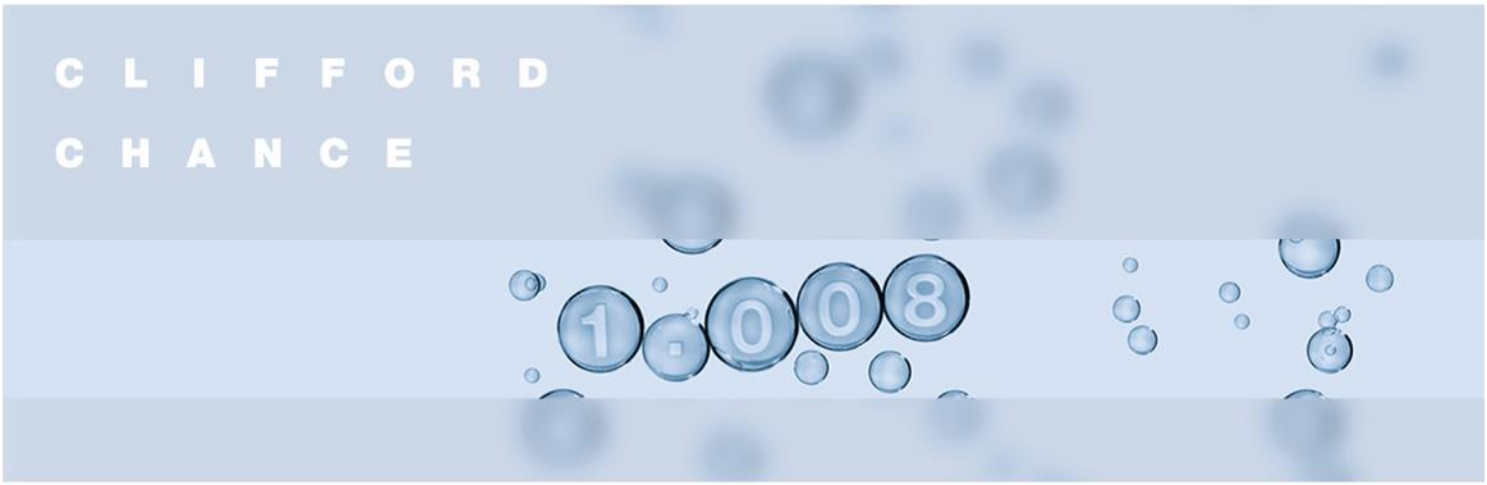

FOCUS ON HYDROGEN: TIME FOR NEW ENERGY IN EUROPE AND FRANCE

2020 is proving to be an extraordinary year for a number of reasons. On a positive note, would one of these reasons be that clean hydrogen has left the zone of hype and entered the territory of hope? There are certainly a number of political signals and industry reactions which, together with technological advances in fuel cells and electrolysis, falling renewable energy and fuel cell prices and stringent climate change requirements, would support such hope.

In this briefing we look at the key features of clean hydrogen and its potential and provide an overview of the related European and French policy and regulatory frameworks.

Key issues

- Clean hydrogen on the rise as part of the solution to meet the 2050 carbon neutrality goal
- Low-carbon hydrogen recognised as needed in a transition period
- Successful development of the hydrogen value chain is a top priority for the European Commission
- Strategic objective of developing clean hydrogen clearly endorsed by the French Government and by regional and local public authorities
- In France, a number of innovative pilots already in operation or in the pipeline
- Post Covid-19 economic recovery plans expected to unlock additional and significant financial support for clean hydrogen in France

KEY FEATURES OF CLEAN HYDROGEN

Hydrogen is the most abundant chemical element in the universe. It is an energy carrier with remarkable potential. The energy stored in its molecule can be released in multiple ways, including through combustion or conversion of the chemical energy into electricity.

Using hydrogen in its pure form on Earth requires an extraction process because the element is found only as a component of more complex substances, such as water. The different processes applied for its extraction and the source of energy they use serve to categorise hydrogen into:

- 'grey' hydrogen – extracted from fossil fuels
- 'blue' (or low-carbon) hydrogen – produced from fossil fuels with carbon capture technology
- 'green' (or renewable or clean) hydrogen – the product of electrolysis powered by renewable electricity, biogas processing or biochemical conversion of biomass.

There is no current specific categorisation for hydrogen from nuclear energy but it is another production route to consider, especially in France.

Renewable hydrogen is on the rise as a viable alternative for fossil fuels and an energy storage reservoir for renewable energy. Only renewable hydrogen has been proposed to be labelled as 'clean' by the European Commission. But there is a recognition that to address hydrogen demand while large-scale production of renewable hydrogen is picking up pace, renewable hydrogen is likely to be complemented in a transition phase by low-carbon hydrogen.

THE POTENTIAL OF CLEAN HYDROGEN

Owing to its characteristics, hydrogen can be used in numerous sectors, including transportation (as fuel for electric vehicles or the maritime and aviation industries), heating (blended with or replacing natural gas heating – power-to-gas projects), electricity (hydrogen produced from renewable sources is stored and then transformed back into power for future use – power-to-power projects), and various industrial processes (e.g. in the production of fertilisers or in the steel industry).

A central benefit of clean hydrogen is the reduction in CO_2 emissions achieved in its production and use. With its many potential applications, especially in energy-intensive industries, clean hydrogen could play a pivotal role in delivering European decarbonisation targets and achieving the European Commission's wider commitment to tackling climate and environmental-related challenges, including the European Green Deal which aims for zero net emissions of greenhouse gases in 2050. Clean hydrogen could likewise be instrumental to delivering France's decarbonisation targets and offer tangible green growth potential for France's industry, a view also shared (for some time now) by the French Association for Hydrogen and Fuel Cells (AFHYPAC).

AN AMBITIOUS EU ROADMAP

Recognising the potential of clean hydrogen, the European Union increasingly perceives it as a key priority to achieve the European Green Deal and Europe's clean energy transition.

The EU had already started to include references to clean hydrogen in recent legislative instruments. For instance, in the context of the EU Clean Energy Package, the Renewable Energy Directive expanded the scope of the Guarantees of Origin system to renewable gas, including hydrogen, and the Alternative Fuel Infrastructure Directive set out minimum requirements on alternative fuels infrastructure, including in respect of hydrogen fuelling points.

The European Commission's communication published on 8 July 2020[1] now demonstrates a holistic full lifecycle approach for developing a hydrogen ecosystem in the EU, the key aspects of which are outlined below.

Further details can be found in our briefing The European Commission's Hydrogen Strategy for a Climate-Neutral Europe.

The EC strategic roadmap for hydrogen

The European Commission's roadmap is structured in three phases:

- **Phase 1 (2020 to 2024)**: the strategic objective is to decarbonise existing hydrogen production (e.g. in the chemical sector) and facilitate take-up of hydrogen consumption in new end-use applications by promoting the production of 1 million tonnes of clean hydrogen with at least 6 GW of clean hydrogen electrolysers installed.
- **Phase 2 (2025 to 2030)**: integration of clean hydrogen into the energy system by expansion of the use of renewable hydrogen in new sectors (in particular steel and transport), producing 10 million tonnes of clean hydrogen with at least 40 GW of clean hydrogen electrolysers installed.

[1] Communication from the EC to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions, "A hydrogen strategy for a climate-neutral Europe", 8 July 2020, COM(2020) 301 final

- **Phase 3 (2030 to 2050)**: clean hydrogen technologies at large scale should achieve maturity to reach all hard-to-decarbonise sectors.

While focusing on clean hydrogen, the roadmap also recognises the role of low-carbon hydrogen production in a transition phase.

Investment agenda for the EU

The European Commission has identified actions along the entire hydrogen value chain which will require huge investments. For instance, from now to 2030, between €24 billion and €42 billion will be needed for the development and construction of electrolysers and between €220 to €340 billion to scale up solar and wind energy production capacity to 80 GW-120 GW to provide the necessary electricity.

To support these investments and the emergence of a whole hydrogen eco-system, the Commission launched the European Clean Hydrogen Alliance, which brings together industry, national and local public authorities, civil society and other stakeholders all along the hydrogen value chain. The key deliverable of the Alliance will be to rapidly identify and build up a clear pipeline of viable investment projects.

A number of EU financial instruments will be made available for the development of hydrogen. This includes notably the InvestEU programme and the ETS Innovation Fund. Hydrogen projects could also benefit from the status of Important Projects of Common European Interest (IPCEI).

Scaling up production

Upstream, the key aim is for hydrogen to become cost-competitive with fossil fuels by creating a supportive policy framework. In this vein, the European Commission is making several proposals, including:

- Creation of tendering systems for Carbon Contracts for Difference (CCfD), being long-term contracts with a public counterpart remunerating the investor by paying the difference between the CO_2 strike price and the actual CO_2 price in the Emission Trading System (ETS).
- Direct and transparent market-based support schemes, allocated through competitive tenders.
- Revision of the State aid framework, including the state aid guidelines for energy and environmental protection, foreseen in 2021.

Backbone transmission infrastructure

Large-scale hydrogen consumption will require corresponding transportation capacities on a regional, national and trans-European level. In combination with newly-built dedicated infrastructure, existing gas infrastructure could be repurposed for hydrogen transmission.

However, there are still barriers to overcome:

- Existing natural gas pipelines are owned by network operators that are often not allowed to own, operate and finance hydrogen pipelines. Against this background, the Commission intends to revise the relevant gas legislation.
- Third-party access rules, clear rules on connecting electrolysers to the grid and neutrality of network operators will be needed to ensure non-discriminatory access to hydrogen infrastructure.

- Another item on the Commission's agenda is to ensure the full integration and interoperability of hydrogen infrastructure in EU infrastructure planning by including hydrogen in the Trans-European Networks for Energy and the Ten-Year Network Development Plans.

Interestingly, a group of eleven European gas TSOs from nine EU member States, including the French TSOs GRTgaz and Teréga, spontaneously presented on 17 July 2020 a plan for a European hydrogen transport infrastructure, which envisages almost 23,000 km of hydrogen pipelines by 2040, approximately 75% of which would be repurposed natural gas infrastructure[2].

Boosting demand in end-use sectors

The European Commission recognises that demand-side support policies will also be needed to overcome the current higher costs of the use of hydrogen. To such end the Commission:

- will propose measures to facilitate the use of hydrogen and its derivatives in the transport sector in the upcoming Sustainable and Smart Mobility Strategy, announced in the European Green Deal and due to be presented before the end of 2020; and
- consider various options for incentives at EU level, including the possibility of minimum quotas of clean hydrogen or its derivatives in specific end-use sectors (e.g. the chemical sector or transport applications).

THE FRENCH HYDROGEN FRAMEWORK

The French hydrogen national strategy – the beginning

Hydrogen Plan 2018

Support by the French Government for clean hydrogen was first announced through a Hydrogen Plan in 2018. This plan was organised around three axes:

- industry – promoting the share of clean hydrogen in the hydrogen consumed by industry
- energy – developing hydrogen as a storage solution for the electricity produced by renewables
- mobility – developing clean transport, notably through the construction of hydrogen fuelling stations.

The initial plan could be read as envisaging low-carbon hydrogen as part of the "clean" hydrogen being promoted. The role of low-carbon hydrogen in the national strategy and its share of the public financial support now remains to be confirmed by the French Government.

Multi-Annual Energy Plan (PPE) 2020[3]

The development of clean hydrogen and its uses in the industrial, energy and mobility sectors is included in the national Multi-Annual Energy Plan (*Programmation Pluriannuelle de l'Energie* or *PPE*) adopted in April 2020. Its purpose is to map out the energy actions of the Government in the next 10 years with the aim of France becoming carbon neutral by 2050.

[2] "European Hydrogen Backbone, How a dedicated hydrogen infrastructure can be created", July 2020

[3] Decree No 2020-456 of 21 April 2020 relating to the Multi-Annual Energy Plan

The Multi-Annual Energy Plan sets out a number of targets for the development of hydrogen, as reflected in the table below.

	By 2023	By 2028
Demonstrators of "power-to-gas" technology (MW)	1 to 10	10 to 100
Share of clean hydrogen in industrial hydrogen	10%	20% to 40%
Number of hydrogen fuelling stations	100	400 to 1,000

Climate Energy Law 2019

The Climate Energy Law of 8 November 2019 sets out a target for hydrogen development, by providing that renewable and low-carbon hydrogen should amount to 20% to 40% of hydrogen consumption by 2030.

French Energy Agency (ADEME)

Public financing at the national level has so far been made available mainly by the French Energy Agency (ADEME) through calls for tenders. In 2019, €90 million was awarded for hydrogen transport projects such as hydrogen fuelling stations. In 2020, new calls for tender are being launched by ADEME, regarding for example, the development of hydrogen in the railway sector.

The financial envelope initially contemplated in 2018 was €100 million per year over 5 years, which fell short of the billions of Euros requested by hydrogen stakeholders and, so far, remains far from the €9 billion investment contemplated by the German National Hydrogen Strategy announced in June 2020 for propelling Germany into a leading role in the hydrogen economy worldwide.

Current momentum for hydrogen development in France

The level of public financial support for hydrogen in France is expected to significantly increase given recent developments.

Covid-19 stimulus plans

The development of hydrogen features as part of the stimulus plans being pursued by the Government for industrial recovery after the Covid-19 crisis.

The support plan for aviation[4], for a total amount of public aid (subsidies, loans, guarantees) of more than €15 billion, includes €1.5 billion over the next three years towards designing the "clean planes of tomorrow" through the use of carbon neutral fuel such as hydrogen. The plan aims at developing a commercial hydrogen-fuelled plane to replace the A320 by 2033 or 2035 (with a first demonstrator to be ready as soon as 2026).

Hydrogen is also part of the support plan for the car industry[5] for a total amount of public aid of more than €8 billion. The Government will for instance impose on public entities an obligation to renew their fleet of vehicles with at least 50% clean vehicles such as hydrogen fuelled vehicles. In addition, the plan includes €150 million to support R&D, notably in hydrogen-fuelled vehicles.

[4] Support plan for aviation published on 9 June 2020 on the site of the French Economy and Finance Ministry

[5] Support plan for the car industry published on 26 May 2020 on the site of the French Economy and Finance Ministry

Political support

Furthermore, recent and repeated political declarations make it clear that the French State is aware of the need to move shift into a higher gear with clean hydrogen.

The Economy and Finance Minister, Bruno Le Maire, announced on 30 June 2020 that the French industrial recovery plan, which is expected to be presented in autumn this year, would include the development of hydrogen and also reportedly referred in this respect to a possible partnership with Germany. Most recently, in his official speech on Bastille Day, the President of the Republic, Emmanuel Macron, indicated the support of the French Government for the development of hydrogen to boost the energy transition and create sustainable jobs. And this approach was echoed by the newly-appointed Prime Minister, Jean Castex, in his speech before the Senate on 16 July 2020. Even more recently, on 23 July, a hundred members of the national and EU parliaments made a public call on the French Government to set up a new national hydrogen plan covering all the value chain and supported by a financial envelope comparable to that of other countries such as Germany. These declarations signal the political intention to invest massively in the development of hydrogen in France.

The awaited French hydrogen regulatory framework

Similar to the situation at the EU level, there is little hydrogen-specific legislation in France. There are technical requirements for hydrogen fuelling stations (implementing the Alternative Fuel Infrastructure Directive), but these are an exception as there are generally few legislative or regulatory provisions focusing specifically on hydrogen.

That said, significant progress is expected in the coming months since the Climate Energy Law has empowered the Government to issue decrees (*ordonnances*) setting out the legal framework necessary for the development of hydrogen, i.e. to allow the production, transport, storage and traceability of hydrogen (guarantees of origin) and to create financial support schemes for clean hydrogen. The law had given one year to the Government to do so, i.e. until November 2020, although a delay of several months is expected on account of Covid-19. The development of the French regulatory framework will need to be consistent with the new EU guidelines and legislation.

The French hydrogen sector – hopes and pilots

Meanwhile, French industry is starting to focus on hydrogen. Certain leading French companies have developed uses for hydrogen domestically and abroad. A few have already received significant public attention, including:

- **Toulouse-Blagnac** – a project undertaken by Engie Solutions and the Occitania Region, as stakeholders of the project company, HyPort, with support from ADEME and the EU. It will become the first airport in the world to host a hydrogen production and distribution station.
- **Jupiter 1000** – a power-to-gas project in the harbour of Marseille/Fos-sur-Mer led by GRTgaz, in partnership with, among others, RTE, Teréga, la Compagnie Nationale du Rhône and McPhy Energy, with support from ADEME and the EU, as well as the Provence-Alpes-Côte-d'Azur Region. Put into operation in February 2020, it aims at using the CO_2 produced by the harbour area facilities and combining it with hydrogen to produce synthesis methane, then injecting it in the gas distribution network.

- **Zero-Emission Valley (ZEV)** project – an example of regional authorities in France actively promoting clean hydrogen. The Auvergne and Rhône-Alpes Region launched the ZEV project in 2017 for the deployment of 20 hydrogen fuelling stations and 1,000 hydrogen fuelled vehicles in the Region, with support from ADEME and the EU.

These initiatives are but a few of the projects seen over the past several years in the sector in France. And activity is certainly accelerating.

The French hydrogen industry, represented by the French Association for Hydrogen and Fuel Cells (AFHYPAC), is now looking forward to a structured strategy from the State. AFHYPAC, whose members include leading French energy companies (e.g. Air Liquide, Engie, EDF subsidiary Hynamics and Total), as well as leading French industrial companies (such as Faurecia and Michelin), published on 23 July 2020 a manifesto[6] calling for more than €10 billion of public investments over the period 2020-2030 – while around €24 billion of private investments are expected over the same period. They also called for a dedicated governance bringing together public authorities and private stakeholders to be put in place in order to enhance France's strategic position in the hydrogen economy.

CONCLUSION

Renewable and low-carbon hydrogen is a source of hope for both meeting the carbon emission reductions targets and fostering industrial recovery after the Covid-19 crisis. Europe is aiming to be highly competitive in developing clean hydrogen applications and is positioning itself for a leading role in this market.

One of the barriers faced today by developers and investors is the absence of a comprehensive legal framework for clean hydrogen at the European and national levels. This legal vacuum must be addressed to ensure the bankability of large projects, enabling investors to commit their equity and have access to debt finance, which will be key to scaling up the production of clean hydrogen. Clean hydrogen value chain actors are looking forward anxiously to the EU legislation to be enacted following discussion of the Commission's strategic roadmap with the Member States, as well as to the regulatory framework that the French Government is committed to issue in the coming months.

As was the case in the beginning for wind and solar power generation, the clean hydrogen industry needs support and time to become cost-effective and competitive, both with fossil-based hydrogen and other energy sources. Support by public authorities, including financial support schemes and forward-looking legislation, are therefore needed to transform hope for hydrogen into reality.

ABOUT

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

For other hydrogen publications, please see our climate, sustainability, green finance and renewables page here.

For hydrogen queries in other jurisdictions, please contact Anthony Giustini and Andreas Formosa (listed under Global contacts below).

[6] AFHYPAC, "Pour un plan national hydrogène ambitieux et cohérent", 21 July 2020

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