021.

Given the current production costs of renewable hydrogen and the lack of a commercial business case for investors, the report acknowledges that government-backed support schemes will be required for some time. While the strategy document contemplates several possible support schemes, the detailed implementation plan is far from clear. If the 6GW target by 2024 is to have any hope of being achieved, several EU governments will need to arrange competitive tenders for such projects in the next 12 months. Such tenders would need to provide direct support to a renewable hydrogen project, either by underwriting the costs or by providing a bankable revenue stream to create a business case for a private investor.

To some extent, the strategy appears to have been written to cover all potential possibilities for hydrogen in the energy transition, so as not to offend any of the many parties who had been lobbying for points to be included in the document. This is certainly true in the widely discussed question of renewable (“green”) vs. fossil-based (“blue”) hydrogen. The strategy makes clear that the priority for the EU is development of renewable hydrogen, produced mainly from wind and solar. An earlier OIES paper[7], using Germany as an example, had explained the rationale for blue hydrogen as a transition step until green hydrogen could be produced in sufficient quantities and fossil-fuel power generation had been largely eliminated from the system. The strategy acknowledges this, accepting that “in the short and medium term” (duration not specified) other forms of low-carbon hydrogen will be needed. It seems a little surprising therefore that the strategy only contemplates cumulative investment of €3–18bn for fossil-derived hydrogen compared with €180–479bn for renewable hydrogen (plus investments in the required renewable power generation). On the other hand, the strategy does contemplate the use of Carbon Contracts for Differences (CCfDs), presumably awarded by auction to guarantee a carbon price to a project developer irrespective of the actual price of carbon prevailing under the ETS. CCfDs appear to be a very logical, market-based mechanism to promote decarbonisation in an economically efficient way. Given the significantly lower cost of blue hydrogen production today, it is to be expected that any auction for CCfDs would be won by blue hydrogen projects initially, with green hydrogen having to rely on more direct support schemes until costs have reduced sufficiently. Therefore, we envisage that successful implementation of the strategy will require several government-backed auctions, both (a) for CCfDs and (b) to promote green hydrogen projects specifically over the next 12 months.

The same “something for every interested party” approach can also be seen on the demand side. All potential applications for hydrogen are mentioned somewhere in the report (existing industrial applications, new applications like steel making, trucks, rail, inland waterways, maritime, aviation and other transport modes, electricity balancing, heat for residential and commercial buildings, blending in the natural gas network). Nevertheless, careful reading of the document does lead to a clear and appropriate prioritisation of applications. Decarbonising existing industrial hydrogen-consuming processes (notably refining and ammonia) is a logical first step, closely followed by zero-carbon steel making. It is clear that for transport, hydrogen’s role is limited to those areas where electrification is not possible, although it is not entirely clear why local city buses and taxis are specifically mentioned, since these applications have already been well demonstrated to be suitable for battery electric vehicles.

[5] https://www.gasunie.nl/en/news/europes-largest-green-hydrogen-project-starts-in-groningen
[6] https://www.spglobal.com/platts/en/market-insights/latest-news/electric-power/052620-danish-companies-plan-13-gw-green-hydrogen-project-to-fuel-transport
[7] https://www.oxfordenergy.org/publications/blue-hydrogen-as-an-enabler-of-green-hydrogen-the-case-of-germany/

Nevertheless, the concept of initial hydrogen clusters developing around initial industrial centres appears entirely logical. In the second phase, the strategy envisages hydrogen starting to play a role in balancing an increasingly renewable based electricity system, although it mentions both daily and seasonal storage without recognising that hydrogen's real advantage is for longer periods beyond the capability of batteries. While blending hydrogen into natural gas networks is mentioned, it is clearly seen as being only for a transitional phase, recognising the inefficiency of blending and the impact on potential for cross-border system operability.

Regarding networks and other infrastructure, the strategy envisages a pragmatic approach where the initial phase will see local hydrogen networks developing to serve the clusters around industrial areas. It envisages that to a large extent, particularly in the Netherlands and Germany, hydrogen networks will be based on conversion of existing natural gas pipelines, taking advantage of the existing L-gas and H-gas networks. While not stated explicitly, the strategy appears to be supportive of the concept that in the longer term a pan-European hydrogen network will develop and co-exist with a methane network, which will increasingly carry bio- or synthetic methane. This concept of parallel hydrogen and methane networks is described further in the European Hydrogen Backbone Report, published by the Gas for Climate consortium of transmission system operators the week after the EU hydrogen strategy.[8] The strategy appears to downplay some of the complexity of converting natural gas pipelines to hydrogen service, but it does recognise that significant investments will be required and that regulatory changes will be required to enable that.

Conclusion

The publication of the EU Hydrogen Strategy is a significant milestone on the journey to decarbonisation of the energy system. It will provide a valuable framework for future, more detailed work on implementation plans. It does provide a clear indication of the enormous size of the challenge, and, if the ambition is to be achieved, the urgency of government action to support specific projects to manufacture renewable hydrogen at scale. It is noteworthy that, in contrast to some earlier publications, it does acknowledge the potential role of low-carbon hydrogen from fossil fuels, at least for a transition period on the journey to the ultimate target of renewable hydrogen.

It does leave a number of questions unanswered, particularly in the area of regulation, where major changes will be required to achieve the ambition outlined in the strategy. While it envisages an open, competitive and liquid market for hydrogen with unhindered cross border trade in the long term, it is less clear how this will be reached following a period of subsidies and incentives required to justify the very significant investments to establish the required infrastructure.

OIES will continue to monitor and assess future developments based on the strategy in our future publications.

[8]. https://gasforclimate2050.eu/sdm_downloads/european-hydrogen-backbone/