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## Market Opportunity Report

Hydrogen – At the core of the European Green Deal's renewable energy strategy

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# Hydrogen – At the core of the European Green Deal's renewable energy strategy

The European Green Deal – the pathway to renewable energy sources

By Stig Kristian Fjeldstad Marthinsen

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## Executive Summary

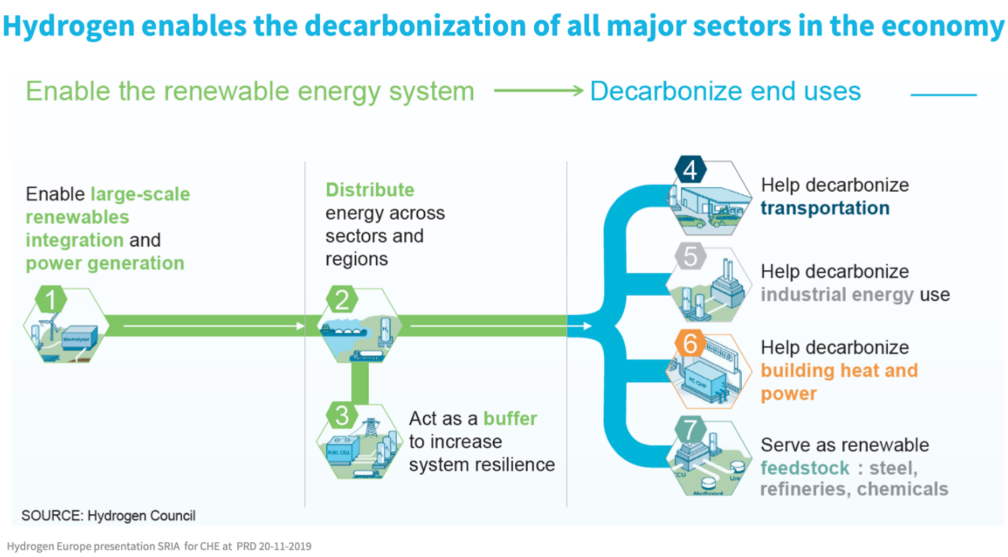
### "In developing and deploying a clean hydrogen value chain, Europe will become a global frontrunner and retain its leadership in clean tech"

Frans Timmermans, First Vice President of the European Commission, 08.07.2020

EU aims at becoming world leader in renewable energy. The European Union´s Green New Deal presents clean (green) hydrogen as a critical renewable energy source for member states to achieve climate neutrality by 2050. Clean hydrogen is considered as a safe energy source, sustainable and competitive.

## Hydrogen is key in EUs Green Deal

The Green Deal, part of the European Union's growth strategy, is to be part of a growing economy meant to benefit the entirety of the European population, and market economy. 2050 is the target year the EU envisions Europe will become the world´s first climate neutral continent through the implementation of clean energy sources, such as clean hydrogen. However, there are a series of challenges to overcome to achieve this goal, which include overcoming fundamental changes to both economy and existing infrastructure as well as major technological breakthroughs, according to Hydrogen Europe.




Hydrogen can used as a feedstock, a fuel or an energy carrier and storage, and is applicable to a wide array of uses across industry, transport, power and building sectors. The zero CO2 emissions is the most important aspect in the use of hydrogen and is therefore an important part of the 2050 climate neutrality goal of the European Green Deal. Hydrogen can help decarbonize industrial processes and economic sectors where reducing carbon emissions is both urgent and hard to achieve. Decarbonizing hydrogen production is made possible by the ever-declining cost of renewable energy and the acceleration of technological developments, which helps expand its use in sectors where it can replace fossil fuels.

To date, significant progress has been made across Europe in decarbonizing its electricity production. Progress has been slower in other sectors of energy carriers, such as gas, liquid fuels and heat. The use of fossil fuels in end-use sectors such as transport, industry and buildings remain predominant. For those hard-to-abate sectors where other alternatives might not be feasible or have higher costs such as heavy-duty and long-range transport, as well as energy-intensive industrial processes, clean hydrogen will play a key role in decarbonization.

Common keywords for hydrogen categories according to their CO2 impacts are “green”, “blue” and “grey”. “Green hydrogen” is produced by water electrolysis, and if the required electricity for the process comes exclusively from renewable energy sources the entire production process is completely CO2-free. “Blue hydrogen” is generated CO2-neutral from fossil fuels, while “Grey hydrogen” is obtained from fossil fuels. Here natural gas is converted under heat into hydrogen and CO2.

# The hydrogen market

## Market breakdown

*Figure 1: Breakdown of the hydrogen market*

| Hydrogen infrastructure | Production | Distribution & storage | End-user markets |
|---|---|---|---|
| •Electrolysers<br>•Compressor<br>•Hydrogen pipeline<br>•Storage solutions | •Electrolysis<br>•Other modes of production<br>  •offshore & onshore | •Large scale storage<br>•H2 in the gas grid<br>•Transport & storage in liquid carrier<br>•Transport by road, ship, etc.<br>•Key technology for distribution | •Transport vehicles<br>  •Cars<br>  •Trucks & large vans<br>  •Maritime (Ship & Ports)<br>  •Aviation<br>  •Train<br>  •Coach/Bus<br>•H2 for heat & power (buildings & industry)<br>  •H2 burners & turbines<br>•H2 decarbonises industry<br>  •H2 in industry |

With its completely CO2-free production, ‘green’ hydrogen offers the potential for permanent decarbonization of the energy landscape and compliance with climate goals. This potential is still largely undeveloped today:

- Around 75 million tons of hydrogen are generated annually worldwide. Around 95% of the production takes place in refineries, in fertilizer production, and in petrochemical plants as a raw material for further processing in various branches of industry. Apart from specialized industries, however, hydrogen is so far unused on a larger scale as an energy source.

- Approximately 95% of the hydrogen is obtained ‘gray’ and ‘blue’ by steam reforming from methane, oil, or coal; for a ton of hydrogen, an average of about nine tons of CO2 are generated. So far, however, energy from renewable sources is largely unused.

As illustrated above, market opportunities will emerge around the hydrogen infrastructure, production, distribution & storage plus end user markets.

### Outlook

According to the Fuel Cells and Hydrogen Joint Undertaking’s Hydrogen Roadmap for Europe, the deployment of hydrogen could by 2030 pave the way for a €130 billion EU-industry for the fuel and associated equipment, reaching € 820 billion by 2050. Being a frontrunner would trigger an export potential of € 70 billion by 2030, with net exports of € 50 billion.

In the first phase (2020-24) the objective is to decarbonize existing hydrogen production for current uses such as the chemical sector. This phase relies on the installation of at least 6 Gigawatt of renewable hydrogen electrolysers in the EU by 2024 and aims at producing up to one million ton of renewable hydrogen. Approximately 1 Gigawatt of electrolysers are installed in the EU today.

In the second phase (2024-30) hydrogen must become an intrinsic part of an integrated energy system with a strategic objective to install at least 40 Gigawatt of renewable hydrogen electrolysers by 2030. Hydrogen use will gradually be expanded to new sectors including steelmaking, trucks, rail and some maritime transport applications. It will still mainly be produced close to renewable energy sources, in local ecosystems.

The third phase, from 2030 onwards and towards 2050, renewable hydrogen technologies should reach maturity and be deployed at large scale to reach all hard-to-decarbonise sectors where other alternatives might not be feasible or have higher costs.

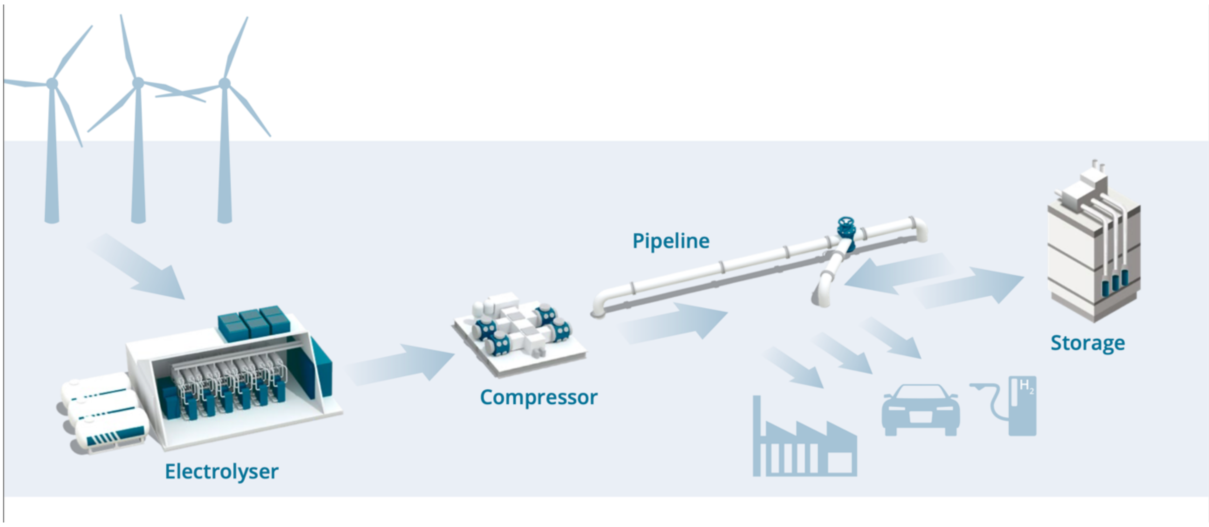
**Key take aways**

- Combined with EU's leadership in renewables technologies, the emergence of a hydrogen value chain serving a multitude of industrial sectors and other end uses the EU hydrogen industry can bring one million highly- skilled jobs by 2030, reaching 5,4 million by 2050.
- Analysts estimate that clean hydrogen could meet 24% of the world energy demand by 2050.
- EU own capacity will grow towards 40 GW by 2030 + imports from 40 GW
- In 2025, renewable hydrogen will become competitive with low-carbon hydrogen or with grey hydrogen with a 50 € per ton $CO_2$ tax (Hydrogen Council, 2020).
- In 2030 renewable hydrogen is expected to become competitive with grey hydrogen.
- Green hydrogen pricing will come down to around €2 by 2030 from the current price level at €3-8 pr kg.
- Hydrogen electrolysis will outcompete fossil fuels/energy by 2030, and renewable hydrogen will reach 10 million tons.

By 2050 60% of the energy demand will be met by electrification. 40% of the energy demand cannot be electrified, e.g., heavy industries and heavy transport. Half of this demand, i.e., 20% of the total energy demand, will be met by renewable hydrogen. Per Anders Engkvist from Material Economics, Stockholm, Sweden, claims the hydrogen market will reach 540 TWH in the near term. See report "Mainstreaming green hydrogen in Europe".

Royal Dutch Shell predicts liquid hydrogen to be the dominant future fuel source.

### Hydrogen infrastructure market




Europe is highly competitive in clean hydrogen technologies manufacturing and is well positioned to benefit from a global development of clean hydrogen as an energy carrier. Cumulative investments in renewable hydrogen in Europe could be up to €180-470 billion by 2050, and in the range of €3-18 billion for low-carbon fossil-based hydrogen.

### Capacity 40 GW + 40 GW by 2030

The European hydrogen industry is committed to produce renewable hydrogen at equal and eventually lower cost than low-carbon (blue) hydrogen. A prerequisite is that a 2x40 GW electrolyser market in the European Union and its neighboring countries/continents (e.g. Norway, North Africa and Ukraine) will develop as soon as possible.

The roadmap of the Green Hydrogen for a European Green Deal A 2x40 GW Initiative for the development towards 40 GW electrolyser capacity in the EU by 2030 is depicted in the table below. The total hydrogen production in 2030 by this 40 GW will be 4.4-million-ton hydrogen, 1 million ton by the 6 GW captive electrolyser capacity and 3.4 million ton by 34 GW hydrogen market electrolyser capacity. The 4.4-million-ton hydrogen (173 TWh) represents 25% of the total EU hydrogen demand (665 TWh), as presented in the Hydrogen Roadmap Europe (FCH JU, 2019). This will ensure Europe's leading position in the emerging global hydrogen economy, which is crucial to become and remain a leader in this emerging technology.

If a 2x40 GW electrolyser market in 2030 is realised alongside the required additional renewable energy capacity, renewable hydrogen will become cost competitive with fossil

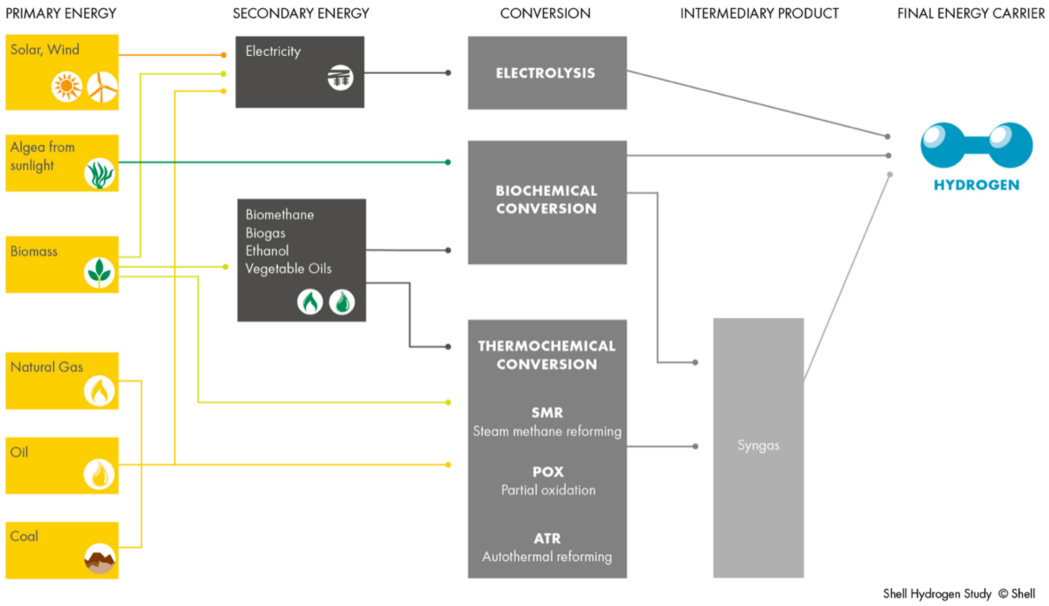
*Table 1: Hydrogen market capacity*

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Captive Market [MW]** | | | | | | | | | | | | **6,000** |
| **Chemical** | 5 | 20 | 45 | 130 | 200 | 200 | 250 | 300 | 350 | 400 | 450 | 2,350 |
| **Refineries** | 10 | 40 | 50 | 100 | 100 | 100 | 200 | 200 | 300 | 300 | 400 | 1,800 |
| **Steel** | | | 20 | 30 | 50 | 100 | 100 | 100 | 100 | 150 | 150 | 800 |
| **Other (glass, ceramics)** | | 10 | 20 | 30 | 40 | 50 | 50 | 50 | 50 | 50 | 50 | 400 |
| **Hydrogen refuelling stations** | 10 | 20 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 | 100 | 650 |
| **Hydrogen Market [MW]** | | | | | | | | | | | | **34,000** |
| **Centralised GW scale (Hydrogen plants)** | | | 200 | 500 | 1,000 | 2,000 | 3,000 | 4,000 | 5,500 | 7,000 | 8,500 | 31,700 |
| **Decentralised 10-100 MW scale** | 10 | 20 | 40 | 70 | 110 | 160 | 220 | 290 | 370 | 460 | 550 | 2,300 |
| **Total (MW)** | **35** | **110** | **405** | **900** | **1,550** | **2,670** | **3,890** | **5,020** | **6,760** | **8,460** | **10,200** | **40,000** |

(grey) hydrogen. GW-scale electrolysers at wind and solar hydrogen production sites will produce renewable hydrogen cost competitively with low-carbon hydrogen production (1.5-2.0 €/kg) in 2025 and with grey hydrogen (1.0-1.5 €/kg) in 2030.

By realizing 2x40 GW electrolyser capacity, producing green hydrogen, about 82-million-ton CO2 emissions per year could be avoided in the EU. The total investments in electrolyser capacity will be 25-30 billion Euro, creating 140,000- 170,000 jobs in manufacturing and maintenance.

## Production




The figure above, from Hydrogen Europe, illustrates methods on creating hydrogen

The industrial production of green hydrogen takes place by means of water electrolysis using exclusively regenerative energy. In large-scale production, the usual demineralized water is split by an electrical current into oxygen and hydrogen in an electrolyzer. In contrast to the conventional method of steam reforming, e.g., from natural gas ('gray' or 'blue'), this type of production is completely CO2-free. Around 55 MWh of electrical energy is required to generate one ton of hydrogen.

Commercially available water electrolysis systems for industrial use today utilize alkaline electrolysis with a potassium hydroxide electrolyte, or a 'Proton Exchange Membrane' (PEM) electrolysis with a proton-permeable polymer membrane. Alkaline water electrolysis is a technology that has been established on the market for many years and does not require the use of precious metals. The latter market is dominated by relatively cheap Chinese technology, whereas the former is the domain in which European players seek to establish technology leadership.

### Offshore and Onshore Production – hybrid platforms

The North Sea region is the world's largest producer of offshore wind, hence huge potential to produce hydrogen. It is estimated that the ocean hydrogen production capacity will reach 1 GW by 2030. Power-to-gas facilities can be directly connected to offshore renewable power installations to produce clean hydrogen. The PosHYdon hydrogen pilot represents the world´s first offshore green hydrogen plant. Another pioneer, the Dolphyn project (Deepwater Offshore Local Production of HYdrogeN), will in 2024 start the production of green hydrogen at scale from offshore floating wind in the Kincardine Offshore Windfarm outside Aberdeen. The concept integrates a wind turbine, desalination unit and electrolysis onto a single floating sub-structure to produce hydrogen that can be transported to shore via pipeline. The first stage is a 2MW prototype in 2024, followed by a 10MW unit in 2027.

The aim is to have the first commercial 10-turbine (100MW) hydrogen-producing windfarm online by 2030 and reach 300 GW of clean hydrogen production in 2050.

A further project is one by BP.L and Danish renewable energy group Oersted.CO who have partnered to develop zero-carbon hydrogen at a German oil refinery, BP's first full-scale project in a sector that is expected to grow rapidly. The project will produce green hydrogen at the Lingen refinery, Germany, through the electrolysis of water using wind power from the North Sea. It is in its early stages and initially aims to build a 50-megawatt (MW) electrolyser to replace 20% of natural gas-based hydrogen at the plant. Production is expected to start in 2024.

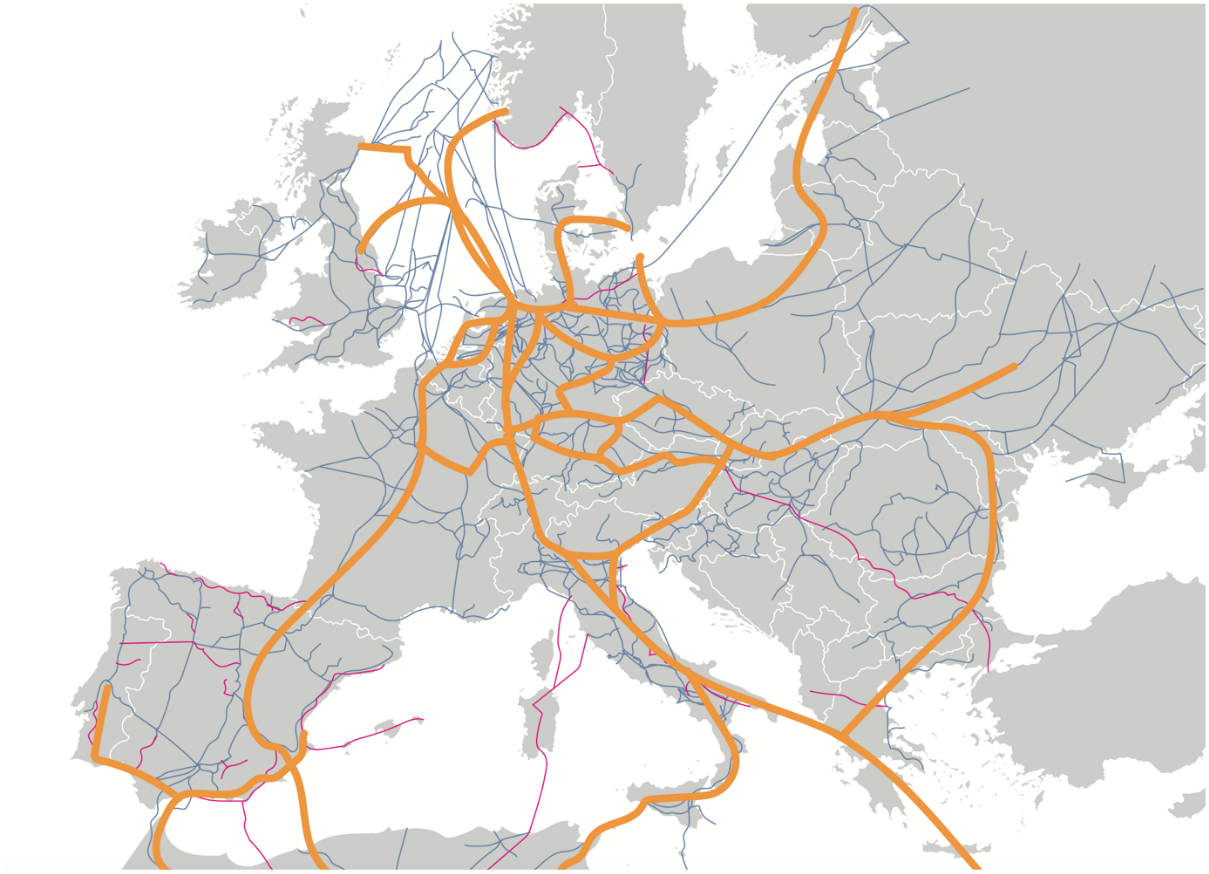
Offshore hydrogen production could take place on retired oil and gas platforms close to wind farms, or in the longer run, on artificial islands that could act as energy hubs connecting numerous winds farms to one power hub. The most developed plan for constructing such an island is the Danish Energy Island to be built in the North Sea which will serve as a hub for 200 giant offshore wind turbines next to producing green hydrogen for storage as transport. A smaller version is to be built in the Baltic Sea near Bornholm. Another initiative is the North Sea Wind Power Hub project which is expected to be ready by the early 2030s. Currently it is estimated that 250 MW electrolyser capacity could be fitted on a large 'mother' platform, while satellite platforms could host 60 MW electrolyser capacity. However, the capacity of wind farms is significantly larger, currently up to 630 MW in the North Sea, but with plans for 1.8 GW farms in the UK in the near to medium term future.

### Distribution

To make renewable energies universally usable with the help of green hydrogen, in addition to sufficient capacity for green electricity and hydrogen generation, a storage and transport network infrastructure is required that can effectively and reliably serve the needs of business and consumers.

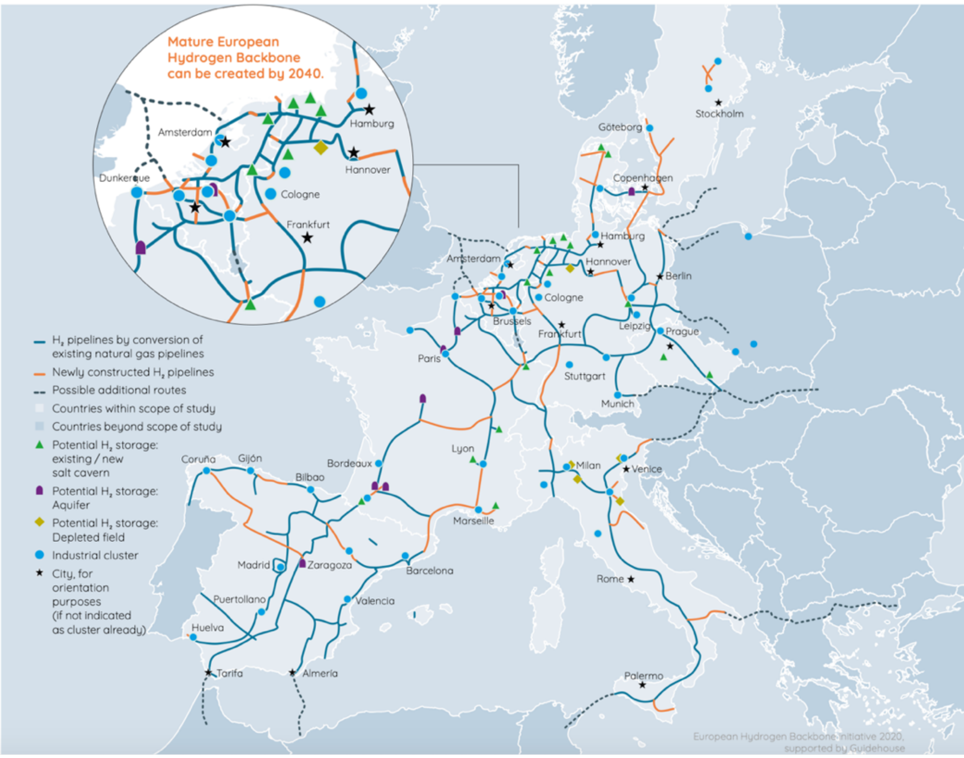
Regardless of how the hydrogen is generated, if it is not produced directly at the point of use it must be transported. There are various technical processes for this: for example, as a gas in high-pressure containers, as liquefied gas in thermally insulated containers, further processed into methanol or ammonia in liquid form, or chemically dissolved in a carrier medium using the so-called 'Liquid Organic Hydrogen Carrier' ('LOHC'). Hydrogenious offers an innovative LOHC-solution that can gain traction, in particular after being selected for the IPCEI Green Hydrogen @ Blue Danube.

Transporting hydrogen via pipelines is seen as key to enabling the hydrogen economy. Hydrogen´s high calorific value and compressibility allows for an extraordinarily high energy density bringing substantial cost savings, only slightly lower than that of natural gas. Thus, repurposing pipelines to distribute hydrogen rather than natural gas has little impact on the capacity of a pipeline to transport energy. In this context it is also worthwhile noting that offshore gas pipelines can be utilised to transport hydrogen to demand hubs far away from production. Hydrogen transport via pipeline is also a cost-effective solution for transporting energy over large distances. Offshore platforms can also be used as hydrogen hubs at sea to supply hydrogen to ships in transit.



The map above shows the European Transnational Hydrogen Backbone - The natural gas infrastructure in Europe (blue and red lines) and an outline for a hydrogen backbone infrastructure (orange lines). The main part of the hydrogen backbone infrastructure consists of re-used natural gas transport pipelines with new compressors.

Several hundred kilometers of pipeline systems are already in use in pure hydrogen operations worldwide. At the European level, eleven gas pipeline operators plan building the European Hydrogen Backbone by first converting an initial 6800 km pipeline network to distribute hydrogen. By 2040 23,000 km hydrogen network is foreseen, of which 75% is converted natural gas pipelines. The estimated cost is €27 to €64 billion bringing the levelized cost between €0,09 to €0,17 per kilogram of hydrogen per 1000km. The map below illustrates the plan.



The map illustrates the vision for the hydrogen network in Europe according to the Hydrogen infrastructure – the pillar of energy transition publication.

The German gas network is highly developed with approx. 40,000 km of transmission lines and more than 470,000 km of distribution networks. Germany also has the largest gas storage facilities in the EU with a working gas volume of approx. 24.3 billion $m^3$. As an important transit country for gas supply, Germany is also extremely well connected to the European gas market. The German gas infrastructure is therefore a central building block for sector integration and the maintenance of security of supply within the framework of an ecologically sustainable power-to-gas strategy. In Niedersachsen (Lower Saxony) there are plans to construct a 130 km pipeline to Ruhr.

## Storage

A major advantage of hydrogen is that it can be produced from (surplus) renewable energies, and unlike electricity it can also be stored in large amounts for extended periods of time. For that reason, hydrogen produced on an industrial scale could play an important part in the energy transition.

The most important hydrogen storage methods, which have been tried and tested over lengthy periods of time, include physical storage methods based on either compression or cooling or a combination of the two (hybrid storage). In addition, a large number of other new hydrogen storage technologies are being pursued or investigated. These technologies can be grouped together under the name materials-based storage technologies. These can include solids, liquids or surfaces. Examples of these are Liquefied hydrogen, Cold- and cryo-compressed hydrogen, Materials-based H2 storage, Hydride storage systems, Liquid organic hydrogen carriers, Surface storage systems (sorbents), Underground Storage and Gas Grid.

### End user segments

The end user segments in which clean hydrogen can play a major role is in transportation, heat and power for buildings, heat and power for industry, and industry feedstock. Examples of these are: fuel cells passenger vehicles, fuel cells trucks and forklifts, fuel cells buses, fuel cells trains, hydrogen in aviation, hydrogen ships, boilers for building heating, fuel cells for combines heat and power, industrial heating, turbines for grid power generation, generators, ammonia production and refining, methanol production, and finally new hydrogen applications being low-carbon steel production. These are but some of the many uses clean hydrogen can be applied to.

### Geographic markets

Hydrogen is already used extensively in industrial processes such as ammonia production and refineries, with total European demand of 327TWh concentrated in Germany, the Netherlands and France. The European Commission published a hydrogen strategy in July 2020 setting out a vision for widespread use of hydrogen in meeting Net Zero targets, including a target for 40GW electrolysers by 2030. Member States including Germany, the Netherlands, Norway, Sweden, France, Spain and Portugal have also defined national strategies for hydrogen, with Germany and France displaying the highest ambition for the technology to date.

A new research report by Aurora Energy Research, provides analysis of the overall potential for low carbon hydrogen in Europe, assessing the likely extent of market growth to 2050. Aurora's analysis suggests that hydrogen demand could grow significantly from 327TWh today to up 2,500TWh by 2050.

#### Germany

Germany offers the most attractive market for hydrogen development and has the highest usage of hydrogen across Europe at more than 70TWh. Germany released an ambitious hydrogen strategy with planned incentives for hydrogen production and usage in industry and a focus on renewables-derived hydrogen. Germany also has access to significant capacity for hydrogen storage and is already a cornerstone of the European gas grid. Future growth in green hydrogen production will be facilitated by strong growth in solar and wind capacity in the coming years.

#### Netherlands, UK and Norway

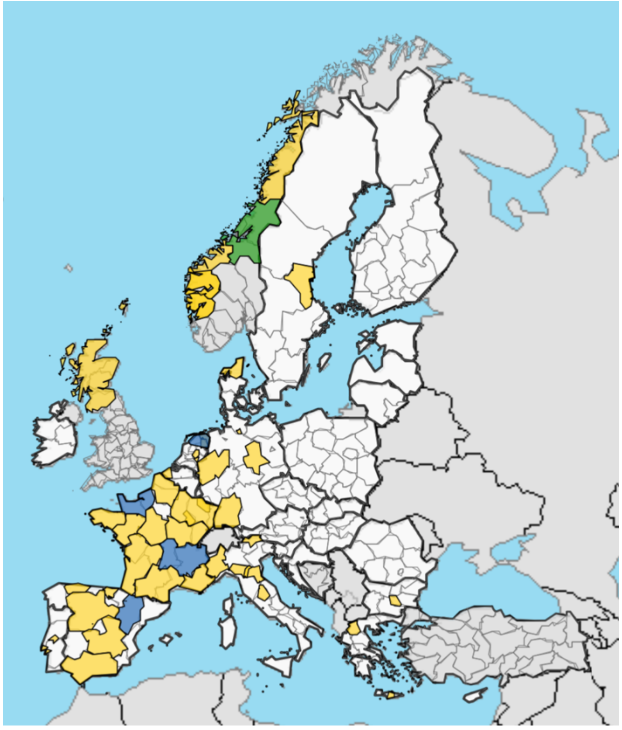
The Netherlands, UK and Norway are identified as strong markets for both green and blue hydrogen – taking a more technology-agnostic stance than Germany or the European Commission on how hydrogen should be produced. All three countries have significant potential for carbon capture and storage (CCS), and a supportive policy environment towards this technology. The UK is yet to define a hydrogen strategy but has already consulted on possible business models and incentive schemes for CCS and hydrogen. Norway is furthest ahead in terms of the adoption of Fuel Cell Electric Vehicles, including Europe's first fleet of hydrogen trucks.

#### France, Portugal and Spain

France, Spain and Portugal look likely to emerge as leaders in green hydrogen production, facilitated by a rapid and extensive rollout of wind and solar generation capacity. Spain´s solar capacity is expected to increase more than five-fold between 2020 and 2040. This is likely to lead to longer periods of low power prices, which improves the economics of hydrogen production through electrolysis by lowering running costs. France is targeting 6.5GWs of electrolysers by 2030, with €7 billion earmarked for green hydrogen projects, and is exploring hydrogen production from nuclear

Iberdrola has launched what will be the largest plant producing green hydrogen for industrial use in Europe. The Puertollano (Ciudad Real) plant will consist of a 100 MW photovoltaic solar plant, a lithium-ion battery system with a storage capacity of 20 MWh and one of the largest electrolytic hydrogen production systems in the world (20 MW). All from 100 % renewable sources. With an investment of 150 million euros, the initiative will create up to 700 jobs and prevent emissions of 39,000 $tCO_2$/year. The green hydrogen produced there will be used Fertiberia's local ammonia plant. It is expected that 17000 TwH from wind and solar energy will be used to produce hydrogen.

### Hydrogen Valleys – the geographic frontrunners in the emerging hydrogen markets



As of today, 89 European regions and cities from 22 countries are taking part in the FCH initiative. Together, they represent approximately one quarter of Europe's population, surface area and GDP. All participating regions and cities are actively working to shape their green energy transitions with hydrogen and fuel cells. Regions and cities can play an important role in creating a future FCH market in Europe by channeling public investments into the sector and supporting the build-up of a European FCH value chain with the potential for local economic growth and job creation. An even larger number of FCH projects are currently under development outside the scope of the study coalition that will considerably drive technology development in Europe.

76 FCH industry players are supporting the initiative, keen to engage in a joint effort with the regions and cities to develop the European FCH market. In the regional and European Public-Private-Partnerships expertise and knowledge are shared.

The Northern Netherlands is the first region to receive a subsidy for its Hydrogen Valley under the name HEAVENN. The Fuel Cells and Hydrogen Joint Undertaking (FCH JU) of the European Commission has granted a subsidy of 20 million euros with a public-private cofinancing of 70 million euros for the development of a fully functioning green hydrogen chain in the region.

Another regional example is the H2 Aberdeen Initiative which is an initiative working towards a hydrogen economy in the Aberdeen city region. The initiative seeks to stimulate innovative hydrogen projects and advance hydrogen technologies in the city. The overall aim is to position Aberdeen as a centre for hydrogen technology by utilising the transferable oil and gas expertise and the exceptional capacity for renewable energy generation in North East Scotland. The Aberdeen Hydrogen Strategy outlines key actions required over a 10-year period to ensure Aberdeen is a world class energy hub leading a low carbon economy and hydrogen technology.

## European hydrogen imports

The integration into the German and other national gas networks offers the possibility of connecting and significantly helping to shape a future international hydrogen market. The pan-European gas market, which is highly developed in international comparison, offers very good conditions for entry into a global hydrogen industry.

By connecting terminals to the North and Baltic Seas, the Mediterranean and international pipeline systems, hydrogen can be imported even from distant producing countries such as Morocco or neighboring countries such as Norway via the existing pipeline network or by ships and land-based logistics. In combination with the emerging storage systems, the imports will support market capacity and flexibility to handle supply and demand fluctuations within the EU.

## European Ecosystems

The European Green Deal, and the focus on implementing clean hydrogen as an energy carrier, is a widespread project stretching across hundreds of different parties working towards the aims of the strategy. With the EU as an active driving force for the energy union and the implementation of hydrogen as a renewable energy source, a number of cooperation platforms have emerged that are important for the development of the hydrogen market.

Some of the most central platforms related to the implementation of hydrogen as a renewable energy source and reaching carbon neutrality in Europe by 2050 include:

| | |
|---|---|
| European Clean Hydrogen Alliance | The European Clean Hydrogen Alliance is the leading group in implementing the EUs clean hydrogen goals. It is a coalition of private companies, public authorities, research organisations, civil society organisations, financial institutions and other organisations. It aims at a deployment of hydrogen technologies by 2030, bringing together renewable and low-carbon hydrogen production, demand in industry, mobility and other sectors, and hydrogen transmission and distribution in order to reach carbon neutrality by 2050. |

| | |
|---|---|
| European Green Hydrogen Acceleration Centre | EIT InnoEnergy, the leading engine for innovation and entrepreneurship in sustainable energy in Europe, has launched the European Green Hydrogen Acceleration Centre (EGHAC), as an effort to support the development of an annual EUR 100 billion green hydrogen economy by 2025 that could create half a million jobs across the green hydrogen value chain. |
| Hydrogen Europe | Hydrogen Europe represents the European industry, national associations and research centers active in the hydrogen and fuel cell sector. It partners with the European Commission in the innovation programme Fuel Cells and Hydrogen Joint Undertaking (FCH JU). The association represents 185 industry members. The goal is to rapidly introduce renewable energy technologies in the European market. |
| Fuel Cells and Hydrogen Joint Undertaking (FCH JU) | FCH JU is working to facilitate the market introduction of Fuel Cells and Hydrogen technologies in Europe and realise their potential in a carbon-clean energy system. This is done by implementing an optimal research and innovation (R&I) programme to develop a portfolio of clean, efficient solutions that exploit the properties of hydrogen as an energy carrier and fuel cells as energy converters, to the point of market readiness. |
| European Hydrogen and Fuel Cells Association | The EHA currently represents 21 national hydrogen and fuel cell organisations and the main European companies active in the hydrogen infrastucture development. Since 2008 EHA is hosting the European Association for Hydrogen, Fuel Cells and Electro-mobility in European Regions, HyER (formerly HyRaMP) representing over 35 regions active in clean electric power and vehicles deployment. |
| Renewable Hydrogen Coalition | Renewable Hydrogen Coalition, comprised of WindEurope and SolarPower Europe, and supported by Breakthrough Energy, the coalition will build a high-level and interdisciplinary network of innovators, entrepreneurs, and corporate leaders from the rapidly growing renewable hydrogen community, including industrial off-takers to reach the EUs goal to produce 10 million tonnes of renewable hydrogen by 2030. |

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