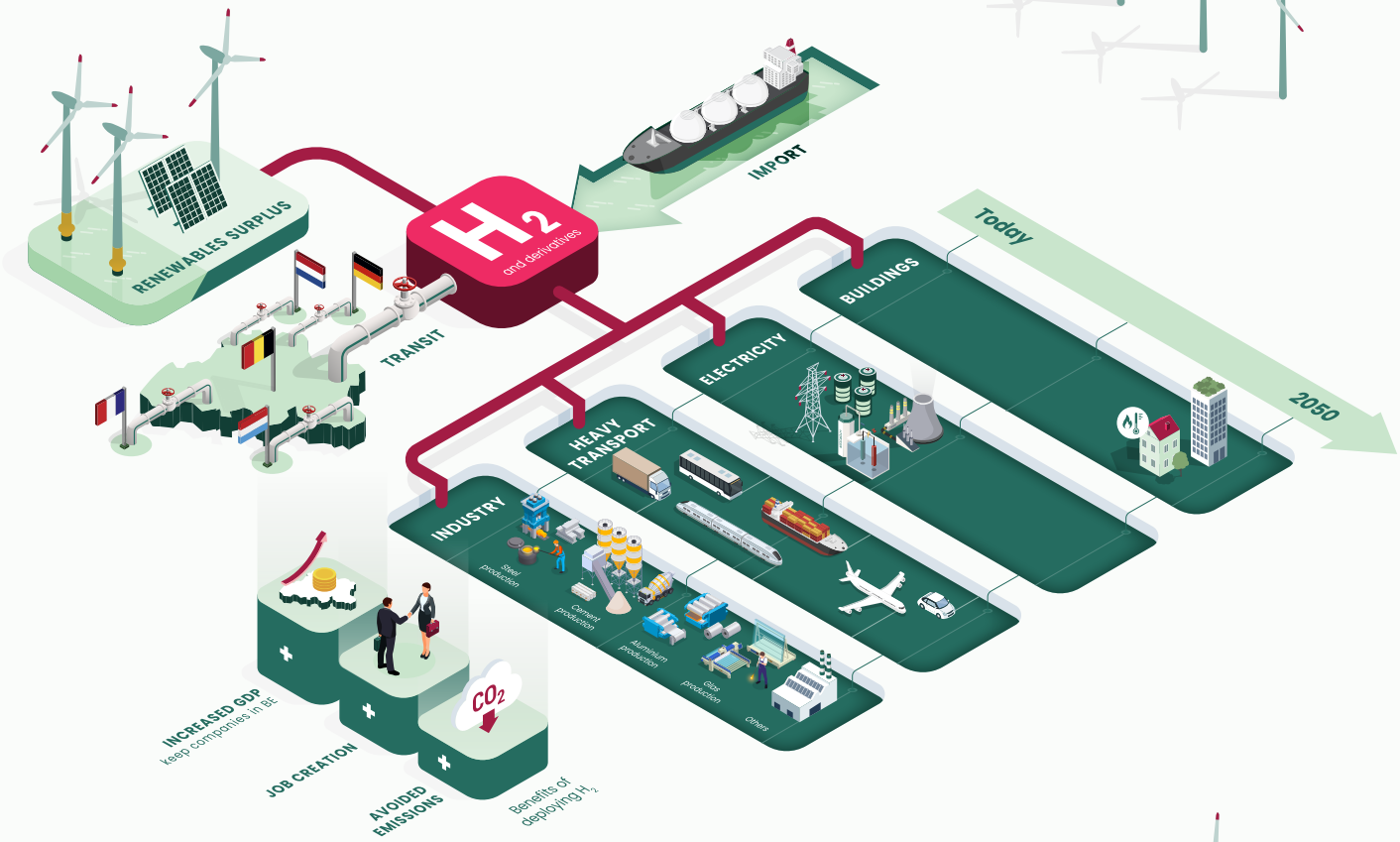
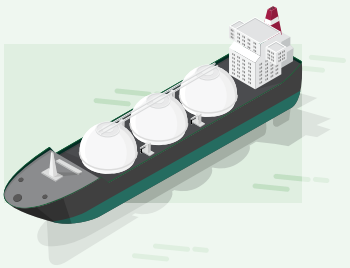


Vision and strategy

Hydrogen

Update October 2022

OCTOBER 2022



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Abbreviations

ATR	Auto Thermal Reforming
CCU	Carbon Capture and Usage
CCU/S	Carbon Capture and Usage or Storage
CCS	Carbon Capture and Storage
CNG	Compressed Natural Gas
CWE	Central Western Europe
GHG	Greenhouse gasses
HNO	Hydrogen Network Operator
IEA	International Energy Agency
LNG	Liquefied Natural Gas
RED	Renewable Energy Directive
SDG	Sustainable Development Goals
SMR	Steam Methane Reforming
LOHC	Liquid Organic Hydrogen Carrier

Executive summary

Climate change is accelerating and urges us to take the necessary measures to preserve our planet. In order to reduce greenhouse gasses by 55% in 2030 and to become the first climate neutral continent by 2050, Europe needs to transition its energy system from fossil fuels to renewable energy.

Much of the energy transition will focus on energy efficiency and electrification. Electrification is the most effective way to harness and consume renewable electricity and should remain the priority where technically feasible and economically realistic. The Belgian energy demand exceeds the local renewable energy production potential. The country will therefore still need to rely on imports and H_2-molecules and H_2-derivatives have to that end an import role to play.

The federal government identifies four sectors that renewable H_2-molecules and H_2-derivatives will help to make climate neutral by 2050: the industry and the heavy transport will drive the initial increase in demand for H_2-molecules and H_2-derivatives. The power sector will follow with its flexibility needs and for coping with longer periods with few wind and sun. The building sector could partially rely on H_2-molecules and/or H_2-derivatives on the longer run. The total domestic demand for both H_2-molecules and H_2-derivatives will raise to 125 – 200 TWh/year in Belgium by 2050 (bunkering fuels included).

Only renewable energy will get a place in the final energy mix before 2050, and as soon as possible. A phased approach is however best suited to ensure both the lowest possible carbon emissions and a level-playing field for hydrogen in the current economic context. Fossil production with lowered GHG emissions (such as SMR and ATR installations coupled with CCS as well as pyrolysis plants) can play a transitional role to kickstart the market but should limit their exposure to the natural gas price and manage their risk of stranded asset if renewables become faster competitive than expected.

The European Union has great ambitions for hydrogen (Hydrogen Strategy, RepowerEU) and assumes that about half of the H_2-demand will be locally produced in Europe by 2030 (about 330 TWh to be produced in Europe). In spite of these ambitions, electrolysis capacity will remain limited in Belgium because of the limited local renewable energy potential. Belgium is fully committed to accelerate the deployment of renewable energy sources in order to rapidly secure sustainable and affordable electricity production (ie offshore wind capacity will almost triple by 2030) but this electricity should in priority be used to decarbonise the electricity supply and to further electrify our energy needs, for instance for road transport and building heating. Developing a minimum electrolysis capacity is nevertheless of strategic importance, both to gain expertise in the exploitation of these units and to support the technological development of Belgian companies.

The federal hydrogen strategy aims to prepare Belgium for the climate challenges, alongside the technological, political and economical challenges of the coming decades. This strategy is based on 4 pillars described here after.

Pillar 1 – Positioning Belgium as an import and transit hub for renewable molecules in Europe

The federal government wants to position Belgium as an import and transit hub for renewable molecules in Western Europe. Belgium has a central position in this region, has important ports in the North Sea and is partly betting on renewable H_2-molecules and H_2-derivatives to become climate neutral. The federal government wants to continue to support its European partners in accessing energy: today with LNG and natural gas, tomorrow with H_2-molecules and H_2-derivatives.

Belgium will import significant quantities of renewable H_2-molecules and H_2-derivatives (20 TWh in 2030 and between 200 and 350 TWh in 2050) to cover its domestic demand as well as the transit activities to neighbouring countries.

The federal government identifies 3 major import routes

- **North Sea route**: the North Sea is one of the major renewable resources for Europe and benefits from favourable wind schemes which allow for the production of renewable hydrogen at a low cost. The synchronized development of offshore electricity and hydrogen networks, coordinated with the other countries surrounding the North Sea, will allow to rapidly harness this energy

- **Southern route**: piped imports from Southern Europe (mainly Iberia) and North Africa is a promising long term solution. It nevertheless requires the development of hydrogen transport networks through Europe and will therefore require more time before being ready. The shipping route may be a temporary solution here.

- **The shipping route** consists in importing H_2-derivatives via ship. It is expected to become the most competitive and thus the preferred solution for supplying H_2-derivatives to Belgium. H_2-derivatives can either be directly used as is or be converted back to H_2-molecules. The reverse conversion to H_2-molecules enables to diversify their supply and for the constitution of strategic stocks that will soon be needed for the security of supply when H_2-molecules gain in importance in the energy mix.

The federal government intends to initiate collaboration with key partners in each of these routes in order to open a new import value chain. Such collaborations have already started with Oman and Namibia. The federal government invests in strategic import and transport infrastructure in order to make this ambition become reality (H_2 transport network and H_2 import facility allowing for the import of H_2-molecules or H_2-derivatives and the injection of gaseous H_2-molecules in the hydrogen transport network).

Pillar 2 – Expanding Belgian leadership in hydrogen technologies

The federal government wants to maintain and strengthen this leading position of Belgium based companies and research institutions active in the technologies of H_2-molecules and H_2-derivatives. The federal government adjusts its available instruments and develops new ones for R&D so that they can contribute as much as possible to the innovation in H_2 technologies (Energy Transition Fund, Clean Hydrogen for Clean Industry, H_2 Import call). It also invests in a test facility for scaling up hydrogen technologies.

Pillar 3 – Establishing a robust hydrogen market

Establishing a robust market for H_2-molecules (and potentially H_2-derivatives) is crucial to make these vectors attractive. The challenge is tackled from multiple angles.

Off-take is where the market starts. The federal government believes that in case any operational support, guarantee or quota would be put in place, it should be focused on supporting the demand for right vector in the right sector, taking the 'energy efficiency first' principle into account. The federal government will investigate together with the Regions and/or the European Commission how a system to unlock the demand for renewable H_2-molecules and H_2-derivatives can be put in place.

A hydrogen transport network is needed to connect supply and demand with each other. The federal government supports the further development of this infrastructure and wants to accelerate its H_2 interconnection with Germany to be operational by 2028. A federal support of up to 395 million euros is therefore foreseen in order to complement private investments.

The emergence of a European market for H_2-molecules makes the European H_2-consumers gain in importance in the international trade and helps them access cheaper molecules. The federal government welcomes the initiatives of the European Commission in this respect (namely on certification and hydrogen market functioning) and is committed to further contribute to their elaboration.

Given the natural monopoly character of hydrogen pipeline networks, the European Commission has proposed to impose similar rules to the transport of hydrogen per pipelines as foreseen for the transport of electricity and natural gas (Hydrogen and decarbonised gas market package). The federal government fully supports this initiative and is committed to contribute to its further elaboration. The European initiative comes however late: the Belgian market is one of the most advanced in the world, with one of the widest hydrogen transport networks. Waiting for the final adoption of the European texts would be detrimental to the fast and efficient development of the Belgian hydrogen market. The federal government is therefore setting in law the minimal provisions necessary on the short term to kickstart the market, knowing that the Hydrogen and decarbonised gas market package will follow.

Confidence in the market must also be built. The federal government works on the development of a certification scheme and of a market platform in order to promote exchange and transparency. A gas quality standard will also be established by the HNO and the CREG following the adoption of the Belgian H_2 law.

Pillar 4 – Investing in cooperation as a key success factor

The federal government will not be able to achieve alone the goals of this strategy: sufficient and effective collaboration at all levels is required in order to make of this strategy a success. Potential areas of cooperation are non-exhaustive. The federal government intends to further continue the collaboration with Regional governments, its European and international partners. Close collaboration with the hydrogen ecosystem is also needed. The federal government is therefore supportive of the initiative of WaterstofNet and ClusterTweed to set-up a Belgian Hydrogen Council to bundle forces to position our Belgian companies abroad and to advise the different governments in Belgium.

A hydrogen perspective

A means for the energy transition

Climate change is accelerating and urges us to take the necessary measures to preserve our planet. In order to reduce greenhouse gasses by 55% in 2030 and to become the first climate neutral continent by 2050, Europe needs to transition its energy system from fossil fuels to renewable energy.

The goal of this transition is to build a sustainable world, in which the society benefits from the resources that the Earth provides without overexploiting them; in which human activities do not cause global warming; in which access to energy is democratized and no longer used as a geopolitical weapon.

Much of the energy transition will focus on energy efficiency and electrification. Electrification is the most effective way to harness and consume renewable electricity. Belgium was one of the first countries in the world to develop offshore wind production and has recently committed itself to almost triple its offshore wind capacity to reach 5,4 - 5,8 GW by 2030 and to look to increase the capacity further to 8 GW.

Electrification is nevertheless not always technically feasible or economically realistic. Some applications require other forms of energy to achieve their duty for multiple reasons, amongst others energy density, weight, reaching high temperatures, chemical reactions, etc.

Also, the Belgian energy demand exceeds the local renewable energy production potential. Elia estimates that the local renewable energy production could at most cover[1] Belgium's electricity needs by 2050 and that the country will therefore still need to rely on energy imports. The relative scarcity of this resource implies that one must use it in the most efficient way in order to minimize its dependency on imports.

H_2-molecules and H_2-derivatives have thus a role to play to complement electrification where best relevant.

1 Elia. (2021) Roadmap to Net Zero

The role of H_2-molecules and H_2-derivatives

Both H_2-molecules and H_2-derivatives will play a role in Belgium's energy transition. While our steel industry will mainly need hydrogen in gaseous form in their new DRI-EAF steelmaking process, chemical processes will still require methane and methanol. Shipping industry can use directly ammonia as a fuel, next to methanol.

The choice of one vector or another will be driven by the available technologies as well as the availability and price of the different molecules. Price aspects will incentivize the direct use of the molecules in their imported form in order to avoid additional conversion losses. The federal government keeps all options open, and considers that **H_2-molecules will be responsible for 30% to 60% of the demand in molecules by 2050 while the remaining 40%-70% will go for other derivatives like e-ammonia, e-methane, e-methanol or e-kerosine.**

Different studies have analysed[2,3] the pace of development of H_2-molecules and H_2-derivaties as energy carriers. The federal government estimates **the total domestic demand for both H_2-molecules and H_2-derivatives between 125 and 200 TWh/year in Belgium by 2050** (bunkering fuels included[4]). This volume will mainly be driven by industry and international transport.

The federal government identifies four sectors that renewable H_2-molecules and H_2-derivatives will help to make climate neutral by 2050, described here after.

2 Deloitte and the FPS Economy, SMEs, Self-Employed and Energy, (2021), "The role of clean gas in a climate neutral Belgium"

3 Boston Consulting Group. (2022). A Five-Step Plan towards Growing the Role of Hydrogen in Belgium's Economy

4 Bunkering fuels are the fuels consumed in international maritime and air transport. Their consumption aren't allocated to a particular country according to international statistics standards given their role in international trade. However, the load of these bunkering fuels in Belgium isn't negligible since they currently represent an annual consumption of about 100 TWh according to Statbel.

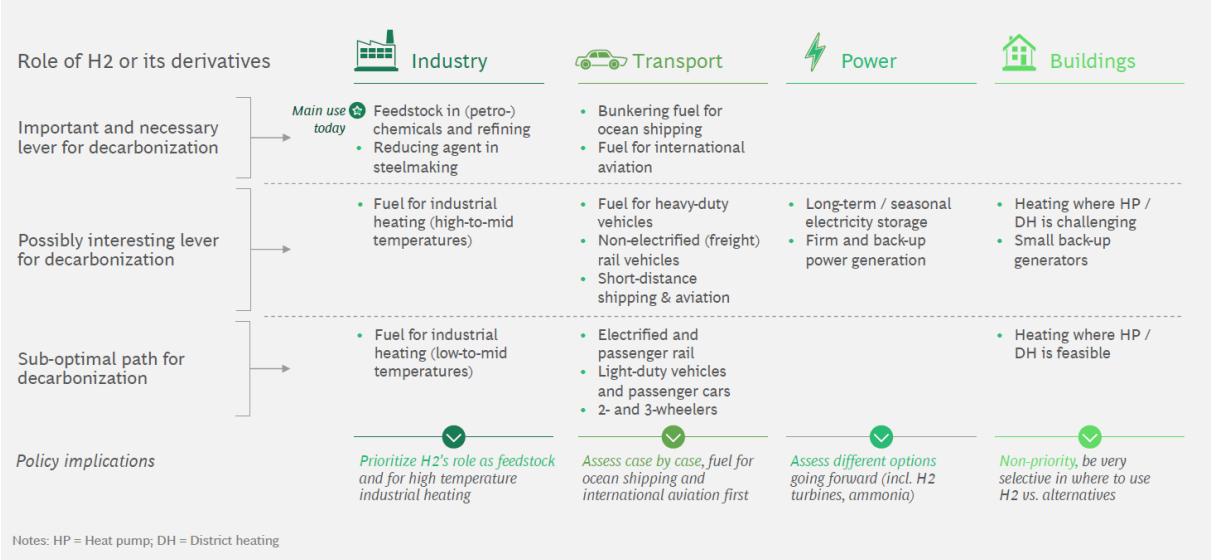

Figure 1. Role of H_2-molecules and H_2-derivatives. Source: Boston Consulting Group. (2022). A Five-Step Plan towards Growing the Role of Hydrogen in Belgium's Economy

Industry

Because of its chemical and physical properties, hydrogen is an important feedstock in different chemical processes such as the production of methanol, aromatics, ammonia or alkenes. By burning hydrogen, very high temperatures can be reached, which justifies its use for instance for the production of steel, cement, aluminium, ceramics or glass. Renewable molecules will also play a role in recycling plastics. Hydrogen and its derivatives are already being used in some of these applications. Demand for renewable molecules in this sector is expected to rise further in the coming years as a sustainable alternative to fossil fuels.[5,6,7]

Transport

The transport sector is still a major consumer of fossil fuels. Electrification is the first priority here. Renewable molecules are only useful when their advantages in terms of charging time, autonomy or weight and volume for energy storage in the vehicle justify the energy losses and higher costs of these molecules.

5 FPS Economy & Deloitte. (2021). The role of clean gas in a climate neutral Belgium

6 FPS Health. (2021). Scenarios for a climate neutral Belgium by 2050

7 VLAIO & Deloitte. (2020). Naar een koolstofcirculaire en CO_2-arme Vlaamse industrie

Aviation currently uses kerosene.[8] Molecules produced by means of renewable hydrogen such as e-kerosene show great promises to make this sector more sustainable as well.

Inland navigation and shipping mainly use diesel and heavy fuel oil.[9] The shipping sector focusses in particular on molecules such as ammonia or methanol, based on renewable hydrogen. Inland navigation will find a balance between the use of electricity and the use of molecules.

Trains mainly use electricity with the exception of a limited number of sections on which diesel trains are still running, in particular for the freight transport.[10] Hydrogen or batteries actually can play a role in these last sections, but this role will remain limited in Belgium. However, there is more potential for the use of hydrogen outside of Belgium.

The transport of goods on the road currently mainly uses fossil fuels.[11] In the future, both battery-electric and hydrogen can complement each other in order to meet the sector's needs. Battery electric drives are more efficient with renewable energy but require expensive, large and heavy batteries. Hydrogen is less efficient but presents benefits with regard to weight and size. The market will find the optimum between the different technologies here as well.

Cars are mainly fuelled with gasoline or diesel. Compressed natural gas (CNG) and electricity are also used, but to a lesser extent. [12]The battery-electric solution will be the most suitable option for passenger cars in the future, as it is feasible and allows direct use of renewable electricity. Battery electric drives are also much more efficient than those based on combustion engines, which further reduces energy requirements and therefore CO_2 emissions. In addition, the batteries of electric vehicles can be used to support the electricity grid by modulating their charging time (vehicle-on-grid) or even by providing flexibility (bi-directional currents, vehicle-to-grid). Such services will limit the need for investments in flexible storage and production infrastructure (i.e. stationary batteries or gas-fired power stations[13]). From this point of view, the use of hydrogen for cars is less efficient than battery-electric vehicles and the federal government therefore doesn't consider this segment to be a priority for the application of hydrogen. However, there will always be a number of exceptions in the future, for example in the case of high-intensity use: the market will find the optimum between these different technologies.

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8 Statbel. (2021). Energy statistics by economic sector From: https://statbel.fgov.be/en/themes/energy/energy-statistics-economic-sector-and-energy-source

9 Statbel. (2021). Energy statistics by economic sector From: https://statbel.fgov.be/en/themes/energy/energy-statistics-economic-sector-and-energy-source

10 Transport & Mobility Leuven. (2020). Elektrificatie van het Belgische spoorwegnet of het gebruik van andere duurzamere vervoerswijzen om dieseltractie te vervangen

11 Statbel. (2021). Energy statistics by economic sector From: https://statbel.fgov.be/en/themes/energy/energy-statistics-economic-sector-and-energy-source

12 Statbel. (2020). Vehicle stock From: https://statbel.fgov.be/en/themes/mobility/traffic/vehicle-stock#figures

13 Elia. (2021). Adequacy and flexibility study for Belgium 2022-2032

Buildings

Currently, buildings are mainly heated with natural gas and oil. Electric heat pumps provide cooling and heat with very high efficiency and can use renewable electricity directly. Heat-networks also provide good opportunities for synergies. However, they can't be installed everywhere and it is clear that some buildings will still use a fuel (such as biogas, hydrogen or e-methane) for heating purposes. The federal government doesn't consider this sector to be a priority for the application of hydrogen.

Flexibility for the electricity grid

Hydrogen and its derivatives have physical properties that make them suitable for storing large quantities of energy for a medium to a long period. This type of service is a support for the electricity grid to counterbalance the variability of supply and demand of renewable energy. The grid has to be able to cope with periods with less wind and solar energy. Hydrogen can be used as a supplement to batteries to store excess capacity and to make it available in times of shortage. The market will determine the optimum between the different storage technologies.

A stepwise approach towards 100% renewable molecules

Several production methods for hydrogen

The H_2-molecule can be produced with various technologies based on different energy sources.

Today, the worldwide production of hydrogen (Belgium included) is largely dominated by steam methane reforming (SMR), a technology that produces hydrogen from fossil methane (natural gas). The concept of this process consists in mixing steam and methane (natural gas) to produce hydrogen and CO_2. This is currently the cheapest method, but it isn't sustainable and produces a lot of CO_2.

Apart from SMR, hydrogen can be produced from natural gas through auto-thermal reforming (ATR) or pyrolysis. Pyrolysis has the advantage of producing carbon in solid form, thereby not releasing any CO_2 in the atmosphere. In the case of SMR or ATR, CO_2 emissions can be reduced by using CCS, even though CCS never allows to capture 100% of the CO_2 produced.

Hydrogen can also be produced with renewable energy sources, namely renewable electricity, biogas or biomethane.

Electricity can turn water into hydrogen and oxygen with the electrolysis process. The climate impact of the H_2-molecules produced in this way is highly dependent on the electricity source. This hydrogen can thus only be considered as renewable when renewable electricity is used.

Biomethane has the same chemical composition as natural gas but is produced from renewable energy sources. As is the case with natural gas, biomethane can be used in SMR, ATR or pyrolysis installations. The climate impact of this hydrogen can be positive when produced via pyrolysis or via an SMR or ATR plant coupled with carbon capture and storage (CCS) as the lifecycle GHG emissions can be negative.

Residual hydrogen from industrial processes of which the production of hydrogen is a by-product also offers interesting opportunities while minimizing waste and unused products in a circular approach.

Evolving towards 100% renewable hydrogen

© Otary

In order to achieve climate neutrality, the use of H_2-molecules and H_2-derivatives only makes sense in the long term if hydrogen is produced from renewable energy sources. **Only renewable hydrogen will get a place in the final energy mix before 2050, and as soon as possible.**

The hydrogen market nevertheless faces two major challenges: volume increase and climate neutrality. Giving the priority to the climate neutrality of the H_2 production (existing and to be developed) would slow down the pace of development of the sector, and thus the development speed of decarbonised solutions for the industry, the transport sector and the other H_2-applications.

A phased approach is best suited to ensure both the lowest possible carbon emissions and a level-playing field for hydrogen in the current economic context. Fossil production with lowered GHG emissions (such as SMR and ATR installations coupled with CCS as well as pyrolysis plants) can therefore play a transitional role to kickstart the market. Within the current energy context, renewable H_2-molecules and H_2-derivatives are becoming faster competitive, even before 2030 under certain gas price scenarios.14. Transitional production means should limit their exposure to the natural gas price and manage their risk of stranded asset through appropriate depreciation period in order to remain competitive.

As far as biomethane is concerned this resource could be leveraged in the future to secure local renewable H_2 production, for instance with existing ATR and SMR assets that are

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14 Boston Consulting Group. (2022). A Five-Step Plan towards Growing the Role of Hydrogen in Belgium's Economy

currently running on fossil natural gas. It is however worth mentioning that biogas production potential (containing 50-60% of biomethane) remains limited in Belgium to about 15 TWhHHV/year as reported by ValBiom[15]. This resource is also highly appreciated by current natural gas applications that are looking at it as a logical transition pathway to renewable energies.

15 ValBiom. (2019). Quelle place pour le biométhane injectable en Belgique?

A limited role for electrolysis capacity in Belgium

The European Union has great ambitions for hydrogen. It already announced in its hydrogen strategy the ambition to production 1 million tonnes of H_2-molecules (6 GW electrolysis) by 2024 and to reach 40 GW electrolysis by 2030. Since then, the Union raised its ambitions to 10 million tonnes[16] of domestic production of H_2-molecules by 2030 with its RepowerEU plan.

In spite of these ambitions, **electrolysis capacity will remain limited in Belgium because of the limited local renewable energy potential.** Belgium is fully committed to accelerate the deployment of renewable energy sources in order to rapidly secure sustainable and affordable electricity production. The offshore wind capacity in the North Sea will for instance almost triple by 2030. This electricity should in priority be used to decarbonise the electricity production and to further electrify our energy needs. The import of renewable molecules supplementing the local renewable energy production is a crucial link in our energy policy.

Developing a minimum electrolysis capacity is of strategic importance, both to gain expertise in the exploitation of these units and to support the technological development of Belgian companies. **Belgium has therefore set itself the target within the national Recovery and Resilience plan of having at least 150 MW of electrolysis capacity into operation by 2026.**

16 10 million tonnes of H_2 is equivalent to ~335 TWh

Supporting the Sustainable Development Goals (SDGs)

Apart from facilitating a complete energy transition to renewable energy sources, the rollout of hydrogen technologies also offers the opportunity to review the production and the consumption methods, to reorient the economy to sustainable and future-oriented sectors and to change the interactions between the energy sector and its environment.

In this respect, hydrogen must contribute to the realisation of the Sustainable Development Goals (SDGs) defined by the United Nations. Belgium identifies eight SDGs that H_2-molecules and H_2-derivatives can help realise, namely SDGs 6, 7, 8, 9, 12, 13, 16 and 17. It supposes the use of the life cycle approach. In producing, transporting, storing and using hydrogen, the impact on human rights, socioeconomic effects, and short- and long-term consequences for the climate, the environment and the biodiversity (including the challenges regarding critical raw materials) will be taken into account.

6.1 By 2030, achieve universal and equitable access to safe and affordable drinking water for all

6.5 By 2030, implement integrated water resources management at all levels, including through transboundary cooperation as appropriate

7.1 By 2030, ensure universal access to affordable, reliable and modern energy services

7.2 By 2030, increase substantially the share of renewable energy in the global energy mix

7.A By 2030, enhance international cooperation to facilitate access to clean energy research and technology, including renewable energy, energy efficiency and advanced and cleaner fossil-fuel technology, and promote investment in energy infrastructure and clean energy technology

8.2 Achieve higher levels of economic productivity through diversification, techno-logical upgrading and innovation, including through a focus on high-value added and labour-intensive sectors

8.4 Improve progressively, through 2030, global resource efficiency in consumption and production and endeavour to decouple economic growth from environmental degradation, in accordance with the 10-Year Framework of Programmes on Sustainable Consumption and Production, with developed countries taking the lead

9.1 Develop quality, reliable, sustainable and resilient infrastructure, including regional and transborder infrastructure, to support economic development and human well-being, with a focus on affordable and equitable access for all

9.4 By 2030, upgrade infrastructure and retrofit industries to make them sustainable, with increased resource-use efficiency and greater adoption of clean and environmentally sound technologies and industrial processes, with all countries taking action in accordance with their respective capabilities

12.2 By 2030, achieve the sustainable management and efficient use of natur al resources

13.1 Strengthen resilience and adaptive capacity to climate-related hazards and natural disasters in all countries

16.5 Substantially reduce corruption and bribery in all their forms

16.7 Ensure responsive, inclusive, participatory and representative decision-making at all levels

17.6 Enhance North-South, South-South and triangular regional and international cooperation on and access to science, technology and innovation and enhance knowledge sharing on mutually agreed terms, including through improved coordination among existing mechanisms, in particular at the United Nations level, and through a global technology facilitation mechanism

17.7 Promote the development, transfer, dissemination and diffusion of environmentally sound technologies to developing countries on favourable terms, including on concessional and preferential terms, as mutually agreed

Figure 2. Sustainable development goals (SDGs) that the rollout of H_2 can facilitate

Strategy

Pillar 1 – Positioning Belgium as an import and transit hub for renewable molecules in Europe

Import routes

Improving the efficiency of our energy uses as well as maximizing the renewable energy production will enable Belgium to reduce its dependency towards energy imports[17]. As the local renewable energy potential remains limited and insufficient to cover all our energy needs, Belgium will remain dependent on energy imports in various forms from abroad.

H_2-molecles and H_2-derivatives present the major advantage of being transportable over longer distances and at a low cost. They thereby open the door to trade with more remote regions, which gives access to more abundant renewable resources and favours competition between producers in order to push the prices down. The IEA concluded in its Hydrogen Report (2019)[18] that the costs of producing renewable H_2-molecules are mostly driven by the access to cheap renewable electricity.

17 Today, most of our primary energy consumption is covered by oil products imported from abroad

18 IEA. (2019). The Future of Hydrogen : seizing today's opportunities. Available at https://www.iea.org/reports/the-future-of-hydrogen

Belgium will import significant quantities of renewable H_2-molecules and H_2-derivatives (20 TWh in 2030 and between 200 and 350 TWh in 2050) to cover its domestic demand as well as the transit activities to neighbouring countries (see here after the ambition to become a gateway for renewable molecules to Europe)19.

As history shows, diversification of imports is key in order to reduce a country's dependency and to avoid the development of inadequate power positions that threaten our security of supply. The federal government identifies 3 major import routes for renewable H_2-molecules and H_2-derivatives which are described here after.

The opening of these routes requires an initial close collaboration with relevant governments and stakeholders. **The federal government intends to initiate such collaboration with key partners in each of these routes in order to open a new import value chain.** Historical relations, common vision and targets as well as interest of Belgian based companies are all put forward in the identification of our partners. The various options in geopolitically stable areas are explored. Memoranda of Understanding (MoUs) have already been signed with some key partners and new ones could be concluded in the future when relevant to set the collaboration further. In the conclusion of such MoU, a particular attention is paid to the integration of the relevant Sustainable Development Goals of the United Nations (see earlier in this note) as well as to the geopolitical aspects. MoUs are also an opportunity to deepen the collaboration in implementing the energy transition and achieving the climate targets of both partners.

The positioning of Belgium as import hub for renewable molecules is also performed via its international promotion by Belgium based companies, eg by exchanging with companies from exporting countries and identifying together potential collaboration fields. The new initiative for a Belgian Hydrogen Council can therefore count on the support of the Federal Government to put Belgium on the map and to become the gateway for renewable molecules in Europe.

The key import tracks Belgium wishes to focus on are described below, without of course excluding other pathways or collaborations.

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19 These figures come from the following studies:

- *Deloitte & FPS Economy, SMEs, Self-Employed and Energy, (2021), Le rôle des vecteurs énergétiques gazeux dans une Belgique neutre climatiquement*
- *Boston Consulting Group. (2022). A Five-Step Plan towards Growing the Role of Hydrogen in Belgium's Economy*
- *FPS Public Health, Food Chain Safety and Environment, (2021), Scenarios for a climate neutral Belgium by 2050*
- *Historical data on international bunker fuels since Statbel, (2021), statistics on energy consumption*

North Sea route (pipeline)

The North Sea is one of the major renewable resources located close to Belgium. It benefits from favourable wind schemes which allow for the production of renewable hydrogen at a low cost (high load factor).

Cooperation between the countries surrounding the North Sea has rapidly become of key importance in order to best coordinate the development of offshore wind energy while ensuring an efficient planning of electrical networks, maritime routes, natural reserves, etc. Several forums are used to that end, ao the North Sea Energy Cooperation (NSEC) and ENTSO-e.

The coupling between offshore wind and H_2 production in the North Sea or at its coast lines raises in importance. In the Esbjerg declaration (May 2022) Belgium, Denmark, Germany and The Netherlands committed themselves to develop 65 GW of offshore wind, 20 GW of renewable hydrogen in the North Sea by 2030 and 150 GW of offshore wind by 2050. In September 2022, the nine NSEC-countries have also announced a target of 260 GW of offshore wind capacity by 2050. The North Sea is about to become a huge Green Power Plant, next to Europe.

Harnessing this energy requires reliable and interconnected networks. While until recently most eyes were on offshore electrical networks, an offshore hydrogen network appears to be a complementary and realistic solution. Interconnected pipelines could feed Europe with renewable hydrogen.

The federal government is committed to accessing renewable hydrogen from the North Sea or producing hydrogen from additional renewable electricity from the North Sea at its shores. It has therefore launched a study to investigate how the development of both electricity and hydrogen networks can complement each other in the North Sea.

Specific attention will go towards the United Kingdom and Norway, where Belgium has already its gas interconnectors respectively Interconnector and Zeepipe. The Hydrogen Network Operator (HNO, to be appointed after the adoption of the regulatory framework mentioned in pillar 3) will be asked to investigate the future use of these pipes together with the natural gas TSO as well as the construction of new interconnectors.

The North Sea has the possibility of delivering hydrogen from 2030 onwards without having further production losses and conversion costs for producing derivatives and for cracking them back into hydrogen.

Southern route (pipeline)

For sourcing H_2-molecules, imports by pipeline from nearby regions from the South (mainly Iberia and North-Africa) are expected to rapidly become competitive: the abundance of renewables may compensate the longer distance to be travelled (compared to the North Sea).

Such import nevertheless requires a wide pipeline network. The opening of this route is dependent on the development of hydrogen transport networks in the Iberia peninsula and through France. The European Hydrogen Backbone initiative foresees a pipeline connection between the North of Spain and Belgium already by 2030, passing through France and Germany before arriving to Belgium via Liège[20]. Most of the Iberian volumes will most probably be consumed on their way and there is little chance that any of these reach Belgian soil by 2030. The European Hydrogen Backbone forecasts additional pipelines and interconnections through Portugal, Spain and France by 2040, making it a more realistic horizon for piped imports from the South.

The Southern route is a promising long term solution for importing H_2-molecules to Belgium but will require time before being ready. The federal government supports European initiatives making it become reality. The Shipping Route can be used for these regions until the necessary H_2 network is in place.

Shipping route

Other regions, hardly linkable by pipeline to Belgium, often show even greater potential for producing H_2-molecules at a low cost. The abundance of solar, wind and/or hydropower resources enables them to reach high utilization rates of the production infrastructure, driving the costs down. This is for instance the case of some locations in the Middle East, Africa, or the America's.

The longer distance implies that the only realistic solution for importing energy from these locations is to convert it into H_2-derivatives. These molecules are then shipped, benefitting from highly mature and proven technologies.

Once arrived in Belgium, H_2-derivatives can either be directly used as is or be converted back to hydrogen (and injected in the hydrogen transport network if needed).

The direct use of H_2-derivatives skips one conversion process, making it cheaper than the reverse conversion to H_2-molecules. The shipping route is expected to become the most competitive and thus the preferred solution for supplying H_2-derivatives to Belgium.

As far as the reverse conversion of H_2-derivatives to H_2-molecules is concerned, the latter is expected to remain more expensive than the North Sea and Southern routes unless there is

20 https://ehb.eu/

a major technological breakthrough. It has however the advantage of diversifying the supply and being able to complement the North Sea and Southern routes when their production capacities are not sufficient. This import chain also enables for the constitution of strategic stocks that will soon be needed for the security of supply when H_2-molecules gain in importance in the energy mix.

The federal government is committed to facilitating the opening of the shipping route. It has therefore concluded MoUs with Oman and Namibia and is launching a call for project for the demonstration of technologies allowing for the import of H_2-molecules or H_2-derivatives and the injection of gaseous H_2-molecules in the hydrogen transport network (see pillar 2).

Hydrogen gateway to Europe

The need for energy imports is not unique to Belgium. The Wuppertal Institute[21] estimates that Belgium, the Netherlands, Germany and Northern France do not have enough renewable resources to cover their own energy demands.

The federal government wants to position Belgium as an import and transit hub for renewable molecules in Western Europe. The country has a central position in this region, has important ports in the North Sea and is partly betting on renewable H_2-molecules and H_2-derivatives to become climate neutral. In a similar way as Belgium today transits natural gas from Norway, the UK or LNG ships to its neighbouring countries, the federal government wants to continue to support its European partners through and beyond the energy transition by helping them to get access to the energy vectors of the future.

It is estimated that this transit activity could double the volumes of imports forecasted for Belgian domestic consumption, totalling to an amount of 20 TWh in 2030 and 200 to 350 TWh in 2050 of imports of renewable molecules, for which about half is available for transit to our neighbouring countries.

This new transit activity represents a great opportunity for the further interconnection of our hydrogen transport network. This will support the emergence of a common, liquid and competitive market in CWE for H_2-molecules (and potentially also for H_2-derivatives) which will increase the negotiating strength of European consumers with respect to producers, in the benefit of the competitiveness of our industrial players.

The federal government invests in strategic import and transport infrastructure in order to make this ambition become reality. On top of the investments in the Belgian hydrogen transport network (see pillar 3), a call for projects on H_2 import infrastructure will be launched by the end of 2022 to support the development of facilities allowing for the import of H_2-molecules or H_2-derivatives and the injection of gaseous H_2-molecules in the hydrogen transport network (H_2 Import Call, see pillar 2).

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21 Quoted in Hydrogen Import Coalition. (2021). Shipping sun and wind to Belgium is key in climate neutral economy

Strategic storage

Strategic storage will soon become of crucial importance when H_2-molecules and H_2-derivatives gain in importance in the total energy mix.

H_2-derivatives such as ammonia or methanol can easily be stored. Technologies also exist for their reverse conversion to H_2-molecules. Despite a moderate system efficiency, this process allows for constituting strategic stocks enhancing the country's security of supply.

Large-scale storage of gaseous H_2-molecules is also an option, in a similar way as performed today for natural gas. The Belgian subsurface however offers limited opportunities for the storage of H_2-molecules. A European approach will be needed to ensure sufficient gaseous storage capacities.

Pillar 2 – Expanding Belgian leadership in hydrogen technologies

Many Belgian companies and institutes are already active in the hydrogen value chain, whether in the development of production and consumption technologies, in their integration into more complex solutions or in their exploitation supporting the company's core business. This abundance of players is illustrated in Figure 32 on the basis of the location of the head offices in Belgium of companies who are member of WaterstofNet and/or H_2 Hub Wallonia.

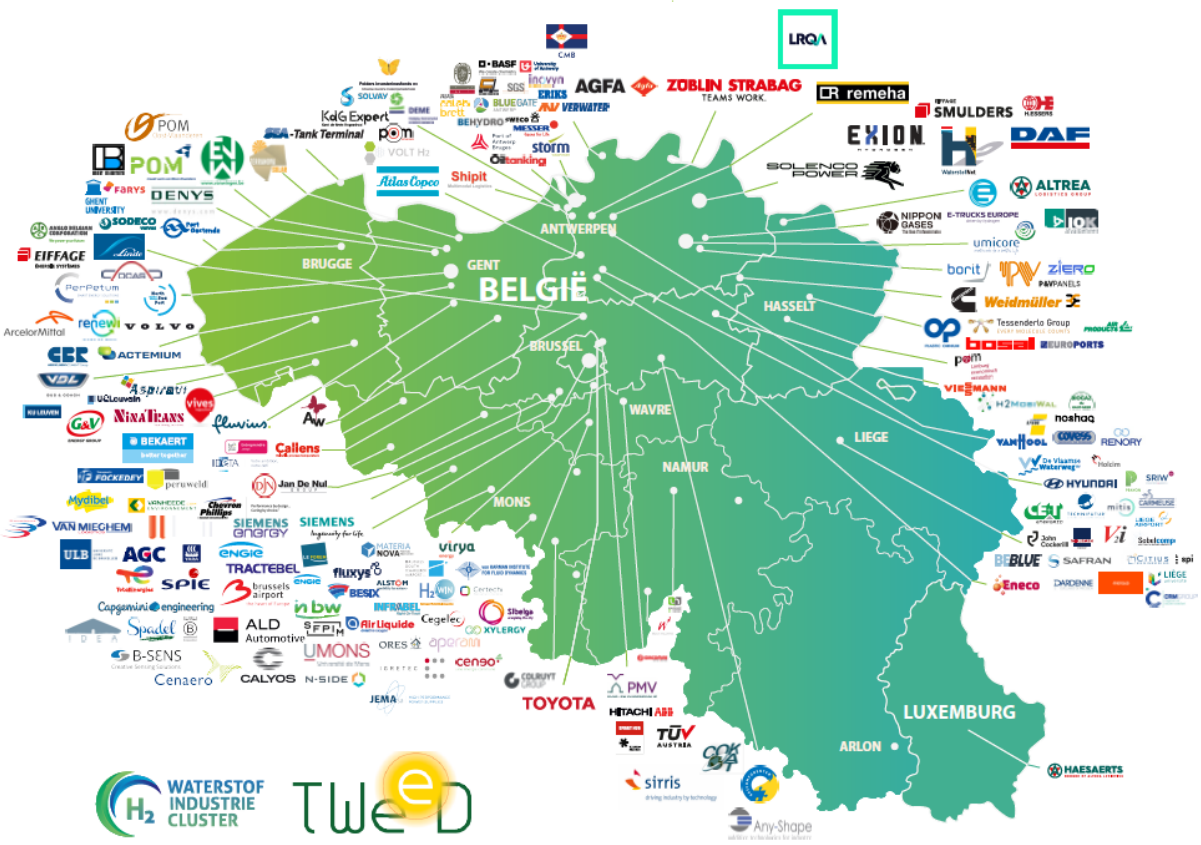


Figure 3. Map illustrating the locations of the head offices in Belgium of companies active in the hydrogen value chain and which are members of Waterstof Industrie Cluster and/or H_2 Hub Wallonia. Source: Waterstof Industrie Cluster and Cluster TWEED. Update 04/10/2022

These companies operate at all levels along the entire hydrogen industry value chain, as shown in Figure 4.

Figure 4. Companies active in the hydrogen value chain in Belgium and which are members of Waterstof Industrie Cluster and/or H_2 Hub Wallonia. Source: Waterstof Industrie Cluster and Cluster TWEED. Update 04/10/2022

Belgium wants to strengthen this leading position of Belgium based companies and research institutions active in the technologies of H_2-molecules and H_2-derivatives.

The federal government adjusts its available instruments and develops new ones for R&D so that they can contribute as much as possible to the innovation in H_2 technologies:

- The **Energy Transition Fund** supports, among other things, research and development on the production, transport and storage of hydrogen and its derivatives. It has been active since 2017, will operate until 2025 and subsidises various projects following an annual call for projects for a total amount of 20 to 30 million euros per year.

- The call for projects **Clean Hydrogen for Clean Industry** is organized within the framework of Belgium's national recovery and resilience plan. It focusses on the development of promising technologies for the production and use of hydrogen and its derivatives with a relatively high maturity level. In this way, the federal government aims to stimulate investments that will enable a faster scaling of commercial applications. A first call was launched in April 2022 for a total support of maximum 50 million euros. A second one will be launched in 2023 for a total support of 10 million euros.

- The **H_2 Import Call** focuses on the development and demonstration of technologies that enable the import of hydrogen (in any form whatsoever, H_2-derivatives included) and its injection on a hydrogen transport network. This call will be launched in early 2023, with an envelope of 10 million euros.

The federal government also supports the development of the VKHyLab, a test infrastructure which will help research institutes and companies to scale up their H_2 technologies. The government invests 1.5 million euros in the acquisition of the site and subsidies the Von Karman Institute of fluid dynamics with an additional 14.7 million euros to develop this project. This test facility will be operational by 2025.

Innovative activities can also be supported through the adaptation of the taxes, excises or surcharges. Given the importance of developing the first electrolysis capacities in Belgium to enable companies and research institutions to develop their experience in this field, the electrolysis activity is exempted from excises on electricity[22].

22 The recent energy norm implies a replacement of the various surcharges by a single excise duty on electricity. Electricity used for the production of hydrogen by electrolysis is exempted from the excise duty on electricity, see circular 2020/C/27 on energy products and electricity, title XII.3.2

Pillar 3 – Establishing a robust hydrogen market

Establishing a robust market for H_2-molecules (and potentially H_2-derivatives) is crucial to make these vectors attractive to the applications that could rely on them for their transition to renewable energies. The creation of such a market requires to tackle the problem from several angles, described here after.

Unlock the demand

There is no market without a demand and even though many actors are getting interested in H_2-molecules and H_2-derivatives to make their activities climate neutral, most of the volumes still need to materialize. Off-take is where the market starts. One of the barriers for this off-take to materialize is the uncertainties of the price levels.

The federal government believes that in case any operational support, guarantee or quota would be put in place, it should be focused on supporting the demand for the right vector in the right sector, taking the 'energy efficiency first' principle into account. These discussion are currently ongoing within the Fit for 55 package (Renewable Energy Directive, RefuelEU Aviation Regulation, FuelEU Maritime Regulation).

Given its limited competences on that matter, the federal government will investigate together with the Regions and/or the European Commission how it can help to put in place a system to unlock the demand for renewable H_2-molecules and H_2-derivatives.

Connect market actors with each other

By essence, a market is a place where people, companies and/or institutions can exchange goods and/or services. The question is then: how can we physically exchange H_2-molecules?

For the expected Belgian hydrogen demand, pipeline transport is the most efficient and secure solution. It requires significant initial investments, but the operational costs are very low compared to the transported volumes[23] and the repurposing of existing natural gas pipelines can help reduce the initial CAPEX. A pipeline network also benefits from the "network effect": the ability to trade with all actors connected to the same network, itself increased by the number of connected actors.

A hydrogen transport network is already present on the Belgian territory. It has been developed by a private player to supply various industrial customers spread across Belgium, France and the Netherlands. In Belgium, it connects the regions of Zeebrugge, Ghent, Antwerp and Charleroi as illustrated in light blue on Figure 5.

Many industrial clusters are further away from this infrastructure. **The federal government wishes to pursue the development of a hydrogen transport network**[24] to be exploited under non-discriminatory third-party access conditions (see here after the draft regulation detailed under "Avoid discrimination").

23 Joint Research Center. (2021). Assessment of hydrogen delivery options. Science for policy briefs. Available at https://ec.europa.eu/jrc/sites/default/files/jrc124206_assessment_of_hydrogen_delivery_options.pdf

24 By « hydrogen transport network » is understood a pipeline network dedicated to the transport of H_2-molecules of a high quality grade. The blending of H_2-molecules in the natural gas network is not targeted here, and not considered as a viable long term solution as it does not enable for a complete transition to renewable energies and given the risk of lock-in effect with fossil fuel technologies.

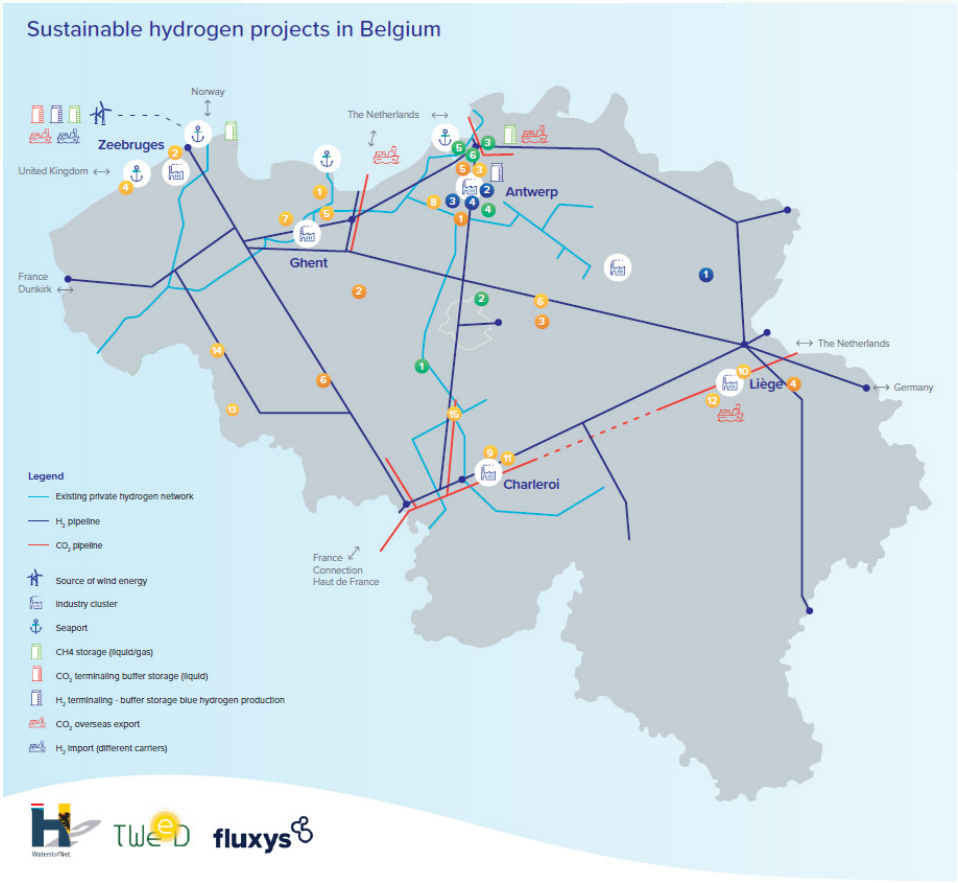


Figure 5. Map showing the geographical distribution of hydrogen projects in Belgium and the current and future infrastructure of hydrogen pipes. Source: WaterstofNet, Cluster TWEED and Fluxys

A first phase will be started with the commissioning of minimum 100 to 160 km pipelines by 2026, supported by a budget of 95 million € from Belgium's national recovery and resilience plan. The commissioning of these infrastructures will follow the market demand and will be in line with our ambitions. Installing new pipes is expensive and has a significant impact on nature, agriculture and citizens. Maximum advantage will be taken of existing pipelines dedicated to the transport of other molecules and that are no longer used, such as the natural gas pipelines that were utilized up to now for the transport of low-calorific gas and that will be shut down as a result of the complete conversion of Belgian consumers to high-calorific gas.

Belgium has the ambition to have its hydrogen transport network interconnected with at least Germany, France and the Netherlands by 2028 in order to support its international positioning as an import and transit hub for renewable energy in Europe (see pillar 1). The federal government has foreseen an envelope of 300 million € in order to accelerate the interconnection with Germany to be operational by 2028.

The federal government wants to ensure the optimal planning of the energy transport infrastructures in order to minimize the total cost for the society. The different networks influence each other as unused natural gas pipes can be used to transport hydrogen. An integrated planning of electricity and hydrogen networks can furthermore deliver interesting synergies as these two energy vectors will interact with each other. Such

synergies include for instance the optimisation of the locations of electrolysers and electric and hydrogen charging stations for heavy transport, and taking advantage in the most efficient way of all the existing infrastructures for energy transport over the Belgian territory. The federal government is setting up a structural consultation between Belgian transmission system operators to that end.

Safety keeps a central role in the installation, the commissioning, the operation and the maintenance of the hydrogen transport infrastructures, as already required by the legal framework in place for the transport of gaseous products by pipeline.

Promote the emergence of a European market

The emergence of a European market for H_2-molecules makes the European H_2-consumers gain in importance in the international H_2-trade and helps them access cheaper molecules. It also connects producers and consumers with each other, making it easier to buy and sell molecules. A European-wide market is beneficial to both producers and consumers and contributes to the deployment of these technologies for the energy transition.

The federal government identify two action points to facilitate the emergence of a continent-wide market:

- Interconnecting our hydrogen transport network with our neighbouring countries is crucial to effectively build a European market on field. Exchanging molecules is at the heart of an H_2-market, so is the hydrogen transport network. As described above, Belgium is already interconnected with France and the Netherlands. **The federal government has the ambition to interconnect its hydrogen transport network with Germany by 2028 and has foreseen an envelope of 300 million € to that end.**

- Common market rules makes everybody speak the same language and makes the market coupling easier. The federal government welcomes the initiatives of the European Commission with respect to the hydrogen market functioning (Hydrogen and decarbonized gas market package) and its certification (Delegated Acts of the RED II), and is committed to further contribute to their elaboration.

Avoid discrimination

Activities are called “natural monopolies” when the size of the activity is itself a competitive advantage and when the CAPEX investments are such that no competitor is willing to enter the market. Such activity leads over time to a monopolistic situation, no matter if there is a regulation or not.

When natural monopoly occur, the State must adopt market rules which prevent any discrimination among market actors. The monopolistic actor could otherwise take advantage of his unique position on the market to eliminate or disadvantage the competition in other activities.

In a similar way as electricity and natural gas networks, hydrogen networks are natural monopolies: the CAPEX is high (usually depreciated over 20+ years) and the size of the network is a strong competitive advantage (the wider the network, the more customers/ suppliers you can trade with). The European Commission is fully aware of this problematic and has therefore proposed a revision of the gas directive and regulation in order to impose similar rules to the transport of hydrogen per pipelines as foreseen for the transport of electricity and natural gas (cf. hydrogen and decarbonised gas market package). Central aspects of the proposed texts are unbundling of the network operator and non-discriminatory third-party access to the hydrogen networks.

The federal government fully supports this initiative of the European Commission and is committed to contribute to its further elaboration. The European initiative comes however too slow: the Belgian market is one of the most advanced in the world, with one of the widest hydrogen transport networks. Waiting for the final adoption of the European texts before transposing these concepts into national law would be detrimental to the fast and efficient development of the Belgian hydrogen market.

The federal government is therefore committed to setting in law provisions related to the unbundling of the hydrogen transport network operator, non-discriminatory third-party access to the hydrogen transport networks, network tariffs regulated by the CREG, etc. Adraft law will be introduced in parliament by end 2022, duly taking into account the feedbacks of the market actors that were collected during the public consultation organized in January 2022. This draft law will be limited to the provisions necessary on the short term to kickstart the market, knowing that the Hydrogen and decarbonised gas market package will follow.

Promote exchange and transparency

Confidence is crucial. Without confidence a market cannot attract large volumes as producers must be ensured to get paid and consumers must be ensured to receive their products. Confidence is also about traceability and transparency in order to guarantee the quality of the product, its origin and its climate impact.

Confidence can be built. In the case of the H_2-market, it requires at least the three following points:

- **Certification scheme.** The European Union is developing standards for defining renewable H_2-molecules (see Delegated acts of the RED II). The traceability and certification of H_2-molecules and H_2-derivatives can be particularly complex due to the multiple potential conversion processes. The federal government is supporting Hinicio in the development of a European voluntary certification scheme and a register for H_2-molecules and H_2-derivatives via the Energy Transition Fund. A pilot phase in Belgium is foreseen within this project. In a second phase, this work could also be extended to low-carbon molecules.

- **Market platform.** The federal government is considering to develop a specific market platform for H_2-molecules and H_2-derivatives. Collaboration with existing platforms to define a "Belgian hub" in it could also fulfil the target of facilitating the exchange of H_2-molecules (and potentially H_2-derivatives) on our territory.

- **Gas quality.** The draft regulation (see "Avoid discrimination") foresees the elaboration of a gas quality standard to be developed by the Hydrogen network operator, under control of the CREG.

Pillar 4 – Investing in cooperation as a key success factor

This strategy is focused on the development of a complete new H_2 value chain supporting our energy transition. The first three pillars have highlighted the specific ambitions and approach of the federal government in this respect. **The federal government will nevertheless not be able to achieve these goals alone: sufficient and effective collaboration at all levels will have to be implemented to ensure the success of this strategy.**

This fourth pillar comes supporting the three others: while specific measures are put in place at federal level to see these ambitions become reality, the contribution of all interested parties shall be leveraged. The challenge is simply too big and collaboration is key. Main areas where the federal government want to cooperate are listed hereafter (non-exhaustive).

Regional governments

Within Belgium, the hydrogen competencies are split between federal and regional levels. The fast and efficient development of an H_2 value chain is not limited to one field of competence but requires synchronization and alignment in the different measures taken. The federal government is committed to pursuing a constructive collaboration with regional governments, ao via the existing ENOVER/CONCERE consultation.

The hydrogen ecosystem

Companies, research institutions and universities active in hydrogen solutions and services are all at the heart of the H_2 market development. Environmental organizations also contribute to shape this ecosystem. The participation of all these actors to implement this strategy is crucial, ao by developing concrete projects, initiating partnerships or supporting the research and technological developments. Regular feedbacks from these players to policy makers is key to best tackle the challenges and barriers that markets actors face on field.

The federal government promotes the collaboration with all hydrogen players and encourages them to get in touch whenever needed. The government the initiative of Cluster Tweed and WaterstofNet to build a Belgian Hydrogen Council that will help promote Belgium and its companies on the international scene and to make the link between policy makers and the hydrogen ecosystem.

European partners

This strategy strongly builds on European collaboration, whether it goes on interconnecting our hydrogen transport networks, coordinating the development of hydrogen production onshore and offshore, developing common market rules and certification standards to facilitate market coupling, developing together a first H_2 import value chain, etc.

The federal government is committed to set the collaboration further with its European partners in the field of hydrogen, ao within the European institutions, the North Sea Energy Cooperation, the Pentalateral Energy Forum, the Benelux, as well as bilaterally when relevant (ie acceleration of the interconnection of BE and DE hydrogen transport networks).

International partners

As widely developed in Pillar 1, this strategy is by essence an import strategy where local renewable production is firstly used for direct electrification and where H_2-molecules and H_2-derivatives are mainly supplied from abroad. Collaboration with our international partners to set up an H_2 import value chain is central in this story.

Pillar 1 has identified 3 major import routes to be developed. Belgium is already closely working with Oman and Namibia to initiate the shipping route from the South. The federal government wants to further engage in these collaborations in order to reach concrete outcomes, and wants to initiate similar ones with key partners in order to open the two other import routes.

Progress and way forward

This document presents the federal government's vision and ambitions in the field of hydrogen. It details how the government will position Belgium at international level and the strategy that it adopts to see its ambitions realised.

Since the first publication of the first is strategy in October 2021, several actions have been put in place and new ones have been announced. The following tables summarize the progress status of each of these actions. The federal government will cooperate with public and private initiatives supporting this strategy.

Pillar 1 – Positioning Belgium as an import and transit hub for renewable molecules in Europe

	Measure	First announcement	Status
1	Since 2021: Engage with key partners in order to open each one of the 3 main import routes for renewable molecules	✓ Strategy 2021	Ongoing (MoUs with Oman and Namibia, identification of partners for the 2 other import routes
2	In 2022: Support the development of hydrogen import infrastructure to have the first imports of H2-molecules (or of H2-derivatives to be cracked into H2-molecules) by 2026	✓ Strategy 2021	Ongoing (call planned to be launched in early 2023)
3	In 2023: Organize hydrogen master classes together with the Belgian Hydrogen Council to establish close relationships with key exporting partners	Update 2022	To be launched in 2023
4	In 2023-2024: Investigate how the development of both electricity and hydrogen networks can complement each other in the North Sea	Update 2022	To be launched once the HNO is designated

Pillar 2 – Expanding Belgian leadership in hydrogen technologies

	Measure	First announcement	Progress
1	In 2021: Support research and pilot projects on hydrogen technologies with the two federal R&D funds (Energy Transition Fund and call Clean Hydrogen for Clean Industry)	✓ Strategy 2021	Achieved (to be continued with CHCI 2023 and future ETF calls)
2	By 2025: Develop a hydrogen test infrastructure	✓ Strategy 2021	Ongoing (collaboration initiated with VKI with several milestones until 2025)
3	By 2026: Develop a limited electrolysis capacity of minimum 150 MW	✓ Strategy 2021	Ongoing

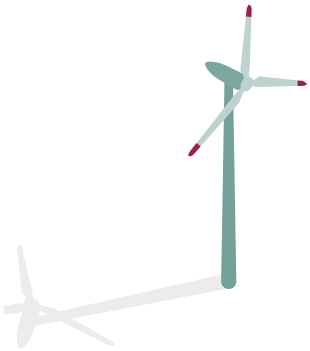
Pillar 3 – Establishing a robust hydrogen market

	Measure	First announcement	Progress
1	In 2023: Set up a framework ensuring an optimal planning of energy transport networks	✓ Strategy 2021	Ongoing (Discussions started, expected finalisation in 2023)
2	In 2022-2023: Adapt the legal and regulatory framework for the transport of hydrogen per pipeline	✓ Strategy 2021	Ongoing (public consultation launched in January 2022, first approval CMR)
3	In 2023-2024: Investigate with the Regions and/or Europe how the federal government can help to put in place a system to unlock the demand for renewable H2-molecules and H2-derivatives	Update 2022	To be launched

4	By 2025: Develop a European voluntary certification scheme and a register for H2-molecules and H2-derivatives	✓ Strategy 2021	Ongoing
5	By 2025: Develop a market hub for H2-molecules and H2-derivatives linked to physical supply hubs in Belgium	Update 2022	Ongoing
6	By 2026: Develop 100 to 160 km of additional H2 pipelines (new and/or repurposed) to be operated under non-discriminatory third-party access conditions	✓ Strategy 2021	Ongoing
7	By 2028: Interconnect the Belgian H2 transport network with Germany, France and the Netherlands	Update 2022	Ongoing

Pillar 4 – Investing in cooperation as a key success factor

	Measure	First announcement	Progress
1	Implement a structural consultation on hydrogen within Belgium	✓ Strategy 2021	Achieved (Re-activation of workgroup ENOVER/CONCERE H2)
2	Adopt a proactive and dynamic attitude within the working groups dedicated to hydrogen (Benelux, Pentalateral Energy Forum, European Union)	✓ Strategy 2021	Ongoing
3	Represent Belgium in international organisations and forums on hydrogen	✓ Strategy 2021	Ongoing
4	Continuous interactions with the sector, research institutes and citizens to keep this hydrogen strategy up to date with the evolution of the barriers and needs	✓ Strategy 2021	Ongoing (ao support to the Belgian Hydrogen Council)



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