

Key narrative: Unlocking hydrogen opportunities together

One of the biggest global challenges we face today is how to adapt to- and mitigate climate change. With its unique proportions, no country can face it alone. Signed in 2015, the Paris Agreement forms the largest agreement for countries to fight against climate change. To successfully limit the effects of the climate crisis, the global community needs to collaborate. Not only by agreeing on national and international reduction targets, but also by collaborating in sharing knowledge, experience and resources to accelerate the development and implementation of clean technologies to reach our targets.

The global energy transition plays a huge role in successfully limiting climate change. It is a cross-sectoral and cross-border system issue in which both national and international efforts should be closely connected. Recent geopolitical developments have only emphasised the urgency of transitioning to renewable energies through international collaboration. Believing in the EU strategy, the Netherlands is committed to creating partnerships across borders that will contribute to systematic changes that directly influence the energy transition.

Carbon-free hydrogen as a crucial player in a climate-neutral economy

There is a growing international consensus that clean hydrogen will play an important role in a climate neutral economy. This is largely due to the creation of new opportunities in balancing the supply and demand of energy, seasonal storage and global exports and imports of renewable energy. It can also be used as an alternative to natural gas in industrial processes, as a feedstock for the production of chemicals, and as a carbon-neutral fuel in virtually all modes of transport, especially those for which electrification is not (yet) an option. Hydrogen facilitates the renewable energy sector as it paves the way for further large-scale investments in wind and solar power by creating flexibility to deal with the variable supply of electricity. Enabling efficient transportation of electricity and creating long-term and large scale storage can also be a result of further hydrogen developments.

The Netherlands' efforts to the challenges of hydrogen

Hydrogen, because of its complexity and innovative nature, comes with its own set of unique challenges that cannot be ignored.

- Production cost of hydrogen are (still) high. Further efforts in research and development as well as scaling up of production are necessary in order to reduce the cost for its widespread adoption.
- As a novelty, further developments in clean hydrogen market frameworks are needed. Certification, standardisation and (EU) regulations need to be recognised.
- Demand needs to be stimulated in order to finance scaled production. This will allow for supply and demand chains to develop alongside each other, resulting in a reduction of costs. At the same time, the entire hydrogen value chain can also be set up.
- Although natural gas grids can be converted to store and carry clean hydrogen, further cross-border infrastructure needs to be developed in order to make full use of clean hydrogen.
- There are various applications that need to be developed and tested before clean hydrogen can substitute fossil fuels.

Despite the challenges, large-scale production of hydrogen is still a solid, viable solution towards a carbon-neutral future. The Netherlands has the means to realise this future via the following efforts:

- Upscaling the production capacity of clean hydrogen. The Netherlands is targeting 500 Megawatts of electrolysis capacity for 2025. This target rises to at least 3 to 4 Gigawatts for 2030.
- In collaboration with various European countries, we are dedicated to paving the way to develop a hydrogen market, with structured regulations, network management, certifications and safety, all playing a role.
- A strong focus on regional, national and international infrastructure and storage.
- Developing and testing of a variety of applications in transport, industry and the built environment.
- Due to Europe's high usage of energy, partnering up for the import and export of hydrogen, as well as other renewable energies is fundamental to reach our mutual goals.

The Netherlands as your clean hydrogen partner

International collaboration is at the heart of our energy transition. The same goes for its widespread application. We are ready to share knowledge, experience and technologies that will bring hydrogen to the mix of solutions contributing to the energy transition.

The ideal hub

The Netherlands possesses many good, solid assets which can help in the development of hydrogen as a clean energy carrier. The country can serve as a hydrogen hub to North-Western Europe. This is due to our strategic location by the North Sea, with our many wind farms, heavy industry and well established naval connections. Work is also already underway by [HyStock](#) for the first large-scale underground storage of hydrogen, which should be operational by 2026.

We can act at every step of the way in the import, production, storage and distribution of hydrogen. This is largely possible thanks to the [Port of Rotterdam](#), known as the largest port in Europe, which serves as a gateway to the rest of the European mainland. Hydrogen corridors can be set up by rail and rivers, allowing for inland shipping between the Rijnmond and the Alps, as well as the hinterland. Rotterdam is also home to the major civil engineering project [Maasvlakte 2](#). Here a conversion park is being developed to house electrolyser developments from a wide range of energy players.

Solutions applied to the Port of Rotterdam can be scaled and applied to other ports around the country, which can also be replicated abroad. [Pipeline corridors](#) with the east and south are also being developed, which will increase our reach and accessibility to share hydrogen solutions and expertise. And [tank storage](#) solutions that are currently used for LNG and other fossil fuels can be adapted for clean hydrogen storage.

Existing gas infrastructure that will be used for hydrogen

Another strong asset of the Netherlands is the large natural gas infrastructure network, which is also one of the most sophisticated in the world. The publication of [HyWay27](#) has confirmed that the existing natural gas network can be used for the transport of hydrogen between regions and abroad. By converting this (already existing) infrastructure, we are taking the transition and development of hydrogen to the next level. Together with our neighbouring countries we are preparing a transnational hydrogen infrastructure known as the hydrogen backbone.

Dutch hydrogen expertise

With a long history of working with natural gas and being the second largest user of hydrogen in Europe, we can translate years of knowledge and experience into developing the entire hydrogen value chain. The same applies for our extensive experience in chemical and energy-intensive industries, providing us with the expertise to accurately apply hydrogen to large industry. And finally, with strong research and development in the field of electrochemistry, Dutch research institutions can play an important role in the needed improvement of electrolysers and innovations in consecutive markets.

With five large industry clusters (including chemical, oil refinery, ammonia and steel) playing a large part in the economy, scaling hydrogen solutions and further development so it can meet these industries high demand can significantly help reduce CO2 emissions.

Our approach

The Netherlands takes a 'quadruple helix' approach to solving global challenges, whereby collaborative environments with government bodies, knowledge institutes, companies and society come together. We are all part of the (global) energy transition, and we all have an impact. This collaborative nature of the Dutch takes place not only nationally but also through our strong connections with Europe and beyond. Together, we can co-create solutions, develop sustainable business models and empower countries worldwide to drive the global energy transition.

A number of collaborative research and development projects are already underway, as well as investment and funding initiatives. For example, [HyDelta](#), a consortium formed by top hydrogen players, focuses on an integrated approach to solutions for the transport and different uses of hydrogen. [GroenvermogenNL](#), a research, demonstration and investment program, recently received more than 800 million euro towards the scaling up, innovating, converting, rebuilding and training for hydrogen and chemistry developments.

Europe's first Hydrogen Valley

The northern region of the Netherlands finds itself with a unique opportunity: to cost-effectively develop an integrated hydrogen ecosystem, which can prove to be a game-changer in global hydrogen developments and accelerate the energy transition. This integrated approach allows for the best technologies from the country to come together and work in one specific region. The entire hydrogen value chain can be created here. From sustainable energy sources and production to storage, transport and applications.

The *Hydrogen Valley* has over 30 subprojects running and in preparation with public-private parties taking a cross-sectorial approach under 4 different themes; storage and infrastructure, generating hydrogen as a raw material for industrial use,

using hydrogen as heat and power in residential areas, and sustainable mobility.

With Europe's first hydrogen valley, the Netherlands can accelerate the energy transition and development of hydrogen, as well as serve as an example for the international community to follow.

Unlocking hydrogen's opportunities together

Hydrogen is highly versatile and can be used in a wide range of industries and applications. It can be used both as a fuel and as a feedstock for several industrial processes. This means we can move away from polluting industries and transition to more sustainable practices, which is especially useful in heavy-duty industries. Transport can also benefit from hydrogen as it reduces emissions of inland shipping and aviation.

The Netherlands knows sustainable development can only be achieved through joint efforts and working together. We carry innovation in our core, which along with first-class technical expertise means only the highest standards will be accepted. With our participation in Horizon 2020 and succeeding programmes, we aim at solving global challenges through excellent science and research, now and in the future. We strongly believe in the EU's commitment to moving away from fossil fuels and towards more sustainable energy sources. We thrive in a high-tech environment, where our global players create flexible, fast-moving networks of specialist companies and research institutes.

With organised national consortia for clean energy expertise, the Netherlands is keen to internationally exchange knowledge and skills in many areas such to set up international supply chains. From production, import, and manufacturing electrolysers, to transport, storage, and applications in heavy industries, hydrogen offers a wide range of possibilities. The Netherlands has a particular focus on renewable energy innovation and offers fast and easy access to the right technology providers, researchers and other specialists. Covering markets across the world, we are happy to hear your stories and work together to create cleaner energy for everyone.