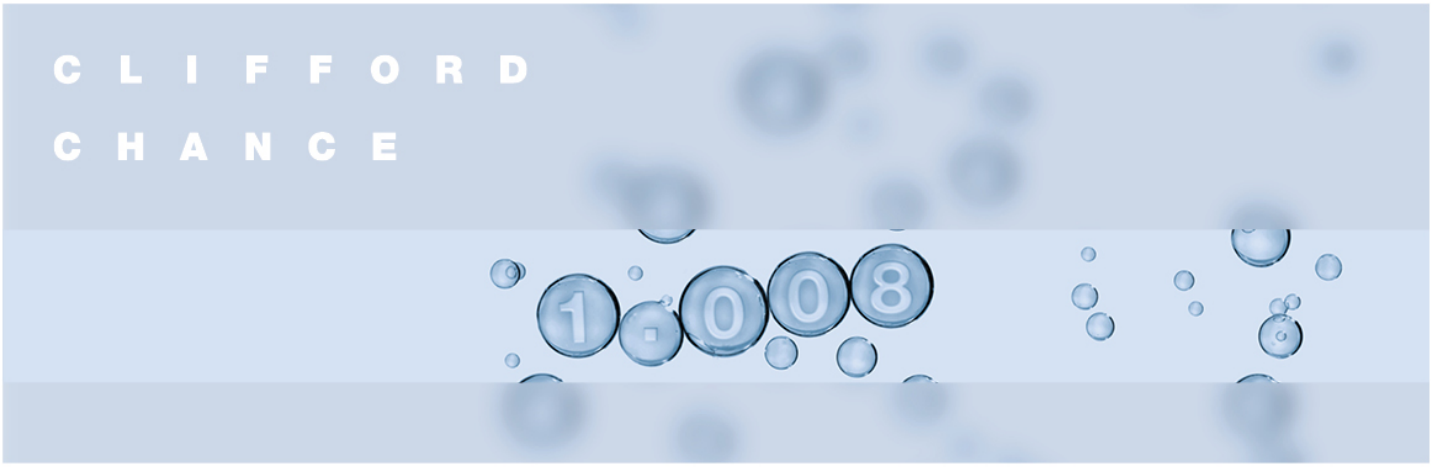

THE POTENTIAL OF CLEAN HYDROGEN: EUROPEAN AND BELGIAN OPPORTUNITIES

INTRODUCTION

Key issues

- Clean hydrogen on the rise as fossil fuel alternative and energy storage solution
- Several innovative projects in the pipeline in Belgium
- Successful roll-out in the coming years top priority for the European Commission
- Green recovery plan to unlock additional financial support for clean technologies, including clean hydrogen

Clean hydrogen is on the rise as a viable alternative for fossil fuels and an energy storage reservoir for renewable energy. The term clean hydrogen refers to initiatives which are either based on renewable or low-carbon hydrogen technologies. Unlike grey hydrogen (which is produced using fossil fuels such as natural gas), renewable (or "green") hydrogen is produced entirely from renewable sources. This method builds on existing green infrastructure by using energy from other renewable sources in an electrolysis process that produces hydrogen without carbon emissions. As it also does not release harmful emissions at the point of use, renewable hydrogen could become a vital technology in tackling climate and environmental-related challenges and accelerating the energy transition. To satisfy demand for hydrogen during a transition phase in which large-scale production of renewable hydrogen is gradually being achieved, renewable hydrogen is likely to be complemented by the production of low-carbon hydrogen. Low-carbon (or "blue") hydrogen is based on natural gas, combined with carbon capture and storage (CCS) technologies, or other low-emission pathways if they are commercially available.

Both types of clean hydrogen can be used in a wide variety of sectors and applications. Electricity generation, transport, heating and a myriad of chemistry or industrial applications are prime examples, such as hydrocarbon refining, ammonia production and steelmaking. In Belgium, clean hydrogen has a particular potential to be used in gas hubs in Zeebrugge and Antwerp and in its large maritime and chemical sectors. These sectors can embed one or more hydrogen production plants within their existing industrial clusters, and benefit from the presence of nearby offshore and onshore wind farms. This on-

site production reduces the costs and risks associated with hydrogen transportation and logistics. Nevertheless, significant challenges remain. Policy and technology uncertainty, value chain complexity, infrastructure needs and public acceptance are just some of the barriers that clean hydrogen developers and investors have to overcome.

In this briefing, we discuss the main benefits of clean hydrogen as well as the remaining barriers to its successful roll-out within the industries where it can be used most effectively. We benchmark the current European and Belgian legal and regulatory framework against the potential of clean hydrogen, finding that there is a need for greater harmonisation and policy coherence (e.g. in terms of a common classification and taxonomy) to create a genuine level playing field with established technologies and energy sources. Despite these barriers, the recent surge in pilot projects is a reason to be optimistic about the future prospects of clean hydrogen.

MAIN BENEFITS OF CLEAN HYDROGEN

One of the main benefits of clean hydrogen is the reduction in CO_2 emissions that it achieves at production and in use. Clean hydrogen can thus support Belgium and other EU Member States to meet their targets, under the Paris Agreement, to curb current levels of CO_2 emissions by 2030. In the same vein, clean hydrogen can play a pivotal role in achieving the European Commission's wider commitment to tackling climate and environmental-related challenges. Among other things, its "European Green Deal" aims for zero net emissions of greenhouse gases in 2050, while at the same time ensures a green, affordable and secure energy supply. This ambitious policy agenda requires a drastic overhaul of the existing energy landscape by innovative technologies, one of which is arguably clean hydrogen.

A related advantage of clean hydrogen is that it can make the renewable power system more secure, stable and resilient. Currently, it is challenging to store and integrate renewable energy produced by sources such as wind and solar within the existing electricity grids, given these sources' intermittent nature. Clean hydrogen production, however, can be used to transform surpluses of intermittent renewable energy into a stable form, which can be stored, including on a seasonal or long-term basis. Clean hydrogen thus complements other energy storage facilities and technologies in the market, such as storage facilities powered by stationary lithium-ion battery products or other electrochemical storage systems. This leads to improved energy efficiency, a more secured energy supply and a better integration of renewable energy sources within the energy mix.

SECTORS WHERE CLEAN HYDROGEN CAN BE USED

Clean hydrogen can be used in a variety of industries that are hard to electrify. For example, in the transportation sector, clean hydrogen can be used as fuel

for electric vehicles to reduce air pollution. In Belgium, several hydrogen refuelling stations have already been built (i.e. by WaterstofNet and operated by Colruyt Group) and several more are in the pipeline. H_2 can also be combined with captured CO_2 to produce a carbon-neutral fuel for the maritime and aviation industries. Further, H_2 has an added advantage in that it can yield potential weight and space saving benefits for heavy transport, aviation and shipping.

Clean hydrogen can additionally be used in the electricity and heating sector (power to power) or in the blending of hydrogen into the existing natural gas networks (power to gas) – whether on a transmission, distribution or local / residential level. It could be applied in several industrial processes (e.g. in the production of ammonia and fertilizers) or consumed as a commodity in the steel and chemical industry. This new technology therefore has many potential applications, especially so in energy-intensive industries.

EU FRAMEWORK

The European Union increasingly perceives clean hydrogen as an essential component in its efforts towards achieving a transition to sustainable energy. In recent years, the EU contributed to the development of clean hydrogen through specific legislative initiatives, the set-up of associations and strategic alliances and, more recently, the funding of industrial projects.

Legal Framework

There is currently no overarching, comprehensive European legal and regulatory framework for clean hydrogen. However, the EU has started to progressively eliminate this regulatory void by including references to clean hydrogen in its recent legislative instruments, which aim at a sustainable energy transition.

In the context of the EU Clean Energy Package,[1] the Renewable Energy Directive for example expanded the scope of the Guarantees of Origin system to renewable gas, including hydrogen, in order to increase transparency and guarantee the sustainable production and processing of hydrogen. This regulatory change was accepted positively in the market, and industry players such as CertifHy are now developing a reliable hydrogen guarantee of origin system deployable across Europe. The independent authority of the Flemish energy market (VREG) and the Belgian gas transmission grid operator (Fluxys) have already implemented the system which enables traceability of the origin of green gas.

In addition, the Alternative Fuel Infrastructure Directive ("AFID") sets out minimum requirements on alternative fuels infrastructure, to be implemented through Member States' national policy frameworks, including in respect of refuelling points for natural gas and hydrogen. Member States must ensure that all hydrogen refuelling points accessible to the public, deployed or renewed as from 18 November 2017, comply with the Directive's technical specifications. In addition, Member States deciding to include hydrogen refuelling points in their national policy frameworks, must ensure that an appropriate number of such points are available to the public by 31 December 2025.

[1] European Communication, "Clean Energy For All Europeans", 30 November 2016, https://eur-lex.europa.eu/resource.html?uri=cellar:fa6ea15b-b7b0-11e6-9e3c-01aa75ed71a1.0001.02/DOC_1&format=PDF.

EU State Aid and Financial Instruments

In its recent "New Industrial Strategy for Europe" communication,[2] the European Commission announced the creation of a Clean Hydrogen Alliance (see below) suggesting that clean hydrogen projects are likely to be designated "Important Projects of Common European Interest" ("**IPCEIs**"). EU governments have greater freedom to grant State aid to such projects, in line with the Commission's 2014 State aid notice on IPCEIs. That freedom is likely to be enhanced when the Commission revises its state aid rules for IPCEIs in 2021. Along the same line, the European Commission's earlier Green Deal communication indicated that the revised State aid guidelines will reflect the EU policy objectives addressing market barriers to the deployment of clean energy products.[3]

Strategic Alliances and Partnerships

In parallel, the EU institutions also partnered with the industrial sector to foster the success of clean hydrogen. The Fuel Cells and Hydrogen Joint Undertaking ("**FCH JU**"), a public-private alliance between the European Commission, European industry and research organisations, was set up in 2008. This partnership supports research in hydrogen energy technologies to accelerate the market introduction of these technologies and reinforce the green energy transition. The FCH JU[4] contributes to the (partial) funding of industrial projects including H2FUTURE, a flagship project aimed at the construction of one of the world's largest electrolysis plants for producing clean hydrogen lead by a consortium between, among others, Voestalpine, Siemens and Verbund. Industrial players are also joining forces and are cooperating through Hydrogen Europe, a trade association which represents industry companies and research organisations as well as national and regional associations.

Latest Developments

More recent EU initiatives of include the European Commission's announcement on 10 March 2020 of a new European Industrial Strategy to help Europe's industry in the transition towards climate neutrality and digital leadership. One of the proposed actions is the creation of a Clean Hydrogen Alliance composed of investors and governmental, institutional and industrial partners. The Alliance's strategy is based on two main objectives: accelerating industrial decarbonisation while also maintaining Europe's industrial leadership. The Alliance will be based on the successful example of existing industrial alliances and the achievements of the FCH JU.

Furthermore, on 27 May 2020, the Commission announced a green recovery plan to help the EU recover from the COVID-19 crisis.[5] The recovery plan will focus on investments in clean technologies and value chains, notably through a new Strategic Investment Facility. This facility should unlock €150 billion of investments, 10% of which would be committed through the Commission's new €750 billion recovery instrument, Next Generation EU. This new Strategic Investment Facility will invest specifically in technologies key to the clean energy transition, including clean hydrogen. In addition, the European Commission also

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[2] European Communication, "A New Industrial Strategy for Europe", 10 March 2020, available at: https://ec.europa.eu/info/sites/info/files/communication-eu-industrial-strategy-march-2020_en.pdf

[3] European Commission, "The European Green Deal", 11 December 2019, https://ec.europa.eu/info/sites/info/files/european-green-deal-communication_en.pdf

[4] The Joint Undertaking itself receives support from the European Union's Horizon 2020 research and innovation programme.

[5] European Commission, "Europe's moment: Repair and Prepare for the Next Generation", 27 May 2020, https://ec.europa.eu/info/sites/info/files/communication-europe-moment-repair-prepare-next-generation.pdf

proposed to strengthen its envisaged "Just Transition Fund" with an additional €32.5 billion so that it would have €40 billion in aggregate at its disposal.

The EU's Energy Commissioner, Kadri Simson, commented that the announcements on 27 May 2020 are to be followed by a stand-alone Communication on a strategic outlook for building a Hydrogen economy in Europe that will be published by the Commission on 8 July. This Communication will build further on a Roadmap that was open for public feedback until 8 June, indicating that potential actions could include non-legislative measures, as well as legislative measures in line with the EU's 2030 and 2050 climate objectives and smart sector integration strategy.[6]

Another important development to follow in the coming months is the imminent revision of the TEN-E Regulation,[7] for which the Commission launched a public consultation that will close on 13 July 2020.[8] The TEN-E Regulation governs the implementation of Projects of Common Interest ("**PCIs**"). It is expected that the scope of this Regulation will be extended to energy infrastructure projects other than electricity and natural gas to ensure consistency with the EU's 2050 climate neutrality ambitions. PCIs benefit from "priority status" during the permit granting process and are eligible for funding from the Connecting Europe Facility, a €30 billion fund set-up by the EU to boost energy, transport, and digital infrastructure.

If this ambitious legislative agenda is enacted, hydrogen projects contributing to the energy transition of Member States should be able to apply for grants under the Connecting Europe Facility program, the "Just Transition Fund" and/or the Strategic Investment Facility. They will also become eligible to reap the benefits of the PCI status.

BELGIAN FRAMEWORK

In Belgium, the regulatory framework for clean hydrogen is scattered across the federal and regional levels (i.e. the Flemish, Walloon and Brussels Metropolitan Region). Both the federal and the regional governments can impose taxes and have certain (exclusive) competences regarding the energy and transportation sector and economic affairs more generally. The Regions also have the authority to regulate most environmental matters. As a result, the regulatory framework regarding the issuance of permits for the construction and operation of clean hydrogen production plants will differ, depending on the Region where the plant is located. Due to the fragmentation of competences in the field of energy and transportation, a working group was set up between the federal government and the regional governments to foster regional collaboration and coordinate the implementation of the abovementioned AFID Directive's minimum requirements on alternative fuel infrastructure.

Clean hydrogen in transportation

In Belgium, legislative steps have already been taken, in particular to implement renewables in the transportation sector. The federal and regional government have introduced several incentives for alternative fuel vehicles. However, the

[6] The Roadmap is available at https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/12407-A-EU-hydrogen-strategy

[7] Regulation (EU) 347/2013 on of the European Parliament and of the Council of 17 April 2013 on guidelines for trans-European energy infrastructure.

[8] The public consultation is available at https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/12382-Revision-of-the-guidelines-for-trans-European-Energy-infrastructure/public-consultation.

absence of a clear legislative framework on licencing, conditions of use, tariffs, etc. negatively affects the smooth roll out of an alternative fuel vehicle market in Belgium.

In the maritime sector, hydrogen-based fuels can be used as low emission alternatives to traditional fossil fuels, especially for containerships. There are however several regulatory and administrative obstacles to the use of hydrogen (fuel cells) in maritime applications. These include the lack of clarity regarding the type of approval required for vessels powered by hydrogen, and the safety measures that must be adhered to during operations and maintenance activities. Hydroville, the first certified passenger shuttle that uses hydrogen to power a diesel engine, is being used in Antwerp to test hydrogen-technology for commercial vessels. This shuttle is an important test case to obtain insights in the new technology and possible regulatory barriers.

Injection in gas grids

Regulatory barriers also exist for the injection of clean hydrogen in the gas grids. A legal framework is essential to inject hydrogen from renewable energy sources into the gas grid, which is the most effective solution for large-scale hydrogen transport – compared to alternatives such as the construction of new hydrogen pipelines or the use of tube trailers/tankers. Currently, there is a lack of standardisation in the EU. Each Member State will have its own legal requirements to determine whether a small percentage of hydrogen may be allowed in its gas grids. For example, Belgium has an explicit legal basis for the transmission of types of gas other than natural gas, which is subject to specific conditions pertaining to safety, compliance with a code of conduct adopted by the Federal Government and compatibility with the quality standards that apply to the natural gas transmission grid.[9] While technical experts estimate that around 5% of hydrogen could in principle be injected into the Belgian transmission grid in compliance with these requirements, other regulatory hurdles remain. For example, existing transmission licences, interconnection agreements with adjacent TSOs and connection agreements with large industrial parties should unambiguously cover a blend of natural gas and hydrogen for these market actors to have the necessary degree of comfort and legal certainty.

In the longer run, more substantial changes to the transmission grid may be necessary to increase the technical maximum concentration of hydrogen in the gas grids. In this respect, the vision between TSOs may diverge. Some might see a progressively increased blending of natural gas and hydrogen as a crucial step in the development of a liquid hydrogen market and will therefore gradually expand the technical capabilities and quality specifications of their existing natural gas grids. Others might be more inclined to construct transmission infrastructure which is exclusively dedicated to hydrogen. To avoid such divergencies, a coordinated European action plan seems vital. This will facilitate the creation of a level playing field and avoid fragmentation of the European energy market.

[9] Such as the Royal Decree related to transport licence for gaseous products of 14 May 2002 and the Royal Decree on the safety measures to be taken when setting up and operating installations for the transport of gas by pipeline of 11 March 1966.

Tax aspects

To promote alternative energy sources, vehicles using hydrogen as fuel are supported by governmental incentives. These include regional tax and registration fee reductions. In addition, federal tax incentives relating to investments aimed at reducing the carbon footprint may also be available. At the same time certain barriers remain as well since the production and importation of hydrogen consumed as fuel is subject to the Belgian excise duties regime. This means that producers and importers of hydrogen are subject to certain permits and authorisations and must charge their customers excise duties.

Permit requirements for the development of clean hydrogen production plants

In each of the three Regions, the development and operation of a clean hydrogen production plant triggers permit and environmental impact assessment requirements. In addition, various specific health and safety regulations, such as the General Regulations on Electrical Installations ("AREI"), and workers safety requirements will need to be taken into account.

Both in the Flemish and Walloon Regions one single permit – which is generally referred to as "*omgevingsvergunning*" or "*permis unique*" – covers both the construction and operation of the project. In Brussels, the development and operation of a plant requires two separate permits and the plant's development may only start if both permits are issued. In the Walloon Region, the permit covering the operation of the plant must be renewed every 20 years, whereas in the Brussels Region such renewal must be organised every 15 years. In the Flemish Region, permits may be issued for an unlimited period of time. These differences between the regional permit regimes are an example of the fragmented policy framework that project developers and investors committed to clean hydrogen can be confronted with.

Recent Surge in Belgian Pilot Projects

Although the Belgian regulatory framework is complex, several impactful (private) innovation projects are currently in the pipeline, making Belgium one of the pioneers in clean hydrogen in Europe. For example, at the end of last year, seven industrial players and public stakeholders (DEME, Engie, Exmar, Fluxys, Port of Antwerp, Port of Zeebrugge and WaterstofNet) joined forces and signed a cooperation agreement for the transport of hydrogen. Another partnership was set up between Eoly, Parkwind and Fluxys to construct a power-to-gas installation in Zeebrugge to convert renewable electricity in green hydrogen on an industrial scale (Hyoffwind). In addition, DEME, PMV and Port of Ostend are building a plant in Ostend to produce clean hydrogen (HYPORT) and Port of Antwerp, ENGIE, Oiltanking, Indaver, VMH, Fluxys and INOVYN are building a "power-to-methanol" demonstration plant in Antwerp powered by clean hydrogen. These are all very promising initiatives to increase the production of sustainable energy in Belgium.

Bankability of clean hydrogen

To scale up the production of clean hydrogen, the bankability of large projects is key. To obtain the necessary funding for such projects, investors need access to debt finance. Among others, to achieve this and as seen in the PV industry, production costs of electrolysers need to be reduced through economies of scale and scope. Renewable energy also needs to be available in greater

quantities and at lower prices, which requires an upsurge in renewable energy installations dedicated to the production of clean hydrogen. This is crucial, as significant amounts of renewables are necessary to produce clean hydrogen. In addition to lowering production costs, other barriers, such as technology-related risks and cashflow uncertainty, should also be tackled before clean hydrogen can become commercially viable and able to obtain project financing on a non-recourse or limited recourse basis.

CONCLUSION

The current Belgian legal and regulatory setting is fragmented and therefore complex to navigate for project developers and investors committed to clean hydrogen. It requires a comprehensive overhaul to address the necessary power changes.

The EU's clear acknowledgment of the challenges ahead is a cause for optimism. Notably, the EU has included clean hydrogen as a top priority in the European Green Deal and the Commission's green recovery plan. A further regulatory push seems in any event required, ideally focussing on two objectives. First, financial incentives will be required to facilitate the required scaling up of the sector and to reduce production costs in order to make clean hydrogen projects commercially viable and bankable. There is also a greater need for harmonisation and policy coherence to create a genuine level playing field with established technologies and energy sources. The expanded scope of the Guarantees of Origin system to hydrogen has been an important first step in the right direction. The imminent revision of the TEN-E Regulation and the EU's State aid rules would also constitute important milestones, which should be complemented by further steps at the national level that are consistent with these important developments at the EU-level.

Despite the remaining barriers, Belgium's recent surge in pilot projects is a reason to be optimistic about the future prospects of clean hydrogen.

ABOUT

Focus on Hydrogen is a Clifford Chance briefing series covering hydrogen-related developments globally. 1.008 is the standard atomic mass of hydrogen.

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