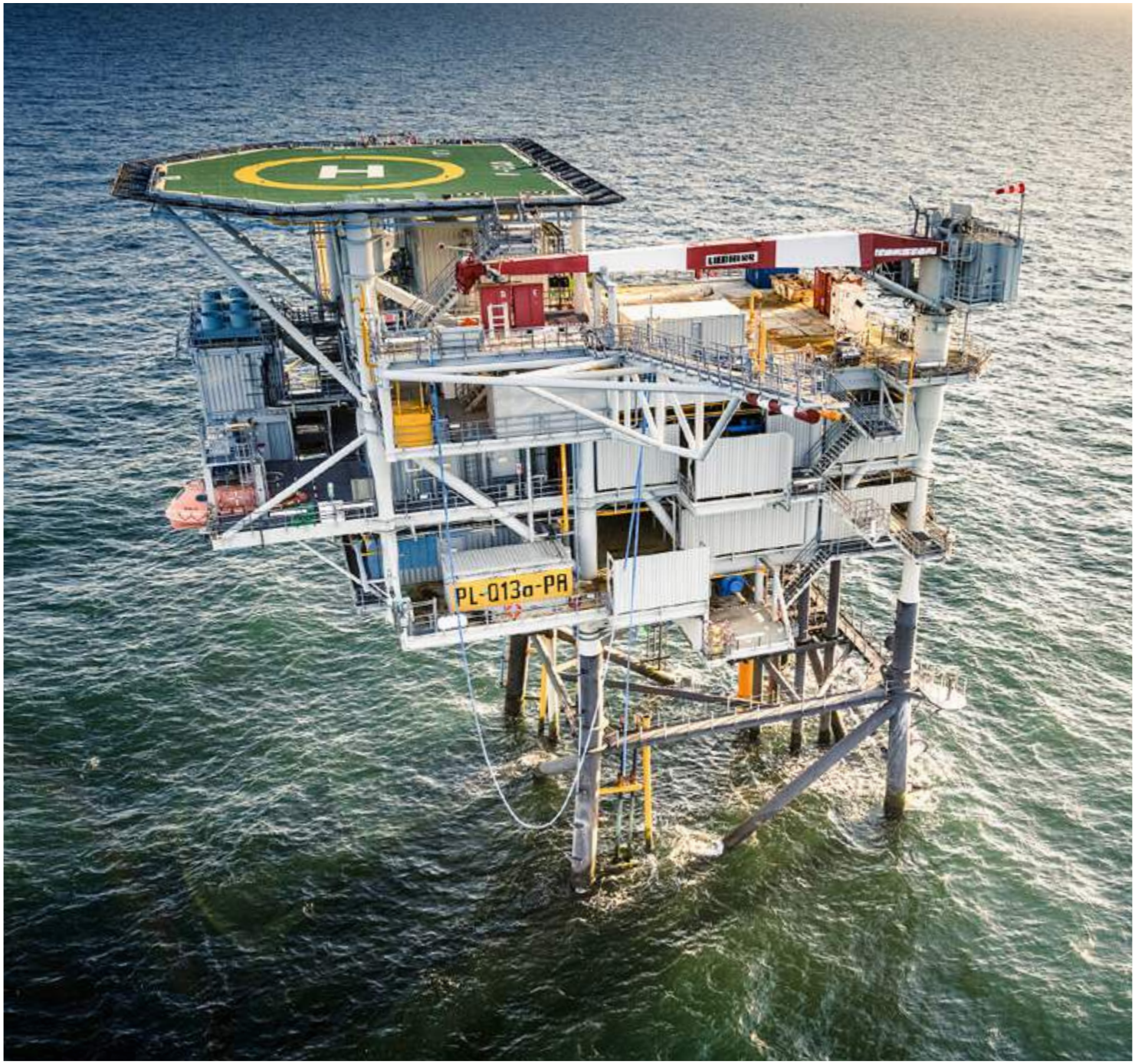
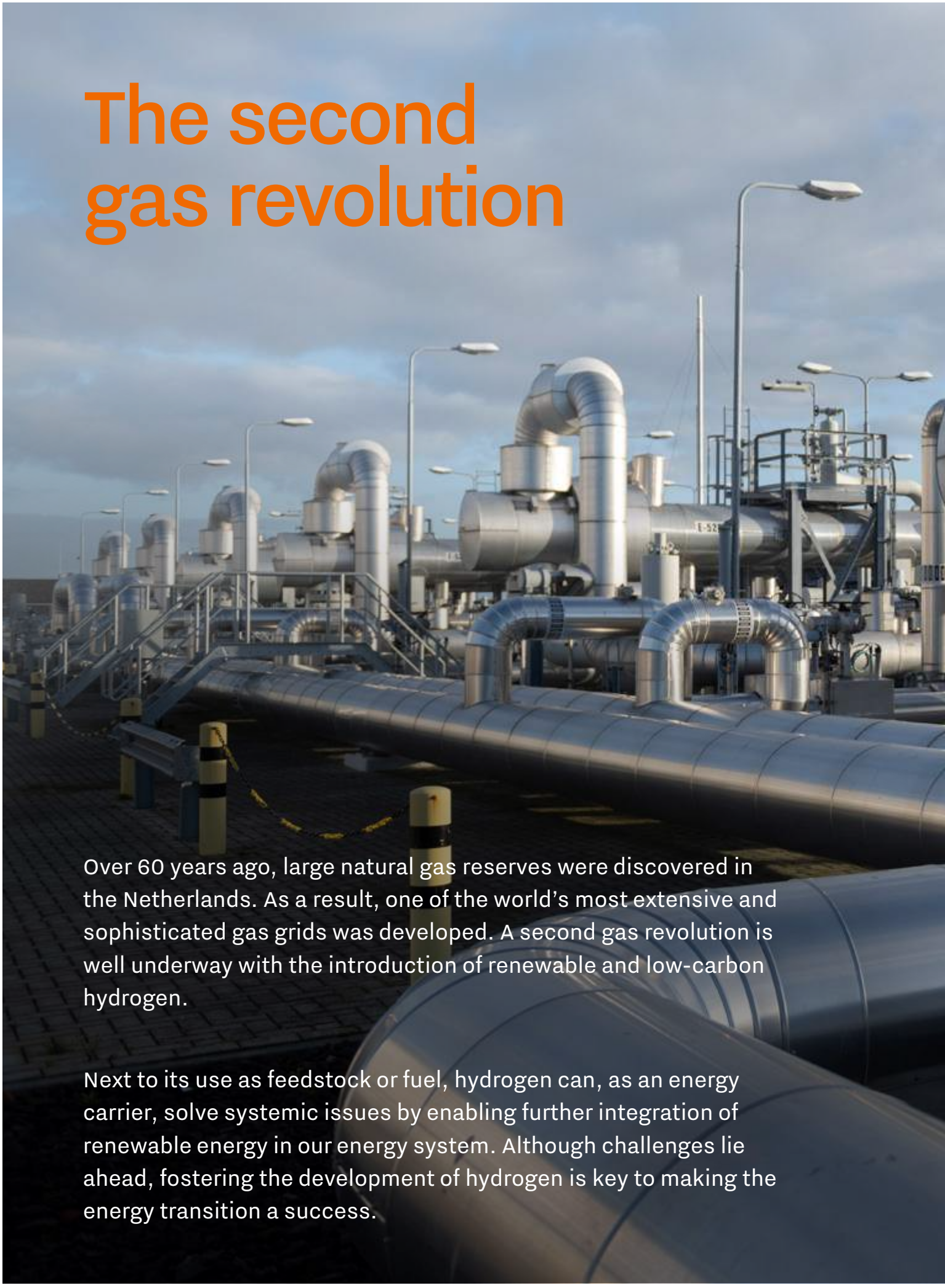
Excelling in Hydrogen

Dutch solutions for a climate-neutral world



Netherlands

The second gas revolution



Over 60 years ago, large natural gas reserves were discovered in the Netherlands. As a result, one of the world's most extensive and sophisticated gas grids was developed. A second gas revolution is well underway with the introduction of renewable and low-carbon hydrogen.

Next to its use as feedstock or fuel, hydrogen can, as an energy carrier, solve systemic issues by enabling further integration of renewable energy in our energy system. Although challenges lie ahead, fostering the development of hydrogen is key to making the energy transition a success.

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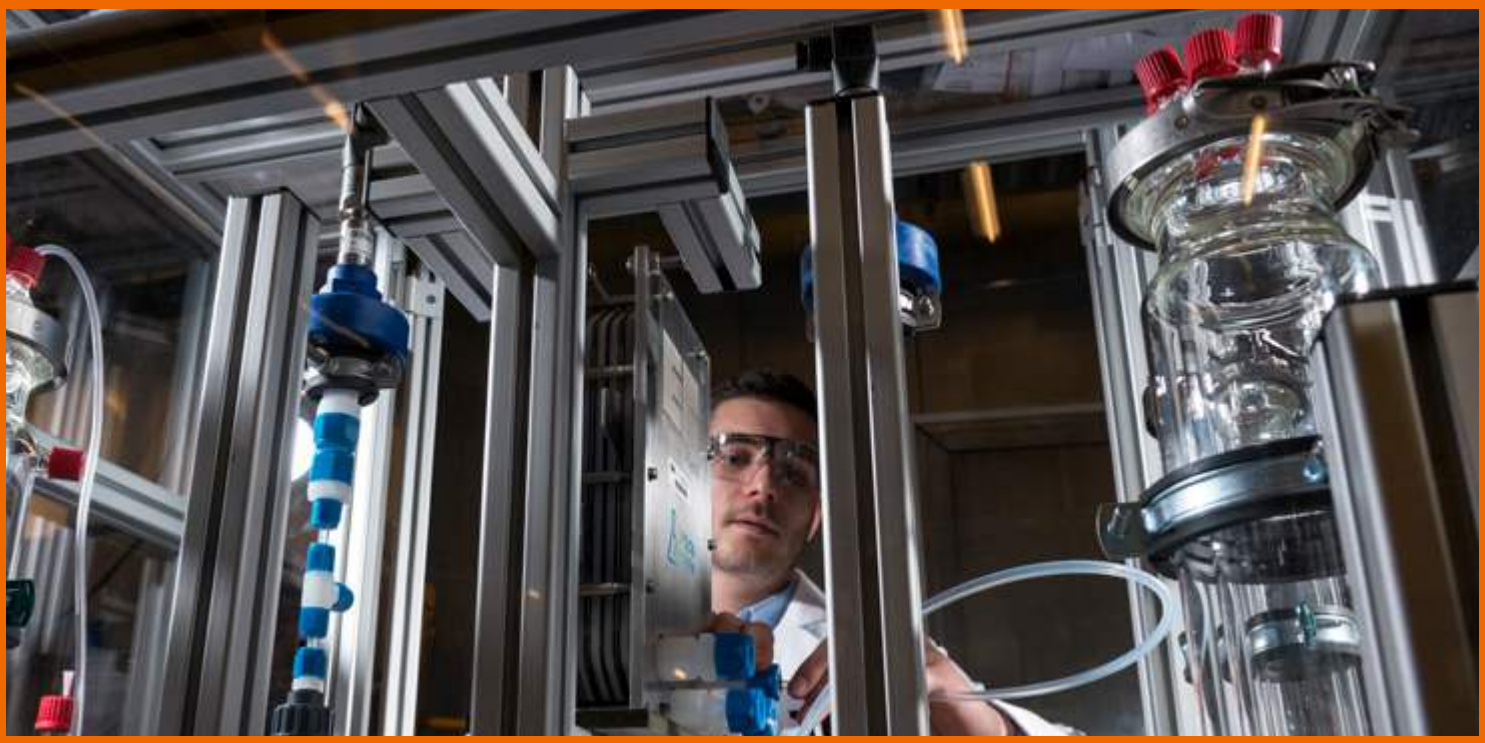

Building hydrogen-fuelled partnerships

Mitigating the effects of climate change is a global challenge of gigantic proportions, and no single country can hope to win the fight on its own. To successfully limit the effects of climate change, the global community needs to collaborate. Not only by agreeing on international emission reduction targets, but also by pooling knowledge and resources to accelerate the development and implementation of clean solutions.

This is particularly true for the large-scale adoption of clean hydrogen. As one of the most flexible and versatile carbon-neutral energy carriers, it is considered a critical enabler in the global energy transition. Its potential is huge, yet unlocking it requires concerted efforts, from substantially scaling up production capacity to creating global demand and from developing infrastructure and logistics to fostering innovation. Hydrogen will have to become a global commodity, in an international marketplace that connects individual countries and enables each to make the most of its natural resources.

The Netherlands is determined to play a leading role in building a global hydrogen economy. As this guide illustrates, the Netherlands is already at the forefront of European initiatives to take the hydrogen revolution further, building on various strengths including its strategic location as the gateway to North-Western Europe and a key hub in the global oil and gas trade, with the necessary infrastructure in place. The North Sea offers a unique opportunity for large scale wind and solar electricity production at competitive cost. The country is also home to a rich ecosystem of research institutes, universities and industrial partners who are effective at translating ideas and concepts into feasible, integrated solutions. This has resulted in a wide-ranging portfolio of solutions that covers every step in the hydrogen value chain, from electrolysis to transport and storage of hydrogen, and a range of applications across sectors including industry, road and maritime transport and residential heating.

Additionally, the Dutch mind-set is considered open, pragmatic and outward-looking. The country is well-known for building productive and reliable partnerships, both at home and around the world. Dutch hydrogen ambitions and initiatives are strongly embedded in European policies and innovation programmes. The country is home to Europe's first 'hydrogen valley', located in the north of the country, attracting foreign investors and technology companies who view the Netherlands as an excellent base for open innovation and business development. And the country's own technology sector has a long history of applying its knowledge and innovations to the specific needs and concerns of other countries and cultural settings.

Transforming hydrogen from a key technology with huge potential to the bedrock of a clean energy system will take years. Yet the technology to start the process in earnest is ready. And the Dutch hydrogen sector is keen to learn about your ideas, ambitions and objectives, and to help you achieve them.

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FME POWERED BY DUTCH TECHNOLOGY

Hydrogen

A critical enabler in the global energy transition

The race is on to substantially reduce our global carbon footprint in time to halt the devastating consequences of climate change. International cooperation and technological innovations are key enablers of successful, large-scale decarbonisation of our societies. Clean hydrogen provides a solution to overcome some of the most persistent challenges in this transition.

Scaling up clean hydrogen production requires large amounts of renewable electricity. Wind power in particular is a vital enabler. The Netherlands aims to install 21 GW of offshore wind capacity by 2030, and to produce at least another 35 Terawatt hour of renewable energy on land. Given the high expectations for clean hydrogen usage for multiple applications, even more capacity is needed to fulfil these ambitions.

Scaling up clean hydrogen production requires large amounts of renewable electricity. Wind power in particular is a vital enabler. The Netherlands aims to install 21 GW of offshore wind capacity by 2030, and to produce at least another 35 Terawatt hour of renewable energy on land. In addition, floating solar parks in between the wind turbines of offshore wind farms could increase the total production of offshore renewable energy. Solar energy being complementary to wind energy, helps with intermittency challenges and enables a more efficient use of the electricity grid. Given the high expectations for clean hydrogen usage for multiple applications, even more capacity is needed to fulfil these ambitions.

As a signatory of the Paris Climate Agreement, the Dutch government has enshrined in law its commitment to a decarbonised future, and has agreed ambitious targets (see the box) in a national Climate Agreement. In addition, the Netherlands is committed to working proactively on the Sustainable Development Goals (SDGs). As such, the Dutch government is committed to reducing carbon emissions while making sure potential negative effects of this transition on the wellbeing of people and communities anywhere in the world are limited. For one of the most densely populated and industrialised countries in the world, meeting these targets will present considerable challenges. Billions of euros will be invested over the coming decade alone to accelerate the energy transition. The Netherlands plans sizeable investments in renewable energy, especially offshore wind energy and solar energy. Other key policies are aimed at putting all this carbon-neutral power to good use, through large-scale electrification of cars, residential heating through heat pumps and the electrification of industrial processes, while at the same time providing sustainable feedstocks to the industry.

Yet, even with these ambitious policies, persistent challenges remain. For example, the country's large industrial sector requires huge amounts of high temperature process heat, as well as feasible alternatives for fossil-based feedstock. As we become increasingly reliant on intermittent energy sources, such as wind and solar power, we urgently need solutions for storing large amounts of energy to avoid grid congestion and assure security of supply, both in the short term and across seasons. Yet another challenge is to decarbonise the marine shipping and road haulage sectors as well as finding a substitute for the natural gas used for heating buildings.

Hydrogen: a crucial link

Hydrogen is widely seen as a crucial technology to overcome such fundamental obstacles to full decarbonisation. It can 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 heavy duty transport, especially those for which electrification is not (yet) an option. Through electrolysis, hydrogen can be used to store and distribute large amounts of renewable electricity, paving the way for further large-scale investment in wind and solar power and creating new opportunities for grid balancing, seasonal storage, providing large-scale energy infrastructure alternatives and even global exports of renewable energy. The hydrogen value chain, both schematically depicted and geographically visualised for the Netherlands, can be found on page 26.

The Dutch angle

The Dutch approach to building a hydrogen-based future has several distinctive characteristics. First of all, it is explicitly driven by the climate policies and

Facts and figures on the Dutch hydrogen ecosystem

180 Petajoules

The Netherlands has a large potential of reducing carbon emissions by transitioning from being Europe's second largest hydrogen producer, with an annual production and usage of 180 PJ of (fossil-based) hydrogen, to becoming a hub for clean hydrogen.

3-4 GW / 2030

To enable large-scale production of renewable hydrogen, the Dutch ambition is to have installed 3 to 4 GW of electrolyser capacity by 2030 (± 10% of the total EU target for that year). The northern region of the Netherlands alone is aiming for an annual production of 65 PJ of clean hydrogen by 2030.

21 GW / 2030

Offshore wind is a crucial enabler of scaling up the production of carbon-neutral hydrogen. Planned projects in the Dutch zone of the North Sea add up to 21 GW of offshore wind capacity by 2030, while there is enough space for a further scale-up to 40 GW in 2040 and 75 GW in 2050.

136,000 km

The Netherlands, together with Belgium and France, already has over 1,000 km of dedicated hydrogen pipeline. The country's dense natural gas grid (136,000 km of high quality pipeline) can -partially- be retrofitted to transport hydrogen at an acceptable cost. This will accelerate the development of a 'national hydrogen backbone', which should be ready in 2030. In 2025-2026 the first part of the backbone will be ready for use.

The Netherlands is strategically located at the heart of the European hydrogen infrastructure proposed by 11 European grid operators. Addressable regional demand in North-western Europe alone is estimated at 400 PJ by 2030.

commitments previously described. Secondly, its scope takes in the entire value chain. Rather than viewing hydrogen production and various applications as separate issues, the Netherlands has adopted an integrated system approach to developing a 'hydrogen economy'. Dozens of pilot projects are underway in which companies, regional and local governments, hydrogen associations and platforms, and Research and Technology Organisations (RTOs) are building a complete hydrogen ecosystem. They not only focus on technology but also on creating demand, business models and on tackling regulatory, human capital, certification and standardisation and safety issues. This is often done in public-private partnerships and in a very pragmatic way: we have an open approach to innovation which encourages experimentation. Thirdly, our outlook on hydrogen is decidedly global in nature. Living in a small country with a strategic location, we have always been strongly aware of the need to look beyond the country's borders. It has caused Dutch companies, ports, research institutes and government to be well-connected to foreign markets with strong collaborative networks all over the world. Therefore, in addition to developing a Dutch hydrogen ecosystem and value chain, the Netherlands strives to help accelerate the global, large-scale adoption of hydrogen as a carbon-neutral energy carrier. And building on the strategic location in global oil and gas logistics, the Netherlands is aiming to become a European hub for the production and transport of low-carbon and especially low-carbon and renewable hydrogen.

Strong foundations

These ambitions are underpinned by strong foundations. Currently, the Netherlands is already Europe's second largest producer of fossil-based hydrogen and is determined to decarbonise this sector. Since large-scale production of renewable (green) hydrogen will take time, 'blue' or low-carbon hydrogen is an important intermediate step. In this case, hydrogen is produced from natural gas but the CO2 released in the process is captured and stored resulting in drastically reduced carbon emissions released into the air. Still, the required technology for green hydrogen is being developed at a rapid pace (see next chapter) with many associated factors in place. There is a highly developed manufacturing industry, with hundreds of companies at every step of the value chain, from producing crucial components for electrolysers to manufacturers of special vehicles and buses. This position is underlined by the launch of an Electrolyser Manufacturing Platform (EMP-NL) with more than 21 Dutch technology companies and knowledge partners assembled to accelerate innovations in the hydrogen economy. The Netherlands also has one of the world's most sophisticated natural gas infrastructures, achieved by developing a national gas grid reaching into nearly every home and business. And in doing so, the Dutch gas sector has built up extensive expertise in handling, monitoring and storing gas. In addition, the country is a major European hub for cross-border trade in natural gas, both in gaseous and liquefied forms. These are strong foundations as we seek to expand and repurpose our existing infrastructure, transforming it into a flexible grid that enables large-scale rollout of hydrogen.

Facilitating international collaboration

Building collaborations with Dutch hydrogen businesses could increase your company's financing possibilities. International B2B cooperation and cross-border consortia are stimulated and facilitated by the Netherlands Enterprise Agency, the Ministry of Foreign Affairs, Innovation NL, FME, NWBA (Hydrogen & fuel cell association), NL Hydrogen and other supporting organisations in the Netherlands. Reach out to learn more (p.126). Additionally, an overview of different Dutch and European hydrogen subsidies can be found on the website of the Dutch National Hydrogen Programme (in Dutch): www.nationaalwaterstofprogramma.nl

The European perspective

Building a hydrogen economy is a major undertaking, that no single country can achieve by itself. We strive for working in close international cooperation in research & development, European policies, demonstration projects and implementation of new technologies that the world as a whole could benefit from. Dutch initiatives are therefore closely aligned with European partners and EU-wide innovation programmes. Examples include:

- Clean Hydrogen Partnership. Succeeding the Fuel Cells & Hydrogen Joint Undertaking (FCH JU), this partnership aims to implement the EU Green Deal and the EU hydrogen strategy by accelerating the production, distribution and storage of clean hydrogen in the EU, especially within hard-to-abate sectors.
- Large projects could acquire the status of Important Project of Common European Interest (IPCEI). IPCEIs focus on large scale research, demonstration and implementation projects of European interest in which more public financing is possible compared to what is allowed under regular state aid regulations. In 2022, the Dutch government selected seven large-scale renewable hydrogen production projects across the country that combined will receive a subsidy of €800-million-euro. With a combined capacity of potentially 1,150 MW it already covers at least a quarter of the 2030 goals in the Netherlands. Earlier in 2022 the first wave was announced, which includes Nedstack's Fuel Cell Giga Factory (see Flagship projects on p.22). In 2023, the third and fourth wave focus on storage and import infrastructure, and mobility and transport with a budget of almost €800 million.

The north of the Netherlands was the first region to receive European funding as a 'Hydrogen Valley'. Its potential is widely recognised: the initiative was backed by dozens of companies from six different countries. In 2020 regional authorities, companies and knowledge partners published an ambitious investment plan of nine billion euros over the next ten years. It encompasses over 50 projects covering the entire hydrogen value chain, including large-scale production, the development of distribution and storage infrastructure and a range of applications.

Hydrogen production

Making clean hydrogen competitive

Hydrogen is only as clean as the energy used to produce it. For hydrogen to have a meaningful impact on the global energy transition, the production of clean hydrogen has to be scaled up substantially. And this, in turn, requires innovations that make its dominant production process – electrolysis – more robust and cost-competitive.

TNO's Faraday lab in Petten is an innovation lab that focuses on optimising existing electrolysis technologies such as PEM, alkaline, SOEC and AEM. It enables manufacturers of electrolysers and their suppliers to develop and test new materials, components and applications under different conditions.

Agreement exists in and outside the Netherlands about the necessity of increasing the availability of clean hydrogen. Yet it has struggled to make a breakthrough: the cost is still several times that of fossil-based hydrogen, and limited demand has, so far, hampered efforts to scale up electrolysis installations and reduce the cost.

Next-generation electrolysers

Many Dutch initiatives focus on the key challenge of making clean hydrogen more affordable. Much of the work is centred around TNO's Faraday laboratory in Petten, one of Europe's largest hydrogen research facilities. In this open innovation lab, researchers and a wide range of industry partners are working to optimise existing electrolysis technologies such as PEM, alkaline, SOEC and AEM. The innovations developed here focus on improving efficiency, boosting production capacity and finding robust, cheaper alternatives to the rare materials used in current electrolysers. Other examples of cross-fertilisation between research institutes and industry partners include VoltaChem, aimed at the electrification of industry, and the Hydrohub innovation programme of ISPT (Institute of Sustainable Process Technology), including its MW-test centre for electrolysers.

Work has started on the Netherlands' first Gigawatt electrolyser to be operational by 2030.

In addition to state-of the-art facilities and research groups, the Dutch hydrogen ecosystem includes a wide range of technology providers. A survey found that, even though electrolysis is yet to become a mainstream technology for hydrogen production, nearly a hundred companies in the Netherlands are already active in the field or are planning to enter this market. These include manufacturers of electrolyser components such as membranes, as well as stack integrators, suppliers of supporting technology and system integrators with the expertise and scale to build complete electrolyser installations. Many of these companies have extensive and valuable experience in other industrial markets, which can help to make the production process of electrolysers more robust and efficient. For example, by standardising and automating production processes, or by developing efficient water purification technologies.

Scaling up production capacity

In addition to optimising electrolyser technology, Dutch hydrogen companies are tackling the question of what is needed for larger scale use. Upscaling electrolysis capacity in the Netherlands has been a focal point of Dutch hydrogen policies, resulting in regulatory policies and financial instruments to stimulate this development. Current electrolysis installations typically have a capacity of 10-50 MW, but to facilitate the huge growth of renewable energy (as well as to compete with much larger 'grey' hydrogen plants), this capacity will have to be a 100 to 1,000 times larger. This requires the development of hydrogen plants incorporating hundreds or thousands of electrolyser stacks. In the Hydrohub programme, a large consortium of research and industry partners has taken up the challenge and presented plans for a 'Gigawatt Electrolyser' to be installed in the Netherlands before 2030. It is part of the Institute for Sustainable Process Technology's Hydrohub programme, which also includes a state-of-the-art open test centre based at the EnTranCe facility, part of Hanze University of Applied Sciences in Groningen.

Moving offshore

Finally, an increasing number of researchers and companies are focusing not so much on the question of how electrolysis can be implemented, but where. This question arises from the fact that hydrogen is widely seen as an ideal storage and transport medium for electricity. This has encouraged efforts to install electrolysers closer to wind or solar installations, in order to minimise the cost (and inevitable energy losses) of transmission infrastructure. In 2023, the Dutch government announced the plans to have 500-MW offshore electrolysis capacity connected to the offshore wind park operational in 2031.

Recent innovations in this area include a wind turbine with an integrated 4-MW electrolyser, and one of the world's first offshore electrolysis platform in the North Sea, called PosHYdon. This is an existing oil and gas platform off the Dutch coast being converted to the world's very first offshore hydrogen platform. Electricity generated by offshore wind turbines will be used to convert seawater into demineralised water and to power a 1-MW electrolyser producing clean hydrogen which is transported through natural gas pipelines to offtakers.

The latter presents an interesting perspective for the longer term. It raises the possibility of converting disused oil and gas platforms into offshore electrolysis installations. Although sea water currently has to be desalinated before it can be used for electrolysis, Dutch researchers are looking at ways to use sea water directly, which would potentially open up new opportunities for electrolysis in areas where freshwater is scarce. And perhaps even for large-scale electrolysis further offshore. The Netherlands is also exploring the possibilities of creating artificial islands in the North Sea, to be used as hydrogen production hubs for the many offshore wind farms to be built over the coming years.

The offshore wind area 'Ten noorden van de Waddeneilanden', located 56 km off the coast of the north of the Netherlands, has been designated for large-scale offshore hydrogen production. The preferred location could provide up to 500 MW of electrolysis capacity to be operational in 2031. The sheer size would make it world's largest offshore hydrogen production location. (Photo: Gemini Windpark)

The Hydrohub Gigawatt Electrolysis Factory project, a consortium of companies, universities and knowledge institutes is paving the way for the design of an electrolysis plant on an industrially relevant scale of 1 GW by 2030. It is part of the Institute for Sustainable Process Technology's Hydrohub programme, which also includes a state-of-the-art open test centre based at the EnTrance EnTranCe facility, part of the Hanze University of Applied Sciences in Groningen.

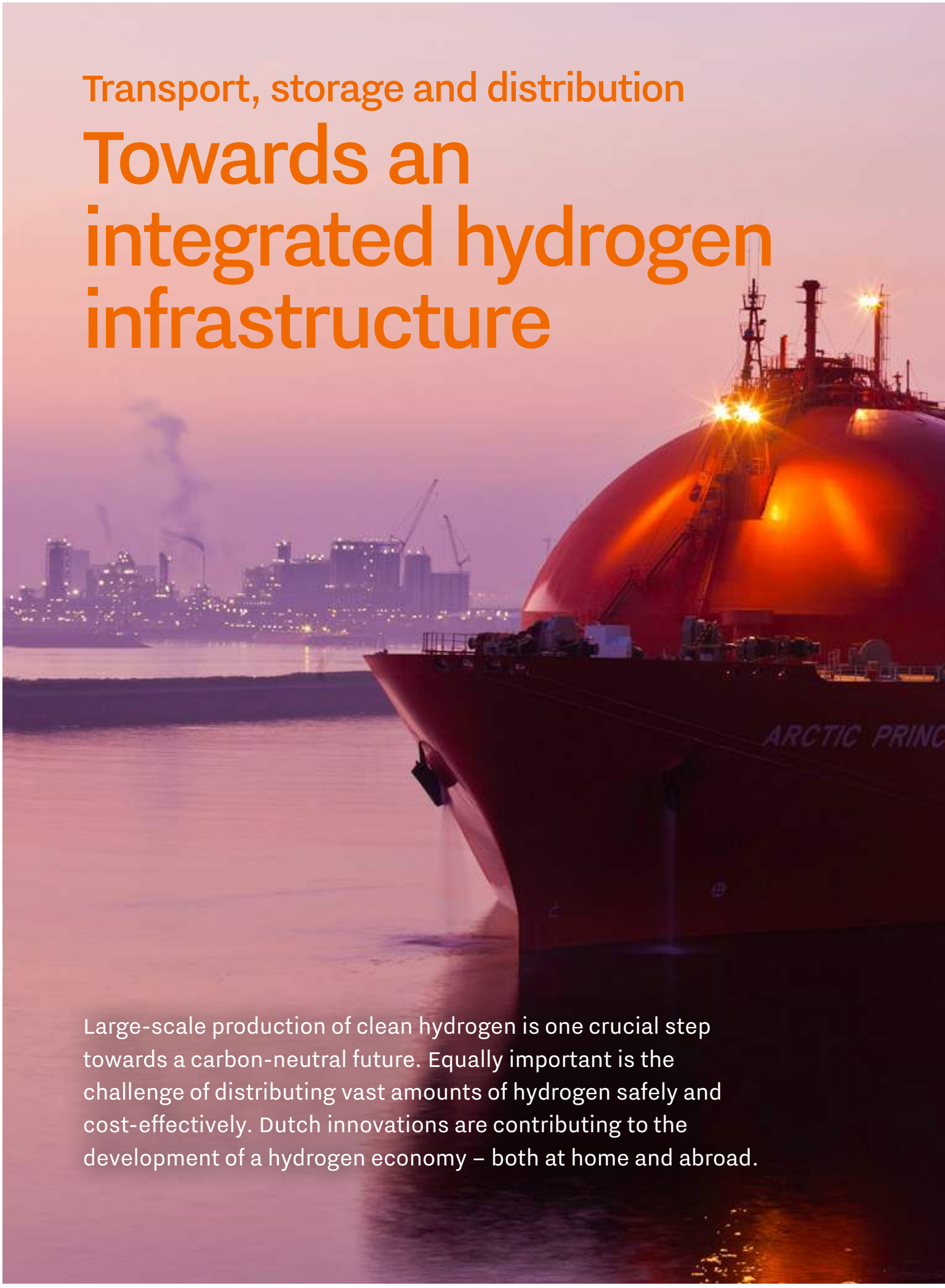
HYGRO specialises in the production, delivery and distribution of hydrogen produced directly from wind. It is building a 4-MW wind turbine with an integrated electrolyser in the province of North Holland. The aim is to maximise synergy between wind power, hydrogen and pipeline & storage technology. The concept optimises conversion of wind power to hydrogen, which can be transported at much lower cost than electricity and with a significantly lower impact on spatial planning.

An existing oil and gas platform off the Dutch coast is being converted to the world's first offshore hydrogen platform. Electricity generated by offshore wind turbines will be used to convert seawater into demineralised water and to power a 1-MW electrolyser producing clean hydrogen.

In the northern coastal town of Delfzijl, gas grid operator Gasunie and HyCC are planning to build a 20-MW electrolyser, which will produce 3,000 tonnes of clean hydrogen each year. They are also studying options to expand its capacity to 60 MW in order to produce sustainable jet fuel. (Photo: Groningen Seaports/Koos Boertjens)

Transport, storage and distribution

Towards an integrated hydrogen infrastructure



Large-scale production of clean hydrogen is one crucial step towards a carbon-neutral future. Equally important is the challenge of distributing vast amounts of hydrogen safely and cost-effectively. Dutch innovations are contributing to the development of a hydrogen economy – both at home and abroad.

The most straightforward way of transporting hydrogen is through pipelines, and the Netherlands is well equipped to build a nationwide hydrogen network. That is because the foundation is already present. First of all, a dedicated hydrogen pipeline network of more than 1,000 km is in place, connected to industrial sites also in Belgium and France.

The existing dense gas infrastructure can, after modest alterations, be repurposed for hydrogen transport. Not just by mixing hydrogen into the natural gas flow, but by replacing one with the other. In the province of Zeeland, a 12-km-long industrial gas pipeline transports around 400,000 tonnes of hydrogen per year, and nearly a dozen pilot projects are underway in residential areas to replace natural gas with hydrogen, using the existing gas infrastructure. Over the coming years, this trend is set to gather pace. One of the key policies on the Dutch climate agenda is that over 2 million homes have to have switched to natural gas alternatives by 2030. This will help to decarbonise the built environment sector whilst providing households with a long-term solution for the energy supply of their homes. Hydrogen has the potential to be an interesting solution besides district heating networks and the installation of electric heat pumps. And as the demand for natural gas falls, much of the network's capacity becomes available for hydrogen transport, especially since the grid includes many 'parallel' pipelines. It is estimated that, by 2030, we could already have developed a national 'hydrogen backbone' connecting our five main industrial clusters with the ports and the neighbouring countries. The national research consortium HyDelta investigates several issues associated with the use of existing natural gas assets for hydrogen.

In addition to transporting hydrogen, the existing natural gas system also offers opportunities for storage, in order to help bridge seasonal variations in the availability of renewable power, or to balance the power grid. For example, in the north of the country, natural gas is stored in huge salt caverns, with a capacity of hundreds of millions of cubic metres. Pilot projects have demonstrated that hydrogen can be safely stored here as well. In addition to this, researchers and industry specialists are already examining the technical and economic feasibility of storing hydrogen in empty gas fields, both on land and in the North Sea.

Building a hydrogen economy requires other and more flexible modes of transport besides pipelines and, in this respect too, the Dutch are working on a range of innovations. For example, researchers at TNO and industry partners are developing special hydrogen tanks. This includes the development of new materials that enable hydrogen to be stored at very high pressure or extremely low temperatures, paving the way for safe and cost-effective transport by road, rail or ship. Other Dutch companies focus on binding hydrogen with other materials, such as nitrogen, carbon dioxide or toluene (a so-called Liquid Organic Hydrogen Carrier: LOHC), to create a carrier liquid that is much easier to transport, sometimes even in existing oil tankers.

The growing market of clean hydrogen requires a properly functioning exchange platform and efficient pricing. This is being explored in the HyXchange project. It conducted a study in 2021 defining the necessary elements of such an international exchange followed by a successful pilot in 2022. HyXchange will continue to test their findings in pilot projects and simulations which will facilitate further growth and development of the global hydrogen market.

Over the next few decades, Europe is expected to become a net importer of clean hydrogen, and we are ready to contribute to the change.

We are working on all aspects of an integrated hydrogen infrastructure in the Netherlands and we are keen on international cooperation opportunities to expand and develop an integrated hydrogen infrastructure globally. Working proactively together in partnerships to take action on these goals is important so that we all achieve our shared climate goals.

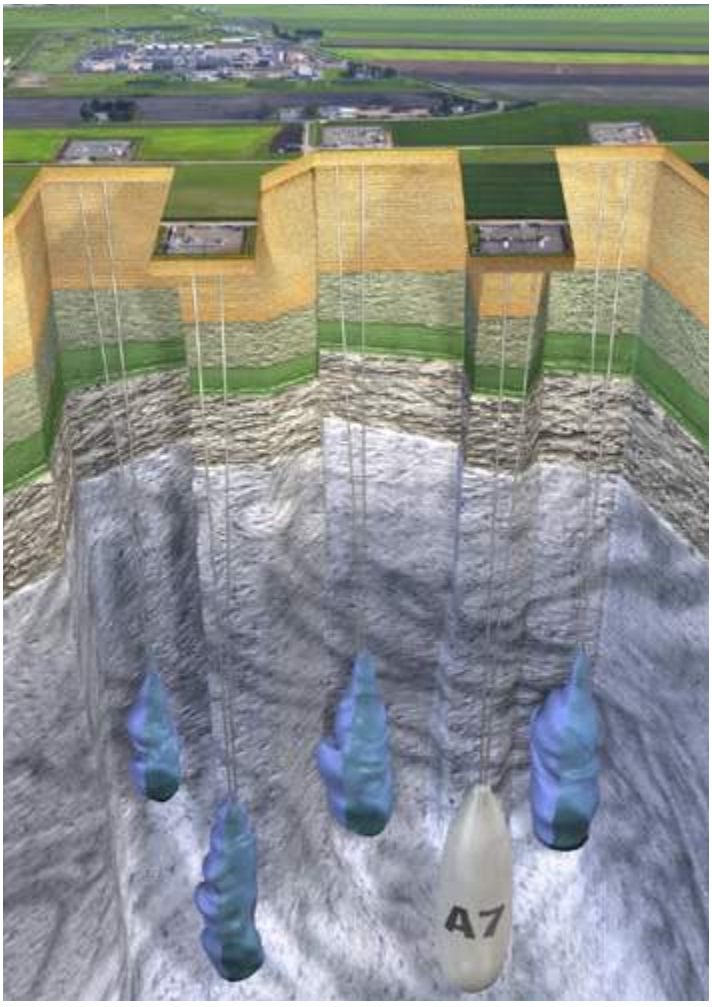
A hydrogen hub

While such innovations open up new opportunities for distributing hydrogen in the last few steps of the value chain, they can also be applied to large-scale transport over (very) long distances. There is an urgent need for such solutions, since there is a huge potential for a global hydrogen market. Studies indicate that in areas with abundant sunshine and/or favourable wind conditions, the cost of renewable electricity could fall to around 1 eurocent per kWh within 10 years. This will boost the business case for large-scale electrolysis, producing renewable hydrogen for other markets. Over the next few decades, Europe is expected to become a net importer of clean hydrogen, and we are ready to contribute to the change.

Some of Europe's busiest transport corridors converge on the Netherlands, thanks to excellent road, rail and inland shipping infrastructure, as well as pipeline connections with much of Europe. The Port of Rotterdam is the largest port for oil and (liquefied) natural gas in Europe, and is working with industrial partners to build up a similar position for hydrogen. Several multinationals are planning to build electrolysers in Rotterdam, and work has started on a dedicated hydrogen pipeline infrastructure. Other companies are focusing on the technology needed for large hydrogen tankers, and for storage infrastructure not just in the Netherlands, but also in the countries that are looking to capitalise on their potential as hydrogen exporters.

As of April 2023, the Dutch government has signed bilateral Memoranda of Understanding (MoU) with Chile, Portugal, Canada, Uruguay, Australia, Spain, Namibia, the United Arabian Emirates, Oman, Japan and more are to be expected. Such partnerships are highly valued by public and private organisations as it paves the way for further international cooperation. It shows the value that the Netherlands gives to building hydrogen corridors in North-Western Europe as well as preparing for large-scale import of clean hydrogen.

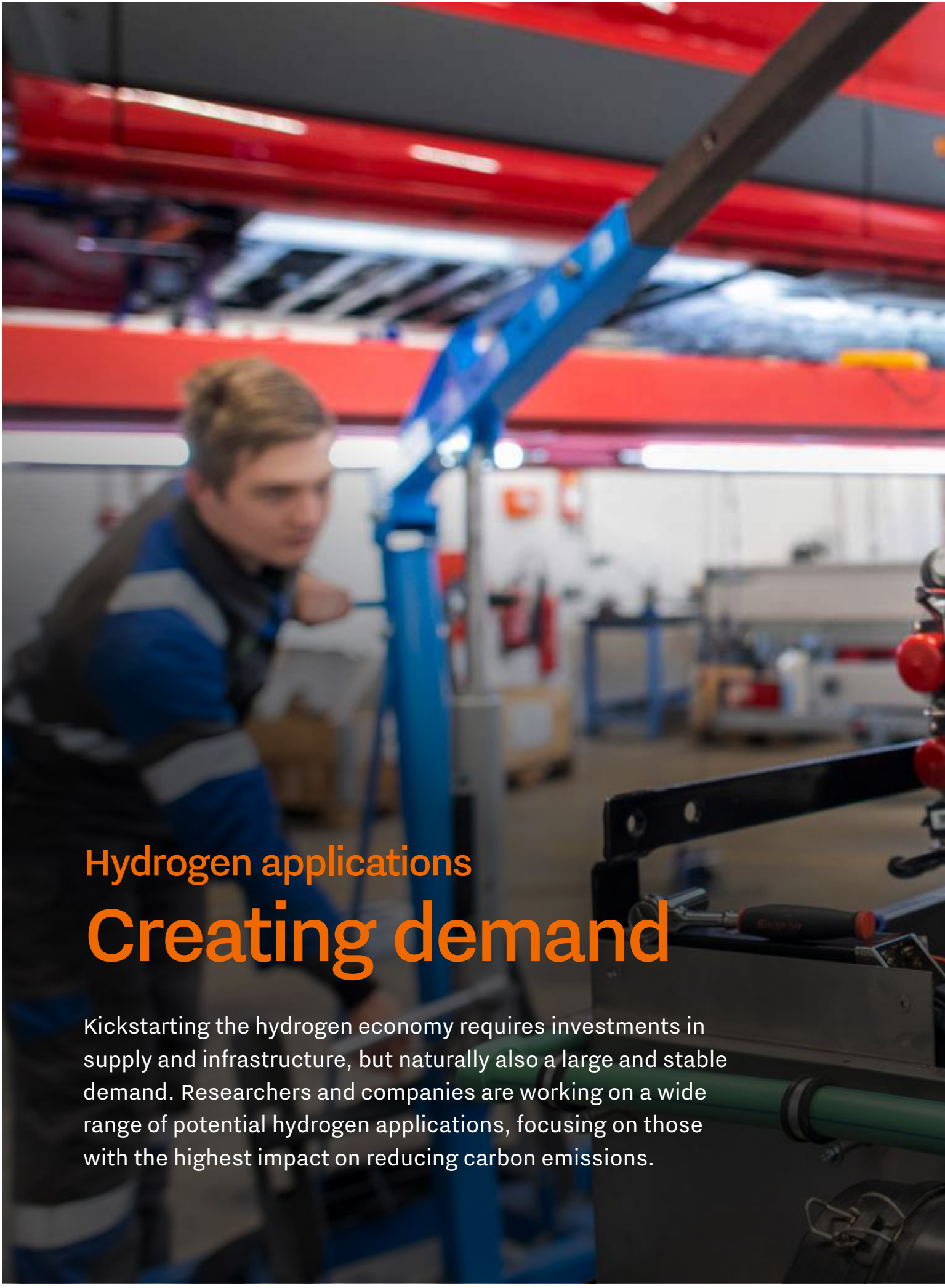
The village of Stad aan 't Haringvliet is home to an active community of residents who are making a collective effort to phase out natural gas. Grid operator Stedin has already confirmed that existing gas infrastructure can be used to transport hydrogen to the village's 600 homes. Elsewhere, in Hoogeveen in the north of the country, similar plans have been developed which will allow hydrogen to be transported to over 500 new and existing houses over the next five years.



Dutch gas grid operator Gasunie is developing its first large-scale hydrogen storage site at HyStock, Zuidwending. Here its subsidiary Energystock operates a storage facility with six underground salt caverns, which are currently used for storing natural gas. Four new caverns will be developed for hydrogen, with a total storage capacity of more than 20,000 tonnes.

A national hydrogen backbone is being developed in the Netherlands, which will consist of 1,400 km of pipeline by 2030. The network will connect regional backbones with each other, with large clusters of industrial consumers and port facilities, as well as with storage facilities and grids outside the Netherlands. Altogether, 85% of the backbone is expected to consist of reused gas infrastructure.

In the province of Zeeland in the South an existing, 12-kilometre natural gas pipeline has been adapted to transport (residual) hydrogen from Dow Chemical's production site in Terneuzen to Yara's fertilizer plant in nearby Sluiskil. The initiative has allowed the two chemical companies to achieve CO2 savings of 10,000 tonnes per year.



Hydrogen applications

Creating demand

Kickstarting the hydrogen economy requires investments in supply and infrastructure, but naturally also a large and stable demand. Researchers and companies are working on a wide range of potential hydrogen applications, focusing on those with the highest impact on reducing carbon emissions.

Holthausen Clean Technology is a fast-growing family business which specialises in converting a wide range of lorries and special vehicles to run on hydrogen.

Industrial applications

One of the areas in which hydrogen is expected to have a large impact on reducing overall CO2 emissions is in industrial processes which require high-temperature heat. These are typically large installations which consume huge amounts of fossil fuel, mainly natural gas. The goal is to adapt industrial burner systems and ensure they can deal with hydrogen's radically different combustion characteristics. In combination with CO or CO2, hydrogen also has a vast potential to replace petroleum and natural gas as a basis for the production of synthetic fuels and sustainable bulk chemicals, such as methanol, alkenes and aromatics.

Mobility

Many Dutch innovations focus on modes of transport for which electrification is not the most preferred option, such as ships and long-distance road haulage. For example, in our large inland shipping sector, the goal is to introduce 150 hydrogen-powered barges over the next 10 years. And, as part of a pan-European project initiated by the province of South Holland, hydrogen fuelling stations will be built along the shipping corridor between Rotterdam and Genoa, Italy via Germany. Dutch solutions for road transport include hydrogen-fuelled buses and trucks, range extenders for electric vehicles and the technology needed for hydrogen refuelling stations.

Residential heating

Gas-fired heating has been the standard for nearly every Dutch home for decades, yet this is about to change. Newly built homes are no longer connected to the gas grid and, over the next ten years, millions of existing homes are expected to switch to sustainable alternatives such as district heating and heat pumps. While for many newer homes this can be accomplished using solar energy combined with heat pumps or geothermal heating, for many older homes, hydrogen may be a more feasible solution. The existing gas infrastructure could be adapted to distribute hydrogen (see also p. 16). The Netherlands has a strong ecosystem of condensing boiler manufacturers, who are investing heavily in transitioning from natural gas to hydrogen. Several have marketed models suitable for gas mixtures with up to 30% hydrogen, and have showcased 100%-hydrogen boilers. Others are working on technology that would allow existing gas-fuelled condensing boilers to be retrofitted for use with hydrogen.

Flexible power infrastructure

Since our electricity supply is becoming more and more dependent on renewable – and intermittent – energy sources, it is important to ensure adequate buffers of carbon-neutral power. Currently, gas and coal-fired power plants provide the necessary back-up to offset a sudden drop in wind or solar power. We are working on the technology to convert these power plants to run on (carbon-neutral) hydrogen, as well as on the storage solutions needed to create large hydrogen buffers (see p. 16). Other innovations include flexible electrolysers that can be used for grid balancing, frequency containment or - combined with fuel cells for example - as emergency power systems.

In the Eemshaven, the port in the north of the Netherlands an existing gas-fired power plant is being prepared to convert to hydrogen. After acquiring the plant from Vattenfall in 2022, RWE continues to pursue the ambition of having the first of the plant's three 440-MW units run on (low-carbon) hydrogen by 2025. By converting the remaining units and switching to clean hydrogen by 2030, this is likely to become the world's first carbon-neutral hydrogen-fuelled power plant.

Researchers at Nefit Bosch are working on a hybrid condensing boiler, suitable for both natural gas as well as for 100% hydrogen. This concept would contribute to the affordability of a large-scale transition to hydrogen. The technology is already being tested in a large pilot project in the UK, in which 1,000 homes will be fitted with hydrogen boilers.

A consortium of more than 30 public and private partners, headed by DNV and glass manufacturer Celsian, has set up a two-year programme aimed at developing new industrial burners for high-temperature production processes. Its goal is to facilitate a fast and cost-efficient transition from natural gas to hydrogen.

Large-scale adoption of hydrogen as a transport fuel requires new technology for filling stations. Several companies, including HyET and Resato, have developed proven solutions for some of the related challenges, such as the need for affordable and reliable high-pressure compressors.

Nedstack is Europe's largest producer of PEM fuel cell stacks. Its technology is used by customers around the world and was key to developing the world's first megawatt-size power plant.
The company is currently closely involved with various projects to develop hydrogen-powered ships. For example, it is working with the shipping sector to develop a hydrogen-electric drivetrain for marine applications. A 100%-hydrogen-powered, 135-metre-long inland barge is being built, which will transport salt from Delfzijl to Rotterdam. Project partners are the NPRC, Lenten Shipping and engine supplier Koedood Marine Group.

Dutch hydrogen flagship projects

Flagship projects in the Netherlands show our efforts to improve current technologies of hydrogen production in different ways. These technologies could help solve issues in the global development of hydrogen by working together in partnerships with foreign industries, governments, research institutions and businesses. That way, our shared challenge of limiting the effects of climate change can be tackled together with partners all over the world.

Fuel Cell Giga Factory

Duration: Target stacking capacity demonstrated in 2027

Partners: Nedstack, Fincantieri, Symbio

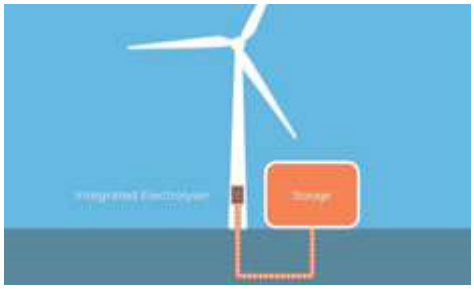
Nedstack, located in Arnhem (eastern Netherlands), is implementing a cutting-edge manufacturing system for fuel cells used in stationary and maritime applications. The Fuel Cell Giga Factory (FCGF) project is aimed at industrialising fuel cell production in the Netherlands to the gigawatt level. As part of the Hy2Tech project, the first Hydrogen IPCEI (Important Project of Common European Interest), the FCGF is a flagship Dutch project focused on advanced manufacturing.

Fuel cells are essential technologies that support the European climate agenda and energy security programme, and create green jobs. Fuel cell manufacturing has been identified as a Strategic Net-Zero Industry by the European Commission. As a leader in high-power/high-use PEM fuel cell technology for over 25 years, Nedstack is taking advantage of policy and market momentum to expand its eastern Netherlands supply chain and increase high volume production.

With support from the Netherlands Enterprise Agency, which has provided a grant on behalf of the Ministry of Economic Affairs, the FCGF project is making high-power fuel cell technology more accessible at lower costs, higher rates, and better quality. The Giga Factory will be capable of producing fuel cells from powder-to-power and aims to demonstrate its target capacity in 2027. This effort is set to provide fuel cell technology for the most challenging applications and contribute to the transition towards clean energy.

www.Nedstack.com

FUEL CELL GIGA FACTORY



Duwaal

Duration: Completion 2024

Partners: Dirk Barten, ENERCON, E-trucks, Municipality of Alkmaar, GP Groot, HVC, Stadwerk072, Spaarnelanden, New Energy Coalition, NXT, Development Agency Noord-Holland Noord (NHN), Participatiefonds Duurzame Economie Noord-Holland (PDENH), TNO, Toyota Material Handling, Toyota Nederland

Duwaal wants to organise the hydrogen demand and supply jointly and simultaneously in the north-west of the Netherlands. Duwaal was founded by a group of companies, including HYGRO. Collaboration is necessary to prioritise the projects in such a way that they help accelerate the breakthrough of the hydrogen economy. In February 2023 a DEI+ subsidy was awarded to kickstart the project.

The first joint initiatives realised are:

- Integrated hydrogen production in a wind turbine;
- Integrated high-pressure wind-produced hydrogen storage, transport and distribution system by road to at least five hydrogen filling stations;
- The joint purchase and management of 100 hydrogen-powered heavy vehicles or gensets.

By developing the chain simultaneously, a reasonable volume is realised from the start, the advantages of hydrogen are optimally utilised and the ‘chicken and egg’ problem is broken. In turn, this simplifies financing the chain. Subsequently other future hydrogen production or supply projects can join the integrated transport and distribution system and profit from lower costs resulted from scaling and increased volume.

www.hy-gro.net/en/duwaal

HYGRO

PosHYdon

Duration: Completion 2024

Partners: Nel Hydrogen, InVesta, Hatenboer, Iv-Offshore & Energy, Emerson Automation Solutions, NexStep, TNO, Neptune Energy, Gasunie, Noordgastransport (NGT), NOGAT, DEME Offshore, TAQA, Eneco

The pilot PosHYdon is the ultimate example of system integration in the North Sea. It is a world's first that green hydrogen will be produced offshore on an operational platform. Together with our partners, we believe that green hydrogen is vital to the energy transition. PosHYdon will teach us a lot about the next steps needed to be taken towards safe, large-scale green hydrogen production at sea. Offshore green hydrogen production will enable large-scale wind farms to be developed far out at sea. Wind energy is then directly converted to green hydrogen and can be transported through the existing gas infrastructure. As a result, offshore wind projects can be realised faster at significantly lower costs for the end users. PosHYdon aims to integrate three energy systems in the North Sea: offshore wind, offshore gas and green hydrogen. All by producing green hydrogen from demineralised seawater on Neptune Energy's Q13a-A platform.

"The Netherlands is in a special position as, in addition to an extensive gas infrastructure network, we can harvest large amounts of wind energy in the North Sea, quantities that are also important internationally. The wind energy can be used to produce hydrogen, which can then be transported onshore along with natural gas via existing pipelines for industry, the transport sector and Dutch homes. PosHYdon is key to accelerating this."

www.poshydon.com/en/home-en/

Holland Hydrogen I

Duration: Completion 2025

Partners: Over 150 partners, e.g. Thyssenkrupp, Worley, Gasunie, Port of Rotterdam, Visser & Smit bouw, Evides, Howden, Conpacksys, Siemens, Kraayvanger, Volker Energy Solutions, FBM Hudson

Shell, together with contractors and vendors, is building the first big renewable hydrogen plant of Europe (200 MW). Once operational in the second half of this decade, it will produce up to 60 tons of hydrogen per day. This is the equivalent of what 2,300 hydrogen trucks will need and is powered by offshore wind produced at the North Sea.

The Holland Hydrogen 1 (HH1) factory rises behind the dunes of the Dutch coast, at the Tweede Maasvlakte plains near Rotterdam, on land reclaimed from the sea. This is a significant Shell investment with financial support from the Dutch government and the European Union through IPCEI, and an endeavour involving more than 150 contractors and vendors.

The project provides an answer to the need for cleaner energy in heavy-duty cargo and industries, sectors that have limited options for other renewable solutions. The design incorporates circular materials wherever possible. The space around the plant will be turned into green retreats for birds and other small animals – to showcase how factories can be, and should be, built.

The HH1 project kickstarts the hydrogen economy of the Netherlands and will speed up society on its path to net-zero emissions by 2050 or earlier, including Shell's own operations and that of Shell clients and partner companies.

https://www.shell.nl/energie-en-innovatie/waterstof/welkom-waterstof.html

Green Shipping Wadden Sea

Duration: 2020 - mid 2024

Partners: Bredenoord, Nedstack, Electric Ship Facilities, Damen Shipyards, Groningen Sea Ports, Stichting Wad Duurzaam, Eekels TBI, Port of Harlingen, Hogeschool InHolland, Stokkel Engineering, Conoship International, Stichting New Energy Coalition, Bureau Scheepvaart Certificering (BSC), EQUANS, Port of Den Helder, Vereniging FME

Towards a fossil-free Wadden Fleet. The Green Shipping Wadden Sea programme aims to reduce CO2 emissions by 60% by 2030. With the programme, coordinated by FME, the port authorities, shipbuilders, suppliers, knowledge institutes and governmental parties want to lead the way internationally and set an inspiring example for clean and fossil-free maritime activities in the Wadden Sea region. Partners are working together to achieve the following goals:

- Accelerating innovations in the area of CO2-neutral and fossil-free shipping for the Wadden Sea fleet;
- Developing (port) facilities for low-emission and energy-neutral shipping (including generating energy-neutral shore power by using green hydrogen).

Ten sub-projects are to contribute to these goals and the overall aim of reducing carbon emissions. Five projects have already started and the other five are under development.

- H2 Ecolution: the flagship of the programme aiming to increase awareness of hydrogen-powered shipping.
- Green hydrogen in the Port of Den Helder: comprises two sub-projects, namely the construction of an electrolyser and the setting up of a test site for ships powered by hydrogen.
- Hydrogen for shore power: aiming to design, test and realise a mobile fuel cell generator in the Wadden Sea ports.
- Maritime Methanol Systems: development and small-scale testing of Direct Methanol Fuel Cell technology for maritime applications. Roll-out is envisaged for the recreational boating, fishing and brown fleet vessels.

www.greenshippingwaddenzee.nl

POSHYDON

GREEN SHIPPING Waddenzee

Five benefits of doing business with the Netherlands

1. Quality and reliability

We combine first-class technical expertise and innovative strength with a commitment to delivering high-quality, reliable products and solutions. Working with Dutch technology means you can be certain of compliance with the highest (European and international) standards.

2. An international outlook

We have been doing business abroad for centuries and understand what it takes to work successfully across borders and cultures. We are also regularly ranked as having the world's most proficient non-native English skills.

3. High-tech excellence

The Netherlands has a long history in high-tech innovation. In terms of the number of patents per capita, we rank second in the world and we are home to world-class research institutes in clean energy technology, global players in semi-conductor technology and excellent machine manufacturers.

4. Joint innovation

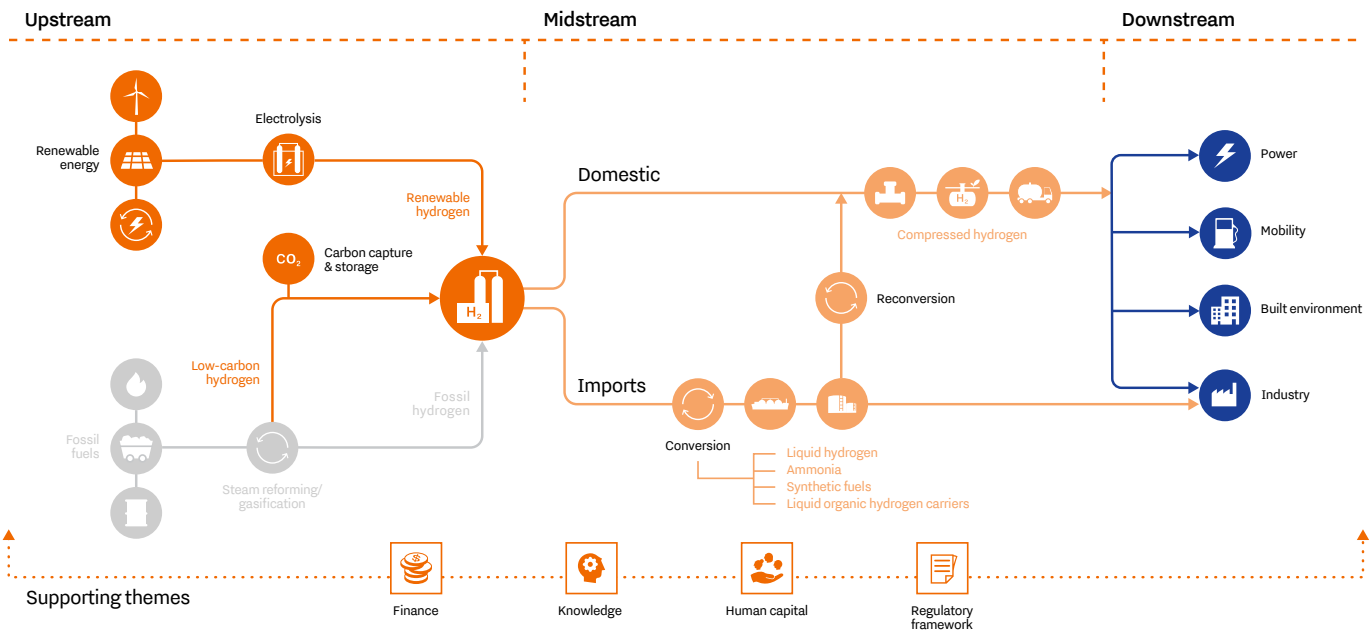
We strive to create flexible, fast-moving networks of specialist companies and research institutes and are proud of the dozens of 'field labs' in which such networks translate fundamental research into innovative solutions and test them in real-life pilot environments.

5. Easy access to specialist expertise

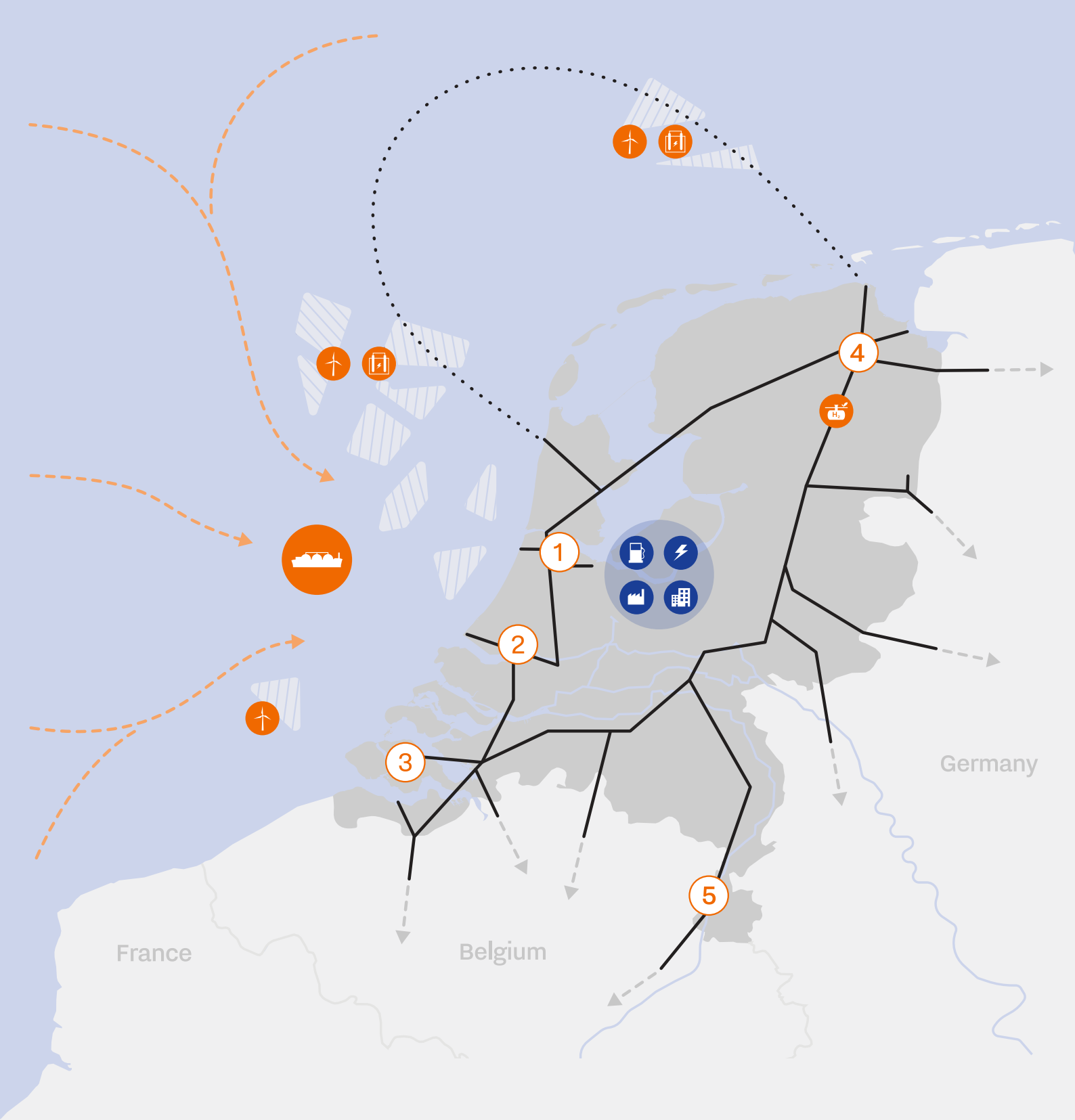
We have organised our clean energy expertise into national consortia. These networks offer fast and easy access to the right technology providers, researchers or combination of specialists. We all pursue a common goal: solving global challenges together.

Hydrogen value chain

A schematically depicted hydrogen value chain showing the steps from production (upstream) to infrastructure, transport and storage (midstream) to various end uses (downstream).



On the right: An outlook on the hydrogen value chain geographically visualised for the Netherlands.



Major industrial clusters

1. Amsterdam
2. Rotterdam
3. Zeeland
4. Groningen
5. Chemelot

- Upstream
- Midstream
- Downstream
- Onshore hydrogen network
- Offshore hydrogen network
- Electrolysis
- (Re)conversion
- Industry
- Offshore wind energy
- Import
- Power
- Storage
- Mobility
- Underground storage
- Built environment

Dutch hydrogen expertise

Looking for specific expertise or technological solutions? In this section, Dutch businesses and other organisations in the Dutch hydrogen sector introduce themselves and their portfolios. Consult the table on p. 28/29/30 to identify possible partners in your future hydrogen endeavours.

Creating international partnerships is essential to stimulate the global hydrogen economy

Nations worldwide are in transition towards a renewable-powered energy system to fight the threat of global warming. The latest IPCC report stresses the urgency to increase the speed and scale of renewable deployment to reach the goals of the Paris Agreement.

Hydrogen can, and - in my opinion - will play a key role in achieving the transition towards a climate-neutral and circular economy. Hydrogen has a multitude of potential applications across energy-intensive sectors. It can be used as feedstock and it can replace fossil fuels in high-temperature processes in our industry.
Due to its high-energy density, it is suitable for long-distance transportation purposes, and it can partially play a role as sustainable backup energy source for longer term, seasonal storages.

However, truly incorporating hydrogen into the global energy system remains challenging. The large-scale (sustainable) hydrogen production, development of a new European and international infrastructure, and a global hydrogen market are still in the early stages of development. This market is expected to become similar in form and magnitude to the current oil and gas markets. Especially because the climate challenges are global and hydrogen is only one of few alternatives available.

To achieve a truly integrated hydrogen system, it requires a cooperating international community. The Netherlands' enormous experience with natural gas, as the "gas roundabout" of North-West Europe, makes it an ideal and willing candidate for a substantial and constructive role within a hydrogen-based economy. Our ports and the fact that we are well-connected to other Northwest European countries provide a geographically strategic position that we can use to become the center of a European and perhaps a global hydrogen market. Furthermore, Dutch knowledge institutions and regional ecosystems, such as the green hydrogen valley, are extremely effective in translating ideas into practice within and outside the Netherlands. As this brochure illustrates, the Netherlands is also home to a wide variety of ambitious companies, ready to kick-start the European and global hydrogen market. In that perspective, I'm proud of the Dutch ambition to lead the development of hydrogen markets.

Activity in the Netherlands related to technological innovation and business developments is increasing. Creating international partnerships is essential to stimulate the development of a global hydrogen economy. It is our joint responsibility to turn initiatives into concrete projects and operational systems and thereby demonstrating hydrogen's full potential in a sustainable energy system.

We understand that realising hydrogen's full potential will take time in which considerable challenges must continuously be overcome. Our aim is to support you in achieving your projects, ambitions and goals.

Peter Molengraaf
Chair Top Sector Energy

TOPSECTOR ENERGIE
Empowering the new economy

	ELECTRICITY	H_2 PRODUCTION	ENGINEERING / INSTALLATION	INFRASTRUCTURE	FLOW SOLUTIONS	STORAGE	MOBILITY	MARITIME	INDUSTRY	BUILT ENVIRONMENT	INFRASTRUCTURE AND STORAGE	RESEARCH / ADVISORY	ASSOCIATION	PAGE NUMBER
&Flux												●		33
54events												●		33
ABB	●	●	●	●	●	●	●	●	●	●	●	●		34
ABC-Techniek B.V.			●	●	●			●	●		●			34
AECOM	●	●	●	●		●	●	●	●	●	●	●		35
AEG Power Solutions B.V.	●	●	●						●	●				35
Air Liquide		●	●	●	●	●	●	●	●	●	●	●	●	36
Air Products Netherlands B.V.		●	●	●		●	●	●	●	●	●			36
Alles over waterstof												●		37
AMF Bakery Systems – AMF Den Boer									●					37
Ansaldo Thomassen B.V.									●					38
Antonius				●		●		●	●		●			38
AquaBattery B.V.		●				●		●	●	●	●	●		39
Arcadis			●	●			●	●	●	●	●	●		39
AVK Nederland BV			●		●				●	●	●			40
Avoxt B.V.		●	●				●	●	●					40
BA2C														41
Bananaa Green Hydrogen Communication												●	●	41
Battolyser B.V.	●	●	●			●	●		●	●	●			42
Berenschot												●		42
Bosal	●	●					●	●	●	●	●			43
Bosch Rexroth B.V.				●	●	●	●	●	●	●	●			43
Bredenoord	●						●		●	●	●			44
BrigH2		●					●		●			●		44
Bronkhorst Nederland B.V.		●	●	●	●		●	●	●	●	●	●	●	45
Bürkert Fluid control systems		●			●		●	●	●	●	●			45
Stichting Cenex Nederland (Cenex NL)							●					●		46
CoheSys												●		46
Connectr - Energy innovation	●	●	●	●	●	●	●	●	●	●	●	●	●	47
ConPackSys B.V.			●	●	●	●			●		●			47
Corre Energy Storage						●								48
Cryoworld				●	●	●	●	●	●		●			48
Danfoss Drives	●		●	●	●	●	●	●	●	●	●			49
De Boer SPS		●	●	●		●			●		●			49
Deerns														50
Deltalinqs													●	50
Demaco Holland B.V.			●		●		●	●	●		●	●		51
Demcon		●	●				●		●			●		51
Desu Systems B.V.		●				●	●	●	●		●	●		52
Doeko B.V.		●	●	●		●		●	●	●	●			52
Dorhout Advocaten N.V.												●		53
Douna Machinery B.V.		●	●	●		●			●		●	●		53
Duiker Combustion Engineers			●			●			●		●			54
Dumaco Woerden B.V.			●											54
Dutch Boosting Group							●		●	●	●	●		55
Dutch Marine Energy Centre (DMEC)	●	●						●	●			●		55
DWG	●	●	●		●	●	●	●	●	●	●	●	●	56
E&E advies												●		56
Eekels Technology B.V.	●					●		●	●		●	●		57
Ekinetix B.V.	●	●	●	●	●	●	●	●	●	●	●	●		57
Ekwadraat Advies BV												●		58
Elestor BV		●				●			●					58
Eltacon Engineering BV	●	●							●		●			59
Enablemi												●		59
ENERCY B.V.			●	●								●		60
ENGIE Services Nederland N.V.	●	●			●		●	●	●	●		●		60
EnTranCe | Centre of Expertise Energy		●	●	●	●		●	●	●	●	●	●		61
EoxTractors B.V.							●		●	●				61
Erez Energy														62
ERIKS Nederland	●	●		●	●	●	●	●	●	●	●			62
E-Trucks Europe B.V.							●							63
EY | Ernst & Young												●		63
Feenstra			●							●				64
Technology Centre Europe Van der Klok Beheer BV / FINN BV		●					●	●				●		64
Fluidwell B.V.		●	●	●	●				●	●	●			65
Fluor		●	●	●	●	●			●		●	●		65
FME												●	●	66
Fountain Fuel				●			●							66
Frames Renewables		●					●	●	●	●	●			67
Fujifilm		●										●		67
Future Proof Shipping							●	●	●	●		●		68
N.V. Nederlandse Gasunie				●		●								68
gAvilar B.V.				●										69
Municipality Sudwest Fryslan		●				●	●		●		●			69
GF Piping Systems		●		●	●			●	●		●			70
Platform Groene Hart Werkt!													●	70
Groningen Seaports	●	●	●	●	●	●	●	●	●		●	●		71
H2ARVESTER	●	●	●						●	●	●	●		71
H2 Circular Fuel B.V.		●				●	●	●	●	●	●			72

	ELECTRICITY	H_2 PRODUCTION	ENGINEERING / INSTALLATION	INFRASTRUCTURE	FLOW SOLUTIONS	STORAGE	MOBILITY	MARITIME	INDUSTRY	BUILT ENVIRONMENT	INFRASTRUCTURE AND STORAGE	RESEARCH / ADVISORY	ASSOCIATION	PAGENUMBER
H2Hub Twente		●	●				●		●		●	●		72
H2O Systems Holland BV		●		●						●	●	●		73
H2Storage B.V.						●	●	●	●	●	●			73
H2Trac B.V.							●							74
HAN University of Applied Sciences				●			●	●	●	●	●	●		74
Hinicio												●		75
HOWDEN		●		●	●	●	●	●	●		●			75
Hy-Cell Co. Ltd.	●						●	●	●			●		76
HyCC		●					●	●	●					76
HyDevCo B.V.		●	●				●	●	●	●		●		77
Hydrogen Powered Solutions BV		●	●			●			●	●	●	●		77
TU Delft Hydro Motion Team			●		●	●	●	●						78
Hydron Energy		●					●	●	●	●	●			78
Hydronex B.V.	●	●		●			●		●			●		79
HyET Hydrogen B.V.				●	●	●	●	●	●	●	●	●		79
HyGear		●				●	●		●			●		80
HyMatters Operations B.V. / HyMatters Research & Consultancy B.V.	●	●	●	●	●	●	●	●	●	●	●	●		80
HyMove B.V.							●	●	●					81
Hysolar		●		●			●	●				●		81
Hystream B.V.	●	●		●		●	●	●	●	●	●	●		82
HYZON Motors Europe B.V.							●							82
Invest International														83
Kapp Nederland B.V.		●	●		●		●	●	●	●				83
Kenter B.V.				●										84
Kiemt													●	84
Kiwa	●	●	●	●	●	●	●	●	●	●	●	●		85
KLINGER The Netherlands		●	●		●				●		●			85
Koedood Marine Group	●		●			●	●	●	●			●	●	86
Koninklijke Van Twist	●								●					86
MAGNETO special anodes B.V.		●			●		●	●	●	●	●	●		87
Magnus Energy B.V.				●								●		87
Marsh Netherlands						●			●		●	●		88
Mechatest Sampling Solutions									●					88
Metalot Future Energy Lab												●		89
Mokveld Valves BV					●				●					89
MTSA Technopower B.V.		●				●	●	●	●	●	●			90
Micro Turbine Technology B.V. (MTT)	●		●						●	●		●	●	90
MV Energietechniek		●	●				●		●	●	●	●		91
Nedstack fuel cell technology								●	●	●				91
Neptune Energy Netherlands B.V.		●	●	●		●								92
Netherlands Enterprise Agency (RVO)												●		92
Nettenergy B.V.	●	●	●									●		93
New Cosmos - BIE	●	●		●		●	●	●	●	●	●	●		93
New Energy Coalition	●	●		●		●	●	●	●	●	●	●	●	94
NGT BV		●		●	●	●			●		●			94
Development Agency North Holland North (NHN).		●			●		●	●	●		●	●	●	95
NOGAT B.V.	●	●		●		●					●			95
North Sea Port				●				●						96
Netherlands Hydrogen & Fuel Cell Association NWBA													●	96
NXT Mobility				●			●							97
OCI Global		●		●			●	●	●					97
Port of Amsterdam	●	●		●			●	●	●		●			98
Port of Rotterdam	●	●		●			●	●	●		●			98
Power2X		●		●		●		●	●		●	●		99
Pro Control Process Automation BV					●		●	●	●					99
Proton Ventures BV			●			●		●	●			●		100
Province of Noord-Holland				●			●	●	●	●	●	●		100
Pure Water Group	●	●							●					101
PwC												●		101
RAI Automotive Industry NL							●	●	●			●	●	102
REDstack B.V.	●	●			●				●					102
Remeha										●				103
Resato International							●							103
Royal HaskoningDHV												●		104
SALD bv			●						●			●		104
Samotics									●					105
Saxion University of Applied Sciences							●		●	●	●	●		105
SHV Energy N.V.				●		●	●		●	●	●			106
Sia Partners	●	●		●	●							●		106
Siemens Energy B.V.	●	●		●		●	●	●	●		●			107
SoluForce B.V.				●	●									107
R. Stahl Electromach				●			●	●	●		●	●		108
Stork			●	●	●			●	●	●	●	●		108
Summit Engineering B.V.		●	●	●		●	●	●	●	●	●	●		109
SuWoTec B.V.		●					●	●	●	●	●	●		109
Swagelok Nederland					●		●	●	●	●	●	●		110
Tebulo Engineering	●	●	●	●	●	●	●	●	●		●	●		110
Teesing B.V.					●		●	●	●			●	●	111

	ELECTRICITY	H_2 PRODUCTION	ENGINEERING / INSTALLATION	INFRASTRUCTURE	FLOW SOLUTIONS	STORAGE	MOBILITY	MARITIME	INDUSTRY	BUILT ENVIRONMENT	INFRASTRUCTURE AND STORAGE	RESEARCH / ADVISORY	ASSOCIATION	PAGENUMBER
T.EN Netherlands B.V.		●	●						●			●		111
TKI New Gas (Topsector Energy)												●	●	112
TNO	●	●		●	●	●	●	●	●	●	●	●		112
To70 aviation												●		113
Torrgas bv		●	●						●			●		114
Toyota Material Handling							●							114
Tradinco Instruments					●		●	●	●	●	●	●		115
TSG Group									●	●		●		115
TSG Netherlands BV		●				●	●	●	●		●			116
TwynstraGudde												●		116
Van Campen Ecotechniek B.V.			●				●							117
Van Doorne N.V.												●		117
VDL Energy Systems B.V.	●	●			●	●	●	●	●	●	●			118
Veco B.V.		●					●		●					118
Vecom Group B.V.		●		●	●	●	●	●	●		●			119
Visser & Smit Hanab	●			●	●				●	●	●			119
VoltH2		●					●	●	●					120
VONK	●	●							●	●				120
Royal Vopak				●	●	●	●	●	●		●			121
Voyex B.V.						●	●	●			●			121
VTTI		●		●		●	●	●	●		●			122
Water Alliance													●	122
WE | doubleyouenergy B.V.	●	●	●			●	●	●	●	●	●	●		123
Wigersma & Sikkema B.V.					●						●			123
Witteveen+Bos	●	●		●		●	●		●	●	●	●		124
WSP	●	●	●	●	●	●	●	●	●	●	●	●	●	124
XINTC		●					●	●	●	●	●			125
zepp.solutions	●						●	●	●		●	●		125
Zeton BV		●							●			●		126

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Building new value chains – that is what drives us. We understand the complexity of transitions and know how to bring market, government, innovations, business cases, technology and policy together. In each of our focus fields (energy transition, raw-material transition, climate adaptation, circular), we have developed and initiated programs with a multitude of partners from business, government and society. Examples include the boosting of sustainable heat projects in the Amsterdam Metropolitan Area, CO_2 as a feedstock for future proof industry and developing international hydrogen value chains.

&flux initated several international hydrogen value propostions, one of them being an industrial import chain between north Africa and the Netherlands. In Estonia we established the hydrogen strategy for Port of Tallinn. Through our research and cooperation with business and government partners we have started to build on a new economic proposition with Port of Tallinn as the central node in the hydrogen ecosystem. Furthermore, we developed a hydrogen action perspective for the Estonian Aviation Cluster to help them become part of the Estonian hydrogen value chain. Our last initiative is setting up a hydrogen valley within Estonia, enabling companies and government to establish hydrogen projects along the full value chain. In the Netherlands, &flux works on the application of hydrogen in several business sactors such as horticulture and the flower and bulb sector.

54events: Dutch Hydrogen Days
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Every autumn, during trade fairs Zero Emission | Ecomobiel, Vakbeurs Energie and Industrial Heat & Power, 54events organizes the Dutch Hydrogen Days – an event with daily dedicated seminars and a hydrogen innovation award.

We organize trade fairs, conferences, seminars and summits in the context of the energy transition in The Netherlands. It is our mission to help people and organizations to enrich their expertise and strengthen their network so they can grow their businesses.

Dutch Hydrogen Days 2023:

- Tuesday 10 October: hydrogen in mobility.
  Hydrogen is gaining ground in mobility, especially for heavy transport by road, rail and shipping. Advantages are ease of use and flexibility. Condition: the availability of hydrogen filling stations – work in progress.
- Wednesday 11 October: hydrogen in the built environment.
  For the built environment, hydrogen is being looked at as a cost-effective alternative in the long run, for (electric) heat pumps and district heating. For its distribution, tests are carried out using the reuse of existing natural gas pipelines.
- Thursday 12 October: hydrogen in industry.
  The use of sustainable hydrogen is seen as an essential part of a climate-neutral industry in 2050. Especially in the chemical industry, sustainable hydrogen can eventually largely replace the use of natural gas.

The Dutch Hydrogen Days 2023 will take place in the Brabanthallen in ‘s-Hertogenbosch.
Free entry for professionals!

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ABB is a leading global technology company that energizes the transformation of society and industry to achieve a more productive, sustainable future. By connecting software to its electrification, robotics, automation and motion portfolio, ABB pushes the boundaries of technology to drive performance to new levels. With a history of excellence stretching back more than 130 years, ABB's success is driven by about 110,000 talented employees in over 100 countries.

ABB's broad portfolio encompasses the full hydrogen value chain from production, transportation, storage to consumption. We are working closely with partners and our customers to create the new hydrogen ecosystem.

Reference projects:

- ABB to install control solution for the automation of Lhyfe's first green hydrogen clean energy production project: new.abb.com/news/detail/62419/abb-to-install-control-solution-for-the-automation-of-lhyfes-first-green-hydrogen-clean-energy-production-project
- ABB will deliver automation, electrification and instrumentation solutions for the Hydrogen Energy Supply Chain (HESC) pilot project: new.abb.com/news/detail/39225/abb-to-support-asia-pacific-clean-energy-project
- ABB will provide a power and propulsion solution for a newbuild vessel operating along the Rhône river in France to run entirely on hydrogen fuel cells: new.abb.com/news/detail/24058/abb-to-enable-worlds-first-hydrogen-powered-river-vessel

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Over a period of three decades ABC-Techniek became a well-known and established system integrator for customers around the world.

Work together to find the best solution and a no-nonsense mentality are important factors that contribute to the growth of our company. Besides this our technical know-how, high internal standards of quality and the passionate drive for our areas of expertise are indispensable. Therefore, we can call ourselves an innovative player in the field of engineering, fabrication and renovating of control systems and electrical and instrumentation (E&I) installations.

ABC-Techniek is an ISO-9001 certified organisation with a proven knowledge along with experience in the design as well as delivery of control- and distribution panels for a power supply up to 690VAC and 3200A. Furthermore an extensive experience in wiring of electrical and instrumentation installations and finally an expertise in explosion protection. Our professional knowledge offers you an integral approach from the designing process to realization, pre-operational and start-up, maintenance and services.

ABC-Techniek provides products and services for the hydrogen and renewable energy industry, petrochemical and process industry (ATEX/IECEx). Our staff is certified to execute inspections in particular on electrical installation in hazardous locations. The professional competence is warranted by the IECEx 05 Certification of Personnel Competence (CoPC).

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AECOM provides decarbonisation professional and project delivery services to support clients to transition from carbon powered infrastructure to more sustainable alternatives. We help customers to decarbonise portfolios, transition to sustainable alternatives and deliver innovative energy solutions in the production, handling, and usage of hydrogen for a full range of mobility, heating and storage outcomes. We provide single-source multidisciplinary engineering, environmental, project and construction management services across the whole hydrogen value chain. Our combination of global experience and integrated technical capabilities delivers strategic solutions that improve and modernise infrastructure; enhance sustainability and resiliency; and benefit communities.

References:

- EPCM services for Shell's Hydrogen fuel stations (heavy and light duty infrastructure) across Benelux
- Design and delivery of filling points for Qbuzz's fleet of hydrogen-powered buses in Groningen, The Netherlands
- Feasibility and pre-FEED design support for world's first 100% hydrogen-fired gas turbine power station and conversion of an existing CCGT to 50% hydrogen blend in the UK
- Upgrade of Italy's historic Apennine diesel railways to hydrogen train transportation and supporting generation, including supply infrastructure
- Confidential site selection, engineering and feasibility services for blue and green hydrogen production facilities, UK
- Confidential green ammonia import facility environmental permitting and program support

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Since decades, AEG Power Solutions has ensured continuous availability of power and the safe operation of critical applications in all environments thanks to a wide portfolio of power supply systems and services. Our distinctive expertise spans AC & DC technologies and we have developed world-class engineering capabilities that span conventional and renewable energy platforms.

We leveraged our unique power electronics, grid integration and conversion expertise to develop power solutions supporting the energy transition, from wind power generation to energy storage and hydrogen production. AEG PS is a proven specialist for storage converters in On/Off Grid energy storage applications thanks to our bi-directional system, Convert SC Flex.

For hydrogen production, our high current rectifiers Thyrobox DC3 are a solution of choice to supply power for the electrolysis process. We provide the complete power block (transformer + rectifier) solution with the integrated grid compliance requirement and low losses. The power blocks ranges from 500 kW – 10 MW blocks which can be connected together to supply the electrolyser cells for large scale projects above 100 MW. AEG PS is working with electrolyser OEM's, EPC's and integrators to support them with our power solutions. We have been an active player in this field for over 8 years and have developed a field expertise to best support our customers.

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Air Liquide, your strategic business partner to accelerate a hydrogen society in Europe.

Reducing CO2 emissions has become a major challenge, in particular for industry and heavy-duty mobility key players. To meet this challenge, Air Liquide has a comprehensive portfolio of technology and service solutions to support the decarbonization efforts of its customers around the world, from the supply of low-carbon industrial gas to active CO2 capture.

To decarbonize the planet, hydrogen plays a key role. The Air Liquide Group's unique expertise in this field dates back more than 50 years. Its technologies are widely used throughout the low-carbon hydrogen supply chain, from production to storage and distribution. This technological expertise has already enabled Air Liquide to forge numerous strategic partnerships to accelerate the activation of hydrogen markets, together with worldwide leading players in key industrial basins.

The momentum is there, and almost everything is actually in place to scale up a hydrogen economy, especially in Europe: early markets coming on stream, initiated efforts to align for deployment, existing supporting policies, a systemic need, a strong technological potential as well as signs of societal acceptance.

Joining forces is essential to accelerate the role of hydrogen in the energy transition!

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Air Products has been a leading global producer of industrial gases for more than 80 years. With a strong focus on energy, environment and emerging markets, Air Products supplies essential industrial gases and related equipment to dozens of industries including refining, chemicals, metals, electronics and food and beverage.

Air Products is the world's largest hydrogen producer. We believe that hydrogen, the most abundant of all elements, will be the solution – the future of energy. Through our partnerships we are already working towards a hydrogen-based world where hydrogen and fuel cell technology will play a central role in decarbonizing heavy duty vehicles and industry. Air Products is active throughout the complete hydrogen value chain including production, distribution, storage and dispensing and has been at the forefront of hydrogen refueling for decades. Air Products has experience with more than 250 hydrogen refueling station projects in 20 countries. Air Products' technologies are used in more than 1.5 million refueling operations annually.

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We focus on the societal acceptance of Hydrogen. For this we host one of the major Dutch Hydrogen Websites. And we organise the 'Hydrogen Experience', practical and interactive workshops on Hydrogen for Companies, Schools and Government institutions.

In these workshops we let people actually experience Hydrogen by making it, storing it and using it in many ways during the event. And we advise others on how to involve stakeholders in their Hydrogen projects. We believe the end users should be involved from the beginning and not at the end.

We organise practical and interactive workshops on Hydrogen for Companies, Schools and Government institutions. In these hands-on events we let people experience Hydrogen in many different ways. We make Hydrogen, demonstrate how our (miniature) Hydrogen car works, show our Hydrogen scooter and our Hydrogen Drone. And we bake some Dutch pancakes on our Hydrogen Stove.

It is an ideal event if you are looking for Hydrogen inspiration as a kick-off for Hydrogen Projects. But we also love to visit schools to teach children and students, communities or inspire business teams.

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Bakeries and food producing companies around the world partner with AMF Bakery Systems – inclusive of AMF Tromp and AMF Den Boer – for best-in-class unit equipment and complete system solutions, from mixer to marketplace. Through innovative, precision engineering informed by our master bakers' expertise, AMF designs integrated production solutions for soft bread and buns, artisan bread and rolls, pizza and flatbreads, cakes and pies, pastries and croissants, and beyond. Single units machines and complete lines, at market standard and sometimes tailor made is what we offer and market for many years. Den Boer is our oven building company, where we produce production ovens, tunnel ovens or band ovens for many food applications, like bread, cake, muffins, pizza, pie, pastry , crackers, rusk, cookies and many more. AMF Den Boer has introduced the world's first Hydrogen fuelled tunnel oven, than can bake at 0,0% emission and thus improve the bakery footprint immediately. Our Hydrogen burners can be retro-fitted onto existing ovens, and also Hybrid models are available, where natural gas and Hydrogen are combined, to make a first sustainable step for bakeries, until prices of Hydrogen drop more.
AMF Europe is part of a global company with facilities in the United States, Latin America, United Kingdom, the Netherlands, China, and Singapore, collaborating with more than 600 teammates worldwide.
With a mix of global networking and local charm, the AMF Europe teams encompass a culture of passionate people who are committed to developing better food and better lives for their teammates, families, customers, and community.

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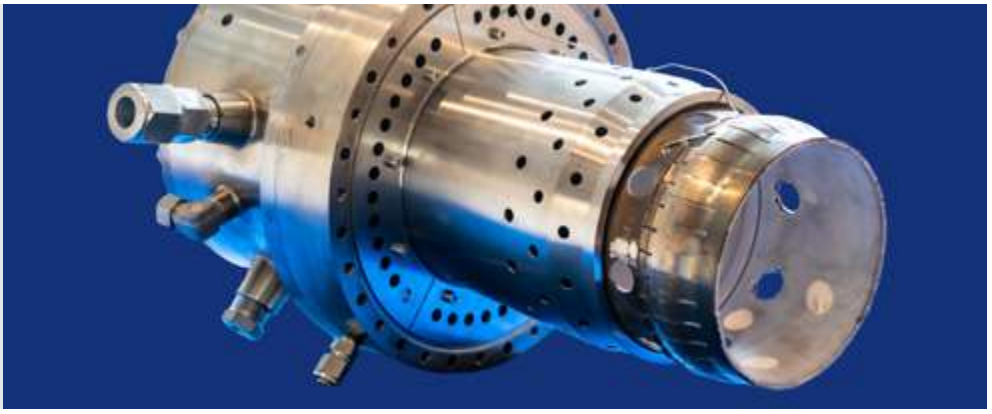

Ansaldo Thomassen (ATH) is a leading supplier of technologically advanced aftermarket gas turbine components, performance upgrades, in-house component repair and outage services for existing GE heavy-duty gas turbines. We offer flexible and comprehensive Service Agreements (FSA's), ranging from parts supply and reconditioning to full scope agreements including remote monitoring and diagnostics and inventory management.

Our vision is to supply cost effective advanced retrofit solutions for a Clean Energy World. ATH is leading a consortium targeting the demonstration of gas turbine retrofit technology for hydrogen. Together with our partners we are currently working on our High Hydrogen Retrofit Project.

Major objective of this project is to develop a cost-effective ultra-low emission (sub 9ppm NOx and CO) combustion system retrofit for existing installed gas turbines in the output range of 1 MW to 300 MW. At the centre of this innovative high-technology project is the patented and novel aerodynamic trapped vortex FlameSheet™ combustion technology platform. Fuel flexibility and stable operation from 100% natural gas to 100% hydrogen and any mixture thereof, is a key requirement.

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The energy transition is taken place right know and we are living it together. Green hydrogen will play a key role in regulating our energy needs based on supply and demand. Therefor the storage of renewable energy and the infrastructure is an important part of the whole process.

Antonius can be your industry partner for storage and transport design of energy. We are an experienced fabricator that can design your production process and build your newly developed product. Your idea will be transferred into a design ready for production. As your partner we will take care of the complete project management, fabrication and assembly of your product. Over 80 years of craftsmanship in shaping metals brought us to the level we are at right now. With our extensive knowledge of materials and production methods, with the best qualified welders in the industry and our special machines we can produce high quality products against all applicable standards. Our craftsmanship is the reason why customers and engineering firms do contact Antonius at an early stage.

We have an ideal situated production location (40,000 m^2) with a direct waterside connection, to transport big parts by ship worldwide.

Meet our strength and challenge us to experience our craftsmanship. Let's work together and make this green deal! ANTONIUS.

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AquaBattery is a deep-tech company based in the Netherlands working to revolutionize green energy storage. Our mission is to cut energy bills and catalyse the development and uptake of renewable energy technologies across the EU and beyond. We recognize that renewable energy is only part of the solution, and only through pairing it with cheap and scalable energy storage solutions can truly make an impact. AquaBattery was founded in Leiden in 2014 to commercialize the world's cleanest energy storage solution: a battery that can store renewable energy in water and salt (such as seawater). Our team is composed of leading experts in water membrane technologies and the energy storage industry, combined with the leadership of visionary founder Dr. Jiajun Cen. Together, the team combines 50+ years of engineering experience with 25+ years in business and management.

We are supported by a network of exceptional partners, such as Climate-KIC, TU Delft, The Green Village Delft, and technical experts at Imperial College London, REDStack, and Wetsus. Our technology has been successfully demonstrated through several prominent installations in the Netherlands and in Italy and has reached TRL 6. Our saltwater battery is a flow battery where power and storage capacity are decoupled. The user can decide on how large the respective components of power or storage capacity need to be in other to suit the application. The cost for scaling up the storage capacity is low, one just need a larger tank, some salt and water. At locations where space is not the limiting factor, we can realise virtually unlimited storage capacities. This makes our battery very well suited for long-duration storage (10+ hrs).

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Arcadis is a worldwide operating engineering company with 250 offices around the globe. With sustainability at the heart of everything we do, our focus is on maximizing our impact aimed at improving quality of life.

The solutions we develop address important societal challenges around resilience, places, and mobility. Leveraging data and technology, we have the capabilities and services to meet client demands driven by global trends such as urbanization, climate change, digitalization, evolving stakeholder expectations and potential unforeseeable events. We embed sustainability across everything we do and apply our wealth of expertise and skills to deliver client solutions that are competitive, resilient, effective, and within planetary boundaries.

The world has changed the way we live and work. Unexpected events and megatrends such as rapid urbanization and climate change are putting pressure on communities, cities, and resources worldwide. As a business, we want to maximize our impact by harnessing the power of technology and data to develop solutions to today's global challenges. We are focused on improving the way resources are utilized, protecting our environment, creating transporting solutions, and planning for the places where we can enjoy our work and home lives.

We differentiate ourselves through our talented and passionate people, our unique combination of capabilities covering the entire asset lifecycle, our deep market sector insights, and our ability to seamlessly integrate health and safety, sustainability and digital components into the design of our solutions around the globe.

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AVK Nederland is part of the AVK Group, market leader in the field of appendages in the segments: water, gas, wastewater, fire protection and industry. Our range consists of a wide variety of valves, fire hydrants, couplings, street covers and accessories that all meet the highest standards in terms of safety, durability and quality.
Every day, AVK solutions help deliver clean water and sustainable energy to millions of people in households and industries all over the world. We assist in transporting, treating and reutilizing wastewater, and in assuring safe, secure surroundings ready to battle unfortunate events of fire. We work towards a better, more sustainable future, where natural resources are used and managed wisely. We want to make our performance on social responsibility concrete and objectively demonstrable by means of the CSR Performance Ladder certificate, level 4.
AVK would like to contribute to a successful and safe energy transition. Hydrogen can become an important link in the energy supply of the future. It is a sustainable option as a raw material and energy carrier. Moreover, the infrastructure needed to transport and store it is already largely available in the Netherlands. With AVK gas valves you are ready for the future with our KIWA certification for hydrogen. AVK also contributes to projects testing hydrogen distribution. In the Netherlands gate valves are supplied to a project with TU Delft 'The Green Village' where 100% hydrogen is being tested.

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Avoxt is a pioneering company that specializes in the development of high-efficiency hydrogen electrolysis technology. Their innovative electrolysis systems use alkaline electrolysis technology to convert water into hydrogen and oxygen with exceptional efficiency.

The technology is highly efficient, making it a more cost-effective and sustainable solution for producing hydrogen.

Avoxt's electrolysis systems are modular, compact, and easy to integrate into existing energy systems. They can be used in a variety of applications, including energy storage, transportation, and industrial processes. Avoxt's systems are also highly flexible, allowing them to adjust to varying electricity inputs, making them an ideal solution for balancing the grid and managing intermittent renewable energy sources.

Moreover, Avoxt is committed to sustainability and reducing carbon emissions. By providing a clean and efficient way to produce hydrogen, Avoxt is helping to reduce dependence on fossil fuels and promote a more sustainable future for generations to come.

Overall, Avoxt's hydrogen electrolysis systems offer a highly efficient, sustainable, and cost-effective solution for producing hydrogen using alkaline electrolysis technology. With their commitment to innovation and sustainability, Avoxt is well positioned to play a leading role in the transition towards a carbon-free future.

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BA2C Europe / Latin America (BA2C) is a green hydrogen and renewables chemicals/fuels/electricity project developer. It is our aim to be (one of) the first project developers introducing new, but most efficient, technologies to produce green ammonia (NH_3), methanol (CH_3OH), synthetic fuels from renewable electricity, municipal and organic waste feedstock. In this way we decarbonize existing brownfield industrial production sites (to make use of the existing assets) or set-up greenfield plants in areas where renewable electricity, municipal and agricultural waste is cheap. BA2C cooperates in its projects together with leading technology developers from all over the World.

With our knowledge with energy transition and industrial transformation BA2C also advices companies and ports to define best strategies to become energy efficient and reduce CO_2 emissions while keeping a good and interesting business case.

BA2C also invests in other green molecule development projects. Examples are the well-known Liquid Wind initiative (to produce renewable methanol from biogenic CO_2 and green hydrogen) and HyAPC, a venture of BA2C. This last Netherlands technology is an oxy-fuel combustion technology using green hydrogen and green oxygen (both from an electrolyser). In future we are convinced HyAPC will play an important role to balance the (renewable) electricity system. Another activity of BA2C is guiding and supporting scientists to develop new generation technologies.

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Bananaa Green Hydrogen Communication focuses on providing insight and imagination of this large-scale energy transition. The result is a shareable digital model that shows European and national governments, the public and the media how this global green hydrogen energy system works and where direction is needed

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Battolyser Systems

Battolyser Systems develops and manufactures the world's first electrolyser with an operating range of more than 100%: the Battolyser®.

That is because a Battolyser® is a battery and electrolyser in one unified system. The patented technology can store and supply electricity as a battery, but during loading and when it is fully charged, it automatically starts splitting water from the electrolyte into hydrogen and oxygen as an electrolyser.

Thanks to its ultimate flexibility which allows to follow any renewables load curve and an outstanding overall efficiency above 80%, we can deliver the lowest Levelised Cost of Hydrogen, while balancing the grid for societal demand.

Battolyser® only uses the abundantly available materials Nickel and Iron and is hence a suitable solution of large scale hydrogen projects.

Battolyser Systems is a Delft University of Technology spin off and has Koolen Industries as the main shareholder. It plans to build a production facility of 1GW nameplate capacity in partnership with Port of Rotterdam.

Commercial demonstration units of 1-5MW are to be delivered in 2024, followed by large scale commercial series production in 2025 onwards for global roll-out.

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Berenschot

We work with Dutch and European organizations in the energy sector, users, industries and governments to conduct system studies, roadmaps, strategic- and policy advice. Our services related to hydrogen are embedded in a systemic view:

Scenario studies: we provide insight into the consequences of choices with regard to our energy system, both economically and energetically. Recently, we developed four national scenarios for a low carbon future in 2050 (II3050). In all scenarios hydrogen (green & blue) plays a pivotal role in system balancing, storage and decarbonisation of sectors.

Flexibility and system integration: we provide support in quantifying the potential and feasibility of flexibility measures like power-2-gas and hydrogen storage. Currently, we are developing a blueprint for a Hydrogen Exchange in the Netherlands. We analyse the technical, energetic and economic consequences of flexibility measures in the short and long run. We often work together with the energy industry.

Techno-economic analysis: we help to translate ambitions into plans for technology options like heat pumps, heat networks or carriers like hydrogen in order to arrive at the best future-proof solution with low costs and high durability.

Implementation of the strategy: we have extensive experience with organizations that operate in a mix of a regulated playing field of government and business. We help you with your strategy, design of the organization and the optimization of business processes.

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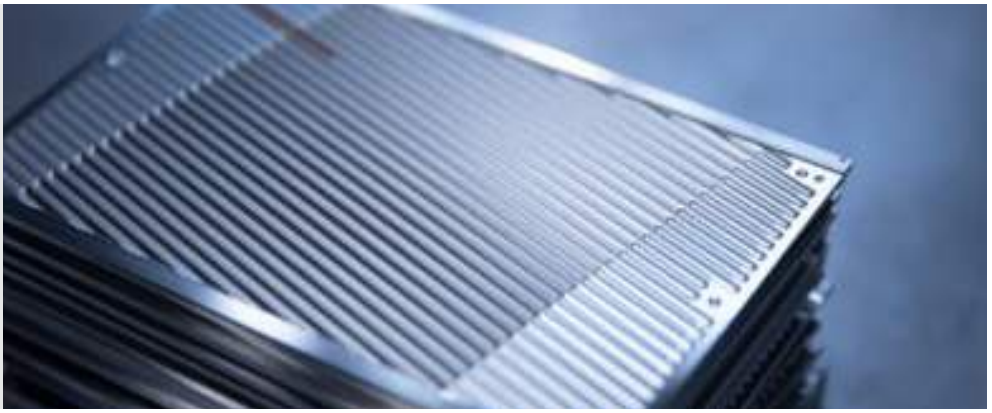

BOSAL is a family-owned company founded in 1923 in the Netherlands.

With more than twenty-five years' experience in the energy sector, BOSAL is determined to take a leading position in the emerging hydrogen market.
We provide proven solutions for numerous hydrogen related technologies which have an important role in the near future, such as Solid Oxide Fuel Cell Technology (SOFC) and Solid Oxide Electrolysers (SOEC).

BOSAL's main competitive differentiator is our offering of our ultra-thin foil high temperature heat exchangers integrated in a hot balance of plant, which combine highest effectiveness with low back pressure in very compact designs.
To increase the level of integration, BOSAL's heat exchangers can be supplemented with a number of value-adding features as: integrated catalytic oxidative and reductive coatings, protective coatings, integrated mixers, insulation and piping.

To offer its customers tailor-made solutions, BOSAL formed successful engineering and research partnerships with several leading industry players.

We have more than 1,700 employees supporting our mission in 16 manufacturing plants and distribution centers and 6 R&D sites worldwide.

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Green hydraulics: basis for efficient H_2 supply. The political framework is in place. Now it is important to find the right technologies for the rapid introduction of green hydrogen. Hydraulics is one of them, as it can compress hydrogen highly efficiently and safely. Last but not least, filling stations are thus particularly reliable and energy efficient.

Proven industrial hydraulics solutions are a major help in building the H_2 infrastructure. With Bosch Rexroth as a partner, the players benefit from needs-based support. This ranges from robust and safe components to engineering support and complete solutions.

When setting up H_2 filling stations, manufacturers and operators can choose from several approaches: For H_2 compression up to 900 bar and a delivery rate of approx. 100 kg/h, either highly dynamic cryogenic pumps or highly efficient compressors with linear or rotary drives can be considered. If smaller delivery rates are required, servo-hydraulic compact axes generate advantages because they require little space, especially for retrofitting in urban areas, and can be put into operation quickly thanks to the Plug & Produce preconfiguration.

Safety shut-off blocks and valves from Bosch Rexroth also prove their worth when transporting H_2 in pipelines. In addition, the hydraulics expert's close-knit service network creates the best conditions for optimum on-site maintenance.

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Bredenoord is an independent family-run business that develops, supplies, maintains and operates the most reliable and cutting-edge decentralized energy systems worldwide and, consequently, provides its customers with energy security. Bredenoord continuously works on developing the energy solutions of the future and is one of the initiators in developing hydrogen applications in mobile and temporary energy, with a focus on sustainability, low emission and safe operation. Development of the first hydrogen genset started as early as 2006 and resulted in the Purity in 2009, which has powered various events, among other projects. With over ten years of experience with the Purity, Bredenoord continues the development of a hydrogen genset and takes part in various demos and pilots.

Through a clever combination of fuel cells and battery packs the Purity can be used straight away for projects with a low power demand. Bredenoord keeps aiming for innovative use of hydrogen technology for mobile power installations and, for example, also researches the use of hydrogen in combustion engines for gensets. These various research projects take place in collaboration with a variety of partners. Bredenoord is always open for new collaborations in this field.

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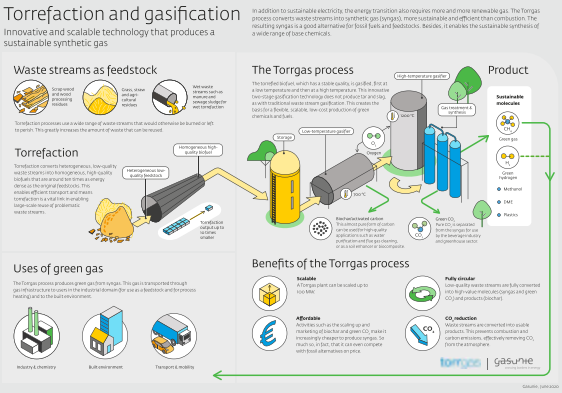

BrigH2 : The Renewable Alternative. BrigH2 plans to start a 50 MW gasification unit to produce 6300 mtpa renewable hydrogen, pure bioCO_2 and Biochar. The Demonstration plant will be situated on Brightlands Chemelot Campus and will serve the industrial users on the Chemelot site, but also intends to produce Fuel Cell grade Hydrogen for the mobility sector.
The project is in the feasibility phase at the moment. The location of the plant on the Chemelot campus fits exactly with the circularity target of the campus and the site. The feedstock will be torrefied biomass, where torrefaction does create a significant extension of the area where the biomass is gathered. Torrefaction also creates an uniform feedstock for the delicate process, reducing the investment costs per ton of renewable hydrogen to the max, but has proven itself in the quality of the syngas produced and the potential for uninterrupted continues production.
Next to the hydrogen production, BrigH2 also provides a long term sustainable route for CCU processes due to the biogenic origin of the CO_2 produced, as well as negative CO_2 emissions by connecting to the CCS infrastructure under development on the Chemelot site. Alternatively the CO_2 prevents an additional fossil CO_2 emission once applied in greenhouses.
The Biochar is of exceptional quality and suitable for a large number of applications now dependent on petrochemical coke of low sulfur.
The technology is developed in Groningen on a 1 MW scale and is further scaled towards a 2 x 12.5 MW unit to produce Methane from syngas in Delfzijl.

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Bronkhorst

Bronkhorst is leader in low flow fluidics handling technology. The small robust flowmeters of Bronkhorst are very well suitable for testing fuel cells and electrolysers, both for research and production applications. Our instruments are ideally suited for delicate control of the pressure or flow of single gases, liquids or fluidic mixes to support development and quality issues. We also support improvements to LOHC (liquid organic hydrogen carrier) and hydrid hydrogen carrier technology. The IN-FLOW range of instruments can be applied to measure high quantities of hydrogen at production sites. Because we offer low flow liquid flow control technology as well, our instruments are used in odorant delivery to hydrogen or natural gas that are injected in gas grids.

Bronkhorst offers an extensive product range of thermal, Coriolis and ultrasonic flow meters and flow controllers for low flow rates of gases and liquids. Its flow instruments are used for a variety of applications in laboratory, machinery, industrial and hazardous areas. By sharing their knowledge and closely cooperating with OEM customers and research organisation in the field, Bronkhorst develops customer specific low flow solutions, e.g. of multifunctional, pretested modules or skids for gas, liquid of vapor flow control.

Bronkhorst is a truly world-wide organisation with an extensive network of distributors and service stations across Europe, the Americas, Africa, the Middle East, Asia Pacific in Japan.

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bürkert
FLUID CONTROL SYSTEMS

Bürkert Fluid Control Systems is one of the world's leading manufacturers of measuring, control and regulating systems for liquids and gases. Bürkert products are used in a wide range of industries and applications, ranging from labs to medical, bio-engineering and aerospace technology. With a portfolio of more than 30,000 products, Bürkert is the only supplier to offer all fluid control system components, from solenoid valves to process and analytical valves, from pneumatic actuators to sensors.
With its headquarters in Ingelfingen in Germany, the company has a wide-ranging sales network in 36 countries and more than 3,000 employees. Bürkert develops customized solutions and innovative products at its five Systemhaus locations in Germany, China, and the USA. The product portfolio is topped off by extensive services, from consulting and conception, through implementation, to maintenance and training.
A rule of thumb applies in the language of engineers: the quality of a system is proportional to the quality of its components. In fact, the peripherals are coming more to the fore among experts – with control and regulating system modules as well as intelligent process related coupling of these components. This is where Bürkert has been active for over 60 years. As one of the few providers who can cover the entire process chain involving measuring, controlling and regulation.
It is no wonder, that the Bürkert product range includes precisely those components which are optimal for use in hydrogen technology: certified modules with low power consumption, a wide temperature range, chemically resistant properties and a good price-performance ratio.

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Cenex NL is an independent not for profit research and consultancy organisation on zero emission mobility and related infrastructure, and the circular economy with regards to mobility. Cenex NL is not driven by shareholders or returns-on-investment and was founded in 2018 for the purpose of accelerating transition to clean transport by providing technical expertise and disseminating lessons learned across Europe.

Cenex NL is a strategic partner of the UK's first Centre of Excellence for Low Carbon and Fuel Cell Technologies (Cenex UK – est. 2005). The Cenex organisations are established players in the European hydrogen community through:

- Active on-going participation in European R&D work:
  - H2ME (2016-2022): EU's largest FCEVs and refuelling infrastructure demo;
  - ZEFER (2017-2022): Commercial and operational viability of high-usage vehicles;
  - HyTrec2 (2014-2020): Hydrogen vans, trucks and refuse collection vehicles in North Sea Region.
- Market studies that analyse the European hydrogen market, enabling conditions and policy landscapes for technology take-up.

We offer expertise to automotive industry, early adopters of FCEVs and policy makers looking to implement strategies to accelerate the use of clean hydrogen in mobility. Examples include:

- Performance analysis of vehicle and refuelling infrastructure at real-world operations;
- Customer value proposition and business case of hydrogen in land transportation;
- Life Cycle Analysis of FCEVs and refuelling infrastructure.

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CoheSys is a consulting company on metallurgical and/or production related issues. With more than 30 years of working experience we have done many projects in high (and low) tech environments. Our projects include setup for laboratory scale production up till mass production. We are busy in semiconductor production and the nuclear industry, but find ourselves equally at home in a foundry.

We excel in fast and reliable literature search and advice and train your people in metal and hydrogen related questions. We understand production in all stages, from drawing board till mass fabrication. If you don't know how to start or how to scale your production process up to the next level: call us.

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CONNECTR
energy innovation

Connectr, where new energy innovations emerge and grow. The Province of Gelderland has a strong energy cluster centred in Arnhem, where Connectr is located. Arnhem is known as the Hydrogen Tech capital of The Netherlands due to the concentration of SME companies in the value chain of high tech hydrogen solutions. By ensuring the vitality and growth of that cluster, Connectr contributes to the energy transition, the regional economy, and the human capital agenda. The strength lies on the implementation level: new ideas are immediately tested and put into practice from Connectr, and they can grow from there.
Connectr is a triple-helix foundation funded by public and private parties as well as knowledge institutions. Partners are the city of Arnhem, The Province of Gelderland, HAN University of Applied Sciences including SEECE and ACE, Development companies as OostNL and KiEMT, IPKW, Generation E and many energy related companies resident in Connectr or the region or actively connected with projects.
Connectr consists of an Innovation Program, an Innovation Lab and Shared Facilities. In the midst of these components, the Core Organization provides connection, reinforcement, and acceleration.
Focus strengthens the contribution to the global energy transition. That's why Connectr focuses on three key technologies that are already developing strongly in the region and that will add value on an international level.

1. Power systems engineering
2. Electrochemical energy storage
3. Sustainable drive systems

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ConPackSys

ConPackSys is an engineering firm located in Dordrecht, the Netherlands close to the Rotterdam and Antwerp harbours. We specialize in the engineering, packaging, construction and commissioning of compressor systems for the industry. This entails the technical design, fabrication and testing of the compressor itself but also its auxiliary systems; drivers, process equipment (coolers, separators), piping, control and instrumentation, noise enclosures and lube oil systems These are all required for safe and sound operation of the compressor. ConPackSys has experience with applications for hydrogen and carbon dioxide(including Carbon Capture and Storage).

Compression is going to be important throughout the hydrogen value chain. Compression is required for storage of hydrogen, for transportation from A to B and also at the end-user. Hydrogen can be converted to green chemicals, to generate electricity or is used in mobility. ConPackSys is able to provide solutions for each of these applications with compressor duties ranging from 10 kW up to 10 MW. We specialize in tailor made and turn key systems for our clients.

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Corre Energy Storage is a Dutch, Groningen headquartered business, that develops large scale renewable energy storage. The technique we use is called Compressed Air Energy Storage (CAES). We aim to develop several projects across Northern Europe, enabling the integration of renewables at large-scale and catalysing the energy transition and the Green Hydrogen Economy. Corre Energy wants to develop its first CAES project in Zuidwending, the Netherlands through its subsidiary Corre Energy Storage. CAES provides an energy balancing solution for both TSO's and renewable energy portfolio operators, without which countries like the Netherlands will be unable to reach the targets of 70% renewable energy by 2030.
Why this project? In order to guarantee a sustainable future – also for future generations – CO_2 emissions in the Netherlands (in Europe and throughout the world) will have to be reduced drastically. In accordance with the Paris Climate Agreement, as society we produce more solar and wind energy every year. However, this growth also has its limitations. For example, the wind and the sun cannot be influenced, which means that sometimes too much and sometimes too little green electrical energy is produced. On days when more energy is produced than the market needs, installations sometimes have to be switched off, causing the loss of valuable energy and investments. On days when too little green energy is produced, natural gas has to be used and CO_2 is released. In short: it is very difficult for society to accurately absorb fluctuations in the electricity network without wasting energy or emitting CO_2. The Corre Energy Storage project in Zuidwending offers the solution for these problems.

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Cryoworld BV is a development company specialized in high-tech cryogenics in general. In recent years we have used our decades of experience for applications in Liquid Hydrogen.

Through our in-depth cryogenic knowledge and experience in building advanced cryogenic installations for (scientific) applications (LHe, LAr, LH2, LiN, LOx) we have experienced that we can offer excellent and efficient designs and build solutions for LH2 applications.
Our experience goes back many years. We have built for example the LH2 infrastructure for the Tokio Olympic games, and delivered in 2015 our first equipment, and rocket test benches for liquid hydrogen and oxygen.

We are particularly proud that major international operating gas suppliers, with their own in depth knowledge of liquid hydrogen, use us to build and/or design parts of their important LH2 products and systems.
We can deliver the following products as a standard or bespoke item:

- Flexible metallic LH2 transfer-hoses with couplings, low heat load, self-closing
- Transfer units
- Storage dewars with low boil of rates, depending on demand and size
- Lab scale liquefiers
- Pump systems
- LH2 bayonet couplings, DN10 to DN40, in straight or 90° version, with optional filters, pressure relieve valve and/or non-return valves

Next to this we develop new systems in close cooperation with some customers.

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Danfoss

ENGINEERING
TOMORROW

Get on target with Hydrogen. Danfoss enables its customers to deliver the most sustainable Green Hydrogen. We can provide a grid-friendly, approved solution with impressive energy efficiency. Low harmonics and a high power factor ensure a competitive power supply for the electrolyzer at hand. With long experience in power conversion combined with a leading position in the world, Danfoss is an ideal partner for investment in the emerging hydrogen market. Our experience ensures that a system is fully scalable and economically viable.
Make use of expert application know-how from Danfoss professionals all over the world:

- Danfoss technology improves stability of the power supply by supporting a diverse range of energy generators and energy storage systems.
- We can reduce the capital investment required for grid infrastructure. Certified for grid code compliance in a wide range of countries, we enable fast system certification for system integrators.
- We mainly are working through OEM and System Integrators.
- At our Application Development Center (ADC) in the Netherlands we can support with engineering, testing (up to 2MW) and simulation facilities.

Optimizing the use of renewable energy and stabilizing the grid is a precondition for a cost-effective transition to a decarbonized energy system. The Danfoss portfolio consists of Drives, DC/DC converters, Grid converters, Active Front End, Motor Drives, Heat exchangers and Valves.

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De Boer
Sustainable Project Solutions

De Boer SPS is founded in 2008 and is an independent company specialised in development of new sustainable energy techniques and business. Examples are projects related to (bio) LNG, production of bio gas, bio methanol, energy from waste concepts etc.

De Boer SPS has developed logistical solutions for the storage and transport of gasses including hydrogen for several customers. New techniques like LOHC and liquid hydrogen where considered and further developed for upscaling and use. Furthermore, De Boer SPS has developed several concepts for (bio) LNG distribution and storage and can be also used for hydrogen distribution concepts.

Secondly, De Boer SPS is involved in new techniques for capture and re-use of CO_2. During the capture of CO_2 also H_2 is produced and with additional (green) hydrogen, this is the basis for several base chemicals and fuels like methanol, ethanol and urea.

Every project and initiative is unique and the approach of De Boer SPS is unique for every project. Please contact us for further acquaintance is our mutual approach will work for your company.

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Deerns

As an independent engineering firm, Deerns specializes in advice, design and implementation supervision in the field of installation technology, building physics, energy supply and sustainability. Our expertise contributes to sustainable, intelligent and future-proof buildings that do what they are intended to do.

Our experts know the challenges our clients face. In the markets in which we operate, especially clean technology, data centers, healthcare, airports and real estate, we know what is going on and what is needed to arrive at a successful solution. We are able to provide suitable advice and design quickly, can provide construction supervision of installations and provide aftercare. So that eventually buildings are created that work for people.

Active in the following themes:
- Advice (Technology/Policy/Subsidies/Permits)
- ProjectManagement
- Technique: Production (Electrolysis/etc.)
- Technology: Distribution (Pipework/ Appendages/Gas station/etc.)
- Technique: Storage (Bottle/Tank/Trailer/etc.)
- Technique: Use (Fuel Cell/Industry/Mobility/ etc.)
- Technique: O&M (Maintenance/Management/ Measurement)

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Deltalinqs Climate Program

Within the Deltalinqs Climate Program (DCP) we work together on the climate transition of the Rotterdam Port Industrial Complex. In the DCP, Deltalinqs works with its members and partners on three themes: future energy mix, sustainable fuels & energy carriers and circular harbor & industry.

The role of the DCP is to connect the right parties to each other, to provide those parties with information and inspiration, and to help our members start innovative projects.

This includes projects across the full hydrogen value chain, including import as well as blue and green hydrogen, infrastructure, and industrial applications in hard-to-abate industries, as well as transport.

In the 'Versnellingshuis' we work together with public partners to mitigate barriers which are inevitable when starting new and innovative projects. Through our involvement in the Data Safe House, we help our infrastructure partners prepare the grid of the future.

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Demaco is an expert in the field of cryogenic technology, we build infrastructures to facilitate the transport and application of industrial gases at extremely low temperatures. Between -160 and -271 degrees Centigrade, to be precise. We work with some of the most recognized companies and institutes around the world. Demaco has worked in the hydrogen industry for over three decades. All projects are executed respecting all engineering and design standards for equipment for potentially explosive atmospheres (ATEX). It is applied to all types of electrical or non-electrical apparatus and as well as safety devices, ensuring reliability.
When it comes to hydrogen cryogenic equipment, Demaco is a turn key supplier, we assume overall responsibility and support customers around the world as a solution provider through the complete journey, starting from the idea to the commissioning of the equipment. Demaco provides the design, manufacture, installation of cryogenic equipment including control system. Demaco serves the hydrogen market with the following products:

- Hydrogen filling stations or loading bays for filling trucks
- Hydrogen loading arms for refueling ships
- Hydrogen transfer lines from the tank or liquefier to the application either on-shore or off-shore
- Hydrogen cryostats
- Hydrogen distribution boxes
- Hydrogen purifier
- Hydrogen liquefiers (small/compact)

Since Demaco works on both standard and highly advanced projects, we have built up a vast experience. Consequently, no cryogenic issue is too ambitious.

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Demcon energy systems develops advanced technical solutions and provide innovative products in the field of sustainable energy. It draws on the extensive multi-disciplinary engineering know-how and production expertise that Demcon has built since 1993 for a very wide range of applications and technologies. The fast-growing Demcon group of companies currently employs 750 people in its branches in Best, Delft, Enschede, Groningen, Maastricht, Münster (Germany), Tokyo and Singapore.

One of the focus areas of Demcon energy systems is the development of technologies and equipment for the production of green hydrogen by means of water electrolysis. Together with partners, Demcon develops and supplies electrolyser modules for the decentralised production of hydrogen for transportation and industrial applications, and other systems related to energy production and storage.

In addition to supplying complete systems, Demcon offers engineering and OEM production services to support our customers with the development and manufacture of their own solutions. Areas of expertise include mechatronics system engineering, multiphysics modelling, electronics and software development and industrial automation. Our customers can thus benefit from the unique combination of the very broad engineering excellence within the Demcon group and the deep understanding of the technical challenges in the sustainable energy sector that is the specialty of Demcon energy systems.

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DESU
Special Hazard Fire Detection & Suppression

Desu Systems strives to make hydrogen production, storage and the fuelling process as safe as possible. Being the European Master distributor for Spectrex flame detectors, we supply to OEM's, contractors and fire safety companies.

We have several flame detectors in our portfolio that can detect an (invisible to the human eye) hydrogen flame within (milli)seconds. Our products are known for their long life and fault-free operation.

Our Hydrogen flame detectors are already in use in many hydrogen filling stations, hydrogen powered vehicles, equipment and in storage facilities all over the world.

With our skilled staff and local stock we strive to provide fast and friendly service. Is your hydrogen project safe? Just give us a call.

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DOEKO

For more than half a century, Doeko is specialized in High tech tooling. Through those years, Doeko gained a lot of experience in cutting tools, plastic injection tools, precision mechanics and mechatronics. Experience that can not be matched with machines or systems. We design and manufacture high-tech components, modules and systems based on precision engineering and machining. We look at your complete production process with a helicopter view and then design the optimal assemblies down to the smallest detail.
Doeko is able to produce your components to the highest precision. In our own modern workshop, we work with 53 highly skilled and experienced people. Besides the people, we work with 25 robots that can run 24/7. The engineering of tooling for your product, can be (partially) done by our inhouse engineers. Doeko believes in hydrogen and wants to help you in producing the right tools and machinery for your product. Whether you have a functioning production line, prototype or design. Together with us, we can bring your product to the next level! As a specialist in high precision tooling we believe that we can help you.
When you want to discuss how we can help you with producing your product, please visit our website or contact us.
We deliver the smartest solution for your production process!

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DORHOUT ADVOCATEN

Dorhout Advocaten has a good reputation in the northern part of the Netherlands as a medium-sized law firm for companies, central and local government, non-profit institutions and other organisations. Our firm employs specialised lawyers in various fields of law. They combine their knowledge with an understanding of commerce. We base our approach on the differences that each sector has. We work in tailor-made teams with the interests the client as our common goal.
Furthermore, Dorhout Advocaten is a law firm for entrepreneurs in the northern part of the Netherlands. Doing business means seizing opportunities and dealing with risks. With our specialist knowledge and over 80 years of experience, we ensure that our clients can translate opportunities into action in a responsible manner and that risks can be managed so that problems can be solved or avoided.
We are committed to:

- providing services of the highest quality, quickly and with determination
- one office for all legal questions
- an organisation with short lines of communication and a single point of contact for all cases
- competitive rates

Energy law covers a wide range of public and private law areas. Each energy source and each part of the energy chain – production, supply and transport – has its own specific legal aspects and regulations.
Energy law has taken on major proportions in the Netherlands in recent years, mainly due to the liberalisation of the electricity market.

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douna MACHINERY
CONNECTING GREEN TECHNOLOGIES

Douna Machinery B.V. is a factory active in mechanical machine building for 98 years. Ultimate experience in prototype construction of various machines where the gas industry is the biggest part. With our own engineering department, we can assist from idea to assembly and production of complete machines. Nowadays Douna is connecting green technologies, for example for future energy supply or energy storage. In addition, precision large machining, certified welding, assembly and measuring in a conditioned measuring room are key words that belong to Douna's craftsmanship.
The industrial hydrogen ecosystem in the Northern Netherlands is receiving a significant boost with the start of the WAviatER project in January 2022. Douna plays a significant role in this project as developing partner. With consortium partners we build an 1 MW Hydrogen production technology for the Aviation sector and Energy applications as demonstration facility on airport Eelde, delivery September 2023.
On the roof of Douna Machinery factory 1400 solar panels generate 550.000 KWh of electricity per year. That is enough to provide about 200 households with power for a year. In addition, it will also save 124 tons of CO_2. With this roof, Douna provides for its own electricity use and has the possibility to provide electricity to other companies on the industrial estate in the future.
Douna Machinery is located in Leeuwarden, almost the center of 'the Hydrogen Valley' in the Northern of the Netherlands.

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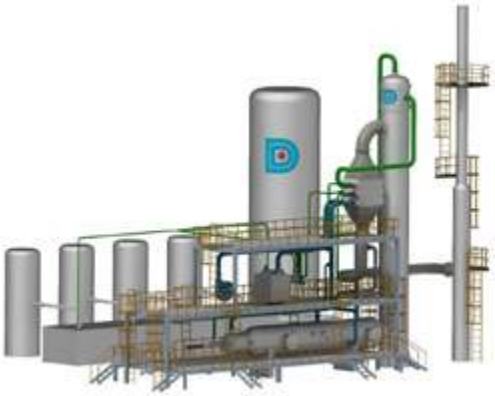

Duiker Combustion Engineers

Duiker specializes in developing, designing, supplying, installing and servicing advanced combustion solutions, tailored to customer needs for liquid and gaseous fuels for the oil refining, chemical and process industry worldwide.
At Duiker we believe in jointly realizing inventive solutions that make a meaningful contribution to people and the environment and hereby Duiker's motto is `Thousands of process solutions, you can rely on our experience'.

The following products & technologies in relation to hydrogen are relevant:

1) Stoichiometry Controlled Oxidation (SCO) for conversion of fossil fired power stations into renewable ammonia (as hydrogen carrier) fueled power stations for zero CO_2 emission electricity.
2) Multi-Fuel Combustion Technology: engineered flexible solutions for revamping existing process heater/furnaces from fossil fuels into low carbon or renewable fuels.
3) Stoichiometry Controlled Oxidation (SCO) for conversion of renewable ammonia (as hydrogen carrier) into high temperature heat for the process industries. This SCO technology is scalable, proven and commercially available.
4) Ammonia cracking technology, developed by Duiker based upon their proprietary SCO technology for converting renewable ammonia into affordable & pure hydrogen. This ammonia cracking technology has been developed for large, world scale ammonia cracking at low costs and for high conversion yields.

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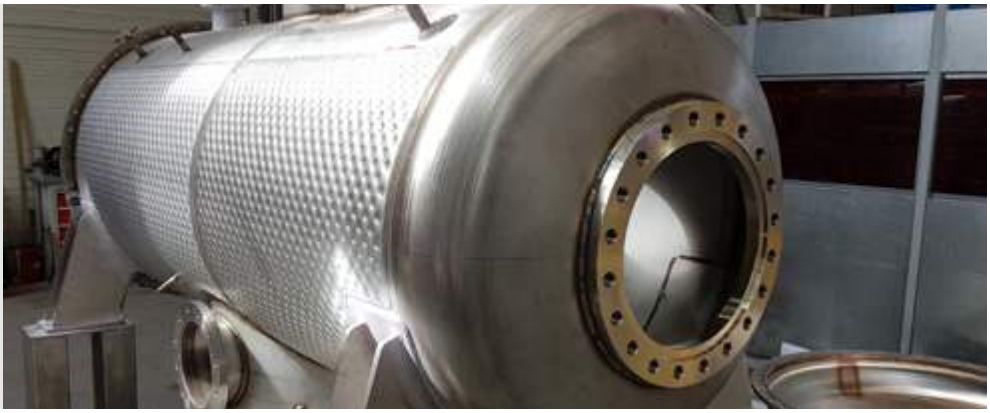

dumaco Woerden

Dumaco (Dutch Manufacturing Companies) is a brand of 7 metal working companies. With over 700 employees we the one stop shop for all your needs:

- Engineering / strength calculations
- Laser- / water cutting
- Tube laser cutting
- Bending
- Certified (robot)welding
- Machining
- Grinding
- Pickling & passivating
- Coating
- Assembly & logistics

At Dumaco Woerden we are specialized in the engineering and production of components and welded assemblies in exclusively stainless steel, this to prevent contamination with carbon steel.

In our state-of-the-art production location in Woerden we work with a team of 70 highly qualified and certified employees. Materials we process are SS 304, SS 316, but also more specialized materials like (Super)Duplex and nickel alloys.

For the hydrogen market we are focused on the engineering and production of PED certified pressure vessels / piping and complete stainless steel skids for electrolyzer systems. We are fully certified to design and weld the components of a system as per applicable design code. Since we can do the engineering, calculations and certification in house we are very flexible in design, advise and delivery time. We are always looking for a partnership and cooperation in our customers and suppliers to make the difference.

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dutch boosting group | vernieuw verbeter versnel

At Dutch Boosting Group, we are system thinkers for the living environment. Always with the bigger picture in mind. Continuously looking for new ideas. Our working method is based on a systematic approach. By explicitly balance needs and interests we believe to create sustainable solutions. We are driven by improvement and curious about new ideas and future-proof solutions. We innovate, we improve, we accelerate: that's how we boost!

We have been successfully applying our expertise for many years in complex Infrastructure projects, Spatial Development and Energy Transition. Sectors in which we see a crucial role for the application of hydrogen. In order to create the highest impact, we boost the application of hydrogen on various levels. Some examples:

- Quick Scans for organizations to determine the most suitable set of solutions, including hydrogen to attain its sustainable energy goals.
- Network analyses for governmental organizations to steer their policy making, by providing overview of stakeholders needs to adopt hydrogen applications, spatial distribution of local potential hydrogen availability and demand.
- Program/Process management of regional hydrogen programs and processes in order to accelerate the development and to stimulate local initiatives in order to boost innovation.

The challenges we face are complex. To find solutions, we are always open for joint ventures and collaborations in order to boost the implementation of hydrogen.

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DMEC
DUTCH MARINE ENERGY CENTRE

DMEC is an international accelerator and service centre for marine energy solutions. We believe that marine energy will be a crucial driver to realise our global energy transition and foster sustainable growth. By advancing innovation, mobilising capital and shaping policies, we create multipurpose energy solutions for a wide variety of markets, including green hydrogen production.

Electricity produced using marine energy applications can be used for offshore or nearshore green hydrogen production. Possible ways of doing this vary from using wave energy converters for producing hydrogen at decommissioned platforms, to future use of salinity gradient technology and tidal turbines to produce hydrogen at existing infrastructures like the Afsluitdijk or the Eastern Scheldt barrier. We foresee a promising future for green hydrogen and marine energy is ready to be a part of this.

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AHEAD OF TOMORROW'S CHALLENGES

Ahead of tomorrow's challenges. At DWG, we firmly believe technology has the power to make people's lives better. Technology has the potential to make the world more efficient, safer and more sustainable. Processes can be accelerated, maintenance costs can be reduced, re-work can be minimised, data can be secured, and it doesn't stop there. All technology will make the future a lot brighter and needs a dedicated expert who knows how to use the right technologies. An expert who can work out and understand your processes. At DWG, our office is full of such experts.
DWG delivers total asset process engineering & design, functional safety, hardware electrical & instrumentation, industrial automation & IT engineering(including cyber security) plus SLA for 7/24/365 maintenance contracting. DWG is specialized and certified partner for Siemens, ABB and Wonderware. AutoCad and EPlan are used as separate hardware E/I tooling but COMOS as a true single database in the middle of digitalization, supporting the transition of document oriented organizations to more data centric, based on the DWG company (but also more and more production companies) vision and strategy. We add value by the DWG ITS(Industrial Things Server) by analysing data via wireless secure smart sensorics to generate domain KPI dashboarding including AI(Artificial Intelligence) and algorithms for customer specific decision criteria. DWG mainly works at projects in the BeNeLux in the 3 harbour regions Rotterdam, Amsterdam and Antwerp!
Ready for the future and beyond. Design goes hand in hand with achievement: and we can do both.

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E&E advies

Consultants of E&E advies focus on connecting the energy transition to economic development. E&E advies supports governmental organisations, the industry and public-private partnerships to develop ambitions, strategies and policy. We perform exploratory research, we advise on policy and strategy, we monitor and evaluate policy or business cases and provide program- and project management.

Our result-oriented approach is based on our wide experience with clients in industry, governmental organizations and research institutes and strong analyses based on both quantitative and qualitative data.

Recently, we worked on several hydrogen projects:

- We developed energy roadmaps for Dutch Provinces and municipalities;
- We performed exploratory research on hydrogen production, infrastructure and use in Fryslân and Drenthe. Based on in-depth research and interviews, we identified regional opportunities and actively involved stakeholders from industry, governmental organizations and universities in our research;
- We have performed analysis that provide insight in the economic value of the energy transition and presented the results in factsheets;
- We monitor climate ambitions of several Dutch municipalities and provinces.

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eekels | TBI

For over 110 years, Eekels has been operating in the Marine & Offshore and Industry & Infrastructure markets. Its employees, totalling almost 600, carry out projects and maintenance & service operations in technical automation, electrical engineering and mechanical engineering.

Eekels has specific expertise in electrical drive systems, shore power connection systems, ship systems (including alarm and monitoring systems) and process automation. Eekels takes care of the entire process from engineering, panel building, implementation and start-up to maintenance and service.

We design, build and commission fuel cell systems including electrical conversion in a range from 100 kW to 500 kW and integrate them for vessels.

For the infrastructure we provide energy storage systems and provide electrical power with hydrogen as an energy carrier. These setups provide energy for construction sites and in harbour areas as mobile shore facility.

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ekinetix
Realizing energy transition

Ekinetix: a leading advisory and engineering firm in the energy transition, with extensive expertise in hydrogen technologies. We cover the entire value chain, from concept development and feasibility studies to the complete realization of technical installations (EPCM).

Ekinetix engineers have been involved in nearly all novel product-market developments for hydrogen in the energy transition in the Benelux. This is possible by our extensive expertise and knowhow in high-tech gases solutions.

We provide turnkey project management and system integration for technical installations. That includes the design, construction and commissioning of installations for hydrogen production and storage, (multimodal) hydrogen refuelling stations and distribution hubs.

Our benchmark advisory work includes building blocks of current hydrogen policy and developments: Green Hydrogen Economy Northern Netherlands; Hydrogen: Opportunities for the Dutch Industry; Permitting guide for Hydrogen Refuelling Stations; A One-Gigawatt Electrolyser Design.

Our clients trust us in all aspects of the hydrogen value chain: industrial gases and energy companies, fuel retail, shipping, grid operators, public bodies and knowledge institutes.
We are the connecting factor in the hydrogen value chain. We deliver innovations in sustainable energy, using our >20 y experience and broad network. If you have an innovative idea in energy transition, Ekinetix can help you realize it.
Ekinetix. Realizing Energy Transition.

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Ekwadraat guides and advises companies and entrepreneurs in the realization of projects in the field of energy saving, sustainable energy and energy saving.

For hydrogen projects, Ekwadraat provides(among other things):

- feasibility studies;
- subsidy applications;
- permits;
- certification;
- justifications for subsidy obligations and legislation and regulations;
- and PPA's.

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Elestor has introduced an innovative electricity storage technology for grid scale applications, based on the flow battery principle. With this, the electricity storage costs (aka Levelized Cost of Storage) are reduced to an absolute minimum. Low cost, abundant active materials (hydrogen & bromine) are used, combined with a patented system design and easy to manufacture compact cells.
This triple cost reduction strategy enables introduction of viable business cases, essential to stimulate the adoption of electricity storage, and thus to accelerate the energy transition.
In the end game the technology has all the properties to replace fossil power plants (bi-directional power plants) and has the potential to become the equivalent in large-scale long duration electricity storage of what Lithium ion is today for mobility.

The essential difference of Elestor's technology with conventional batteries is that power (MW) and capacity (MWh) are uncoupled: The Elestor technology is 100% modular and virtually any desired MW-MWh combination can be designed, enabling very cost-effective bridging of long periods during which hardly renewable electricity is generated. With a progressing dependency on intermittent energy sources (sun, wind), this property becomes increasingly distinctive, if not decisive, for the energy transition to succeed.
Another unique feature is that the Elestor technology can be integrated in hydrogen infrastructures and electrolysers, resulting in largely reduced production costs for green hydrogen. This has been concluded and quantified from an in-depth feasibility study, carried out in cooperation with a large European energy corporate.

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ELTACON ENGINEERING BV

Eltacon Engineering supplies gas treatment systems for the Power Industry and Oil & Gas market. Located in The Netherlands, Eltacon is an independent engineering contractor since the year 1987. Over the years we have obtained an excellent reputation in the design and fabrication of tailor made equipment.

For applications on the energy transition and related markets we have supplied several hydrogen treatment and mixing stations. In order to reduce carbon emissions hydrogen can be mixed to the current fuel gas stream to a suitable fuel gas mixture. By means of flowmeter, pressure reduction, measurement of Wobbe index etc. the downstream mixture will be regulated automatically. Eltacon will supply the complete treatment system based upon skid mounted units.

Reference projects have been delivered to (among others) Russia, Poland and Belgium and include natural gas mixing with hydrogen, nitrogen, BOG's and COG's.

For end-users, EPC contractors, turbines manufacturers and other clients Eltacon delivers high quality products with flexible services. The company itself is very flexible and is able to meet the variety of requests from the market.

The same as our clients, we are constantly striving for new solutions that minimize environmental impact. Conversely, they want to maximize productivity while generating a reliable supply of energy. Eltacon Engineering can meet those market needs, and others, thanks to our extensive experience and recognized know-how.

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ENABLEMI

Enablemi is specialized in developing and managing innovation projects, which contribute to the Sustainable Development Goals. Regarding innovation, we believe the technology is at the heart of innovation, but it cannot go without a strong network and good collaboration. Therefore it is our aim to bring together companies, educational and knowledge institutions, governments and end-users (quadruple helix) to accelerate development of new energy technologies.

We have consultants with technical, financial, marketing and project management backgrounds. Who all use their qualities to accelerate the energy transition by coordinating innovations from their origin, the idea, to a plan, to the implementation of a finished product or service.

A snapshot of recent activities showing our involvement with regards to hydrogen technologies:

- Development of several research projects for various consortia involving Eindhoven University of Technology, on the topics of system integration and asset planning.
- We researched the feasibility of setting up a hydrogen boat-racing class in the North of the Netherlands, as an impulse-instrument for the Northern hydrogen economy.
- Involved in consulting, development and project management of multiple PAW (Programma Aardgasvrije Wijken) field labs involving the transition from fossil gas to sustainable alternatives including full or partial hydrogen substitution.
- Arranging funding for startups and companies, specialized in hydrogen technology.

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ENERCY is an international engineering consultancy specialised in the development of Green Hydrogen ecosystems, also known as Hydrogen Valleys. We provide the following technical and strategic consulting services:

- Project development
- Technical project design
- Identification & Application for EU Funding
- Project management
- Stakeholder engagement & public awareness
- Capacity building

In cooperation with our international partners, Enercy has led the technical design, and supported the development and delivery of several Hydrogen Valleys across Europe such as the BIG HIT project in the Orkney Islands, UK, the HEAVENN project in the Northern Netherlands and the GREEN HYSLAND Flagship Project in Mallorca, Spain as well as EU Hydrogen IPCEIs. For these multi-million, integrated cross-sector projects we provide technical support, and bring together international stakeholders from the private sector, government and civil society, to develop economies of scale and bring down costs to support the implementation of green hydrogen as a key pillar of the energy transition. In order to create a full-fledged hydrogen economy, we also contribute our more than 20 years of experience in the hydrogen sector to support immersive training and educational programmes. ENERCY is also an active member of the European Clean Hydrogen Alliance and the EU Clean Energy Island initiative.

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ENGIE is an international leading company in the business of technical services and renewable energy generation. The 6.000 employees of ENGIE in the Netherlands support consumers, institutions and commercial companies to make the change to a more sustainable way of working and living. At ENGIE, we believe that Hydrogen will accelerate the transition to green energy in regions around the world for the benefit of all. Green Hydrogen, produced through the process of electrolysis will provide:

- Decarbonised solutions in mobility on both water and land
- Grid stabilisation services to solve congestion problems
- Storage capacity of intermittent energies

Renewable hydrogen, or hydrogen as a by-product, is a versatile energy vector that can be used to decarbonize many applications. At ENGIE, we offer solutions that are present across the entire value chain: strategy, design, engineering, construction of energy efficient assets, digital platforms, operations, and financing. We are committed to delivering the expected results. Our proximity to our customers allows us to enhance local resources, through production and decentralized Hydrogen storage for local uses.

Are you a company or local authority looking for partners capable of providing you support and advisory to develop carbon free solutions? ENGIE can work with you in your zero carbon transition goals, design integrated turn-key energy solutions that meet your specific needs.

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EnTranCe|Centre of Expertise Energy contributes as a learning, practice-oriented knowledge community to a clean, renewable and affordable energy supply. Scientists, students, businesses and authorities all come together at our center of expertise to share knowledge. With our premise people in power, we develop the innovations that are much needed for the energy transition and strengthen the regional knowledge economy.

The multidisciplinary energy research carried out by EnTranCe is mainly on the level of villages, districts, neighborhoods or companies. This is where large-scale energy suppliers and infrastructure meet small-scale, local energy initiatives. And this is where the main breakthroughs will be needed to ensure a successful transition.

Project examples:

- Groene Waterstof Booster: helps entrepreneurs to realize hydrogen innovations and ideas. With a financially attractive scheme (voucher program), we give companies access to a strong and broad network in the Netherlands and unique test opportunities on the grounds of EnTranCe.
- Waterstof Innovatie Netwerk Groningen: a hydrogen facility which companies and organizations can use to accelerate the development of hydrogen techniques. With WING, SMEs can host hydrogen training sessions for staff, conduct physical tests and demonstrate technology.
- Hydrohub MegaWatt Test Centre: a state-of-the-art research facility on the grounds of EnTranCe to optimize and scale up the production of green hydrogen via electrolysis.

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EOX Tractors produces emission free tractors through unique technology and groundbreaking designs for agricultural and infrastructural construction purposes. As an innovative agile start-up, working with commercial partners and academic institutions, we stay ahead of the market in delivering zero-emissions vehicles. In 20 years' time, all tractors will be electric. Many farmers have already laid a good foundation for this transition by investing in solar power, wind energy or even an electrolyzer. Today we are therefore designing and building the machines to work fully electric or on hydrogen as front runners in the industry.

The EOX platform is designed as a smart modular chassis with proven electric powertrain technology for optimal efficiency. Our unique electric drivetrain powers four independently controlled wheels. The availability of this technology makes our platform ready for a wide variety of autonomic applications. Based in Arnhem at Industry Park Kleefse Waard, EOX Tractors operates in the Dutch center of hydrogen technology development. Together with affiliated partners connected through our investor's network we are able to stay ahead with zero-emission and autonomic productions and developments.

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EREZ ENERGY
GREEN HYDROGEN

Erez Energy is producer and supplier of green hydrogen. Our standardized electrolysis systems are located on site at the offtaker or co-located at a solar park and/or wind farm.
Erez Energy works with the hard-to-abate industries and mobility. Erez Energy takes care of the complete scope: permits, financing, installation, operation and logistics of the green hydrogen.

The electrolysis technology is selected based on the application of the hydrogen. This results in the green hydrogen characteristics that match the requirements of the offtaker.

To achieve the big ambition of the energy transition first steps are required. Therefore our standardized systems are on a 1-10 MW electrolysis scale. Each Erez Energy system produces at least 100,000 kg of hydrogen per year.

The produced green hydrogen for the hard-to-abate industry is either mixed with natural gas for high heat processes or is directly fed into an industrial process. The green hydrogen produced for mobility is mostly transported to its destination via tube trailers.

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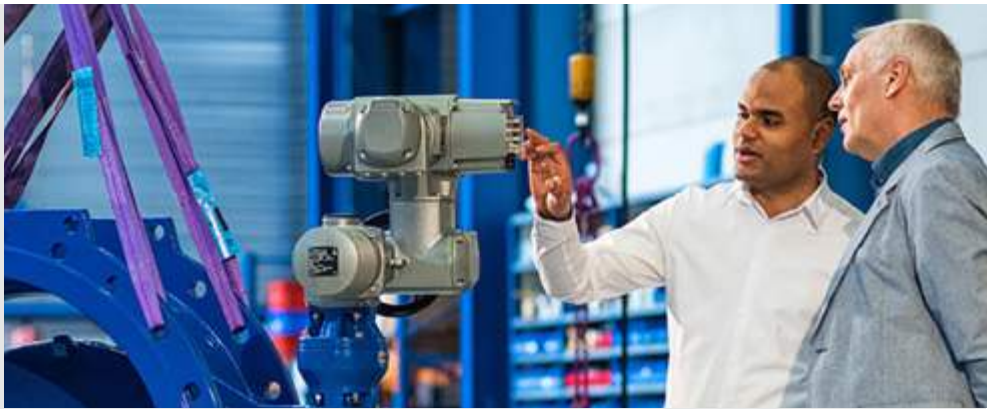

ERIKS

ERIKS is a specialized industrial service provider that offers a wide range of technical products, co-engineering and customization solutions, as well as related services for all possible hydrogen applications. We help customers in a variety of industrial segments to improve their products' performance and reduce their total cost of ownership. Over 5000 skilled colleagues worldwide serve customers in their original equipment manufacturing (OEM) and maintenance, repair and overhaul operations (MRO).

Our technical know-how is the basis of our specialism. We have built up deep expertise in the areas of sealing & polymer, gaskets, valves & instrumentation, industrial & hydraulic hoses, industrial plastics, power transmission & bearings and tools, maintenance & safety products.

We supply A-brands as well as our own ERIKS products. Besides we have our own departments for engineering, clean manufacturing, assembly, condition monitoring, smart asset management, inspection and field service engineers.

At ERIKS, we stand for doing good business. We value long-lasting relationships with all our stakeholders and contribute to a better and more sustainable society. ERIKS sees hydrogen as an important sustainable energy carrier for the near future. We are working on building this hydrogen fuelled world by combining hydrogen knowledge and products available in all our expertise areas. Our team of hydrogen specialist in the Netherlands is at your service for a customized solution.

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E-Trucks Europe develops, produces, sells and rents hydrogen trucks. This concerns heavier trucks with an energy-consuming structure such as garbage trucks, but also vehicles with a crane, hook-arm system, tipper or cooling installation on board. We have been doing this as a family business since 2010 from our workshops in Westerhoven (the Netherlands) and Lommel (Belgium).

In 2013, we launched our proof of concept of a hydrogen refuse truck, which we used to collect waste paper in the city of Eindhoven for a year. Then we took the time to use the experiences of the test period to improve the truck and the hydrogen-electric system, in which we use a fuel cell. We have now delivered zero-emission refuse trucks to various Dutch cities such as Amsterdam, Breda, Eindhoven, Groningen and Helmond. We also have orders from Belgium, Germany and Italy. There is great interest from almost all countries in Europe for our hydrogen refuse trucks. The European Commission is stimulating this development based on its vision for the future of hydrogen and its Clean Vehicles Directive to green mobility.

As E-Trucks Europe we actively collaborate with more than 70 chain partners. In practical terms, this means a.o. that we develop projects together around new hydrogen refuelling stations. If you are also interested or if you have any questions, please do not hesitate to contact us.

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At EY, we are committed to a better working world. We do this by working together on a future-proof and sustainable energy sector. We are keen to live up to our commitment to sustainability and eager to support organizations in their distinct sustainability efforts.

On your sustainability journey, EY teams can help you reach your goals by designing tax frameworks and risk management methodologies to accelerate transition, decarbonize your supply chain, and genuinely green business operations. To support this, we help you stay aware of policy developments and their impact and assist with securing incentives and funding and complying with new tax and non-financial reporting obligations.

EY teams insight creates a bird's eye view of your sustainability strategy, supporting and flexing across your enterprise. This insight allows us to bring in key players at vital stages, sharing our technical and market experience related to the tax, legal, governance and workforce challenges you face during your sustainability journey.

With the use of these financial, grants & incentives, tax and legal expertises, EY shares its sector knowledge about hydrogen applications. Initiating consortia of (inter)national companies and applying for Dutch and European grants and incentives is an important pillar for the (knowledge) development of new hydrogen and fuel cell solutions. In this way, EY contributes to the transition to a sustainable future and the creation of long-term value.

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Feenstra started in 1947 and is since its establishment a major player in the Dutch market for installation and services of energy supply systems in dwellings. Both for private residential and housing corporations. These energy supply systems consist of solutions for heat, cold and electricity generation and storage. With more than 800 field service engineers, Feenstra is also active in the field of renewable energy solutions and the energy transition. We are front-runners with our partners in the field of hydrogen-projects, for existing and new buildings. For Feenstra's 800,000 customers we are always looking for new solutions whereby sustainable and comfortable living play a central role.

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TCE Van der Klok Beheer and TCE FINN are Netherlands based companies. They started in 2011 to streamline research, engineering, design and manufacturing components to finalize and bring to market innovative, green technologies designed to operate in the current world infrastructures.

This is a brief history summery of the TCE companies including the development of its technologies and products. In addition, an overview of the principles involved, a description of the products, testing protocols and results, and the current and future outlook for the company. This will be followed by sales projections, market development strategies and opportunities, growth needs and recognized challenges.

TCE has many years experience in engineering and production Hydogen electrolysers. The TCE Hydrogen System is a patented electrolytic retrofit technology for diesel engines. The product gases (oxygen and hydrogen) are an enhancement additive to the diesel fuel, not a fuel replacement. Using water, the product gas is produced in pods via an electrolytic process near the engine. The amount of gas produced is directed by the integrated computer system and determined by the power load of the engine. The harder the engine works, the more product gas is produced. It is then safely injected into the airstream just prior to combustion. TCE is specialist in machining high precision volume Electrolyser part and Electrolyser assembling.

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Fluidwell develops and supplies products for use in potentially explosive environments in particular.

In more than 30 years we have grown into a major international OEM partner in measurement and control technology, with applications in the oil, gas and hydrogen industry. Our core expertise is the development, certification, assembly and international marketing of ATEX, IECEx, CSA and FM certified products.

Within hydrogen, we focus on developing and assembling electrolyzer systems based on PEM and AEM in collaboration with our strategic partners. Our focus is on decentralized hydrogen production locations using our standardized connectable systems of 50-500kW, which are typically fed by an intermittent source. High efficiency, durable and low total cost of ownership are key parameters with a focus on applications up to 10MW.

In addition, Fluidwell has developed a Weights and Measures certified truck-dispenser system that is used throughout Europe on tube trailers to supply hydrogen filling stations (HRS), large-scale consumers and storage locations.

In the supply chain for safe hydrogen production, we are internationally active in several areas and we are looking for new partnerships.

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Fluor is a global, publicly traded engineering, procurement, construction (EPC) and maintenance company. We work with clients in diverse industries around the world to design, construct and maintain their capital projects. Fluor has more than 46 years of experience in the hydrogen industry with 50 plants producing a total of more than 2,300 million cubic feet per day of hydrogen, including the world's largest hydrogen production plant at the time. Moreover, Fluor has its own independent electrolysis expertise, and knows the licensors of the basic elements and the developers of the hydrogen electrolysers applying these technologies. With this knowledge, we can assist clients to select the right application for their objectives.
Fluor in The Netherlands offerings:
We successfully executed projects in Europe for more than 75 years using a multi-office execution approach. With Fluor's offices in Hoofddorp, Bergen op Zoom, Geleen and Rotterdam, plus Stork, A Fluor Company, we can support clients with additional technical and project support. Our comprehensive solutions span the entire project life cycle and deliver capital efficiency. Industries served includes Advanced Technologies & Life Sciences, Oil & Gas, Refining, Chemicals & Petrochemicals, Gas Processing & Underground Gas Storage.

- Conceptual Studies, Full Front End Engineering and Design
- EPC and Project Management Consultant (PMC) capabilities
- Zero Base Execution
- Value Improvement Programs
- Organizational Effectiveness
- Integrated Partnership Programs

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FME is the Dutch employers' organisation in the technology industry. The 2,200 affiliated companies include technology start-ups, trading companies, small and medium-sized industrial enterprises as well as large industrial conglomerates. Our members are active in the fields of manufacturing, trade automation and maintenance in the metal, electronics, electrical engineering and plastics sectors.

Around 400 members are active in the renewable energy sector and 130 members in the hydrogen sector. Together with our members we coordinate and participate in multiple hydrogen projects in the Netherlands and in an international setting.

FME members employ a total of 220,000 people, have a combined turnover of € 91 billion and their exports total € 49 billion.

We connect and mobilize companies, knowledge institutes, end users and investors in order to find solutions to the global challenge for a greener future. Please connect with us if you are looking for a specific company, product or service. Let's work together!

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Fountain Fuel is a disruptive start-up: we are currently the only company in the Netherlands building fully zero-emission energy stations, combining hydrogen refueling and electric fast charging.

In recent years we have thoroughly researched available technologies and applications for hydrogen as a fuel for mobility. This has given us a head start in terms of knowledge and we are now using this to make headway.
We use proven technology, have collaborations with robust partners like Linde Engineering, municipalities and the automotive sector (companies like Toyota, Hyundai, BMW, Renault and Stellantis).

Our business case has been reviewed and found solid by the European Investment Bank (EIB) in 2021. We receive EU funding (CEF) to build the first three Fountain Fuels: in May 2023, we open the first Fountain Fuel energy station in Amersfoort, soon followed by locations in Rotterdam and Nijmegen. And we receive EU funding (ELENA) for the preparation of the next 8 Fountain Fuels. By 2025 we have planned a total of 11 energy stations. By 2030 there will be 50 Fountain Fuels, spread throughout the Netherlands.

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Frames Renewables; the best of both worlds. We are a manufacturer and supplier of renewable energy systems with the flexibility and innovativeness of a start-up and the professionalism and reliability of a renowned industrial supplier. Specialized in design and turnkey supply of installations for hydrogen generation (electrolyser systems), hydrogen storage and hydrogen applications for industry, horti- and agriculture and mobility. At Frames Renewables, we work closely together with our clients to put the unique power of our knowledge, skills and dedication into action in order to offer the best possible solutions.
Frames was founded in 1984. For 35 years we have built a reputation of quality and reliable systems to serve the international oil & gas industry. Driven by our ambition for sustainability, Frames Renewables was founded in 2010. Our Drive is based on two things.
First of all we feel the responsibility to put our know-how to work to create a cleaner and better world of tomorrow. We know, this sounds fluffy, but at Frames Renewables we don't stop at bold statements and bullshit claims. We develop and deliver solutions that help you reduce CO_2 footprint, turn waste into value or switch to sustainable applications.
The second thing that drives Frames Renewables is our relentless drive to solve problems. With our technical background we accept any challenge and what better way to do this then together with customers on real-life problems.
We collaborate with clients around the world to provide tailor made or standardized plug-and-play products.

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Value from Innovation

Fujifilm is the world's largest imaging company. Many of Fujifilm's new products find their roots in the company's original product: photographic film. However, our activities nowadays extend over a much wider area then only photographic film. Using the experience and know-how from our imaging history, we have diversified into many new markets. Today more than 70% of the products sold by Fujifilm have been developed over the last decade. These include medical and life science applications. But also highly functional materials have been developed for semiconductor, photovoltaic, automotive, water treatment and gas separation applications.
Based on our long standing knowledge in coating thin functional layers onto substrates, Fujifilm is developing membranes for various industries. The first achievements of Fujifilm membrane technology are in the field of water purification and natural gas treatment. In those business areas, membranes are increasingly competing on price and performance with conventional purification techniques. The development of Fujifilm's ion exchange membranes and gas separation membrane technology takes place at the R&D labs of Fujifilm in Tilburg, The Netherlands and in Tokyo, Japan.
With the growing need for green energy and carbon neutral future, hydrogen electrolyser technologies become an important cornerstone to meet the national, European and global CO_2 reduction targets. Membrane technology will play an important role in this for with several electrolyser types like Alkaline, PEM or AEM. Besides the technology, economy of scale will be required to meet cost down targets for green hydrogen as indicated by the international institutes and governmental roadmaps.

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Future Proof Shipping (FPS) offers zero-emissions marine transportation services to enable players across the value chain make the transition to zero-emissions. We are connecting and enabling the entire maritime and green energy value chain, starting with logistics service providers and cargo owners who are ready to take the lead.
As a zero-emissions vessel owner, we are building our own fleet of zero-emissions inland and short-sea vessels, which we offer for charter. With our zero-emissions advisory, we are enabling others to make the transition to zero-emissions through technical, financial, and commercial support as well as project development and management.
Over the next five years, we aim to build and operate a fleet of 10 zero-emissions inland and short-sea vessels based on long-term time charter contracts to operators, logistics service providers and cargo owners/shippers. We do this by retrofitting existing diesel-propelled ships in partnership with other investors or their current owners who are looking to adopt a zero-emission business model.
One of our current projects is to retrofit the Maas, an inland container vessel to sail 100% on zero-emissions hydrogen fuel.

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Gasunie is a leading European energy infrastructure company. The Dutch state is our sole shareholder. Our core activities are gas transport and gas storage. We serve the public interest and facilitate the energy transition by providing integrated infrastructure services.

In the Netherlands and the northern part of Germany, Gasunie operates infrastructure for the large-scale transport, storage and conversion of gas. At the moment, this is mainly natural gas, but the energy transition is increasingly shifting towards CO2, green gas, heat and hydrogen. Our infrastructure, services and geographical position mean that we are at the heart of the north-western European energy market.

By developing new value chains, in close cooperation with Germany and North Sea countries, Gasunie contributes to maintain the strong Dutch position as a significant energy hub and gateway for energy flows to north-western Europe. This is vital for an affordable and reliable energy supply of northwest Europe.

On the way to becoming a zero-emission society, natural gas is increasingly being replaced by hydrogen, especially in manufacturing and industry. By 2030, Gasunie has developed large-scale transport and storage infrastructure for hydrogen in the Netherlands and northern Germany that connects hydrogen suppliers with hydrogen buyers.

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gAvilar specializes in gas pressure regulation. We produce regulators and systems (stations) including safety devices for network companies and industry in the world. Mainly still for natural gas but more and more for other gases, because of the energy transition, like biogas (green gas) or hydrogen.

Our products are suitable for hydrogen, confirmed by Kiwa for some specific ones, and are therefore used in several pilot projects in The Netherlands. One of them called H2@Home that is going to test a special regulator in a typical 'home' situation at The Green Village, a test location at the Delft University campus where they installed a small hydrogen network to be able to heat a standard house with hydrogen.

This product closes the hydrogen supply based on external sensors, gas detectors, that are installed in the most critical places inside the house. The project is subsidized by the Dutch Government.

Also for the purpose of hydrogen blending we have developed an electronic volume converter that can calculate the calorific value of the gas. It works with an optional gas quality sensor and enables the invoicing for real energy instead of cubic meters.

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Bolsward is one of the 11 cities. The municipality of Sudwest Fryslan wants to use 10% of the windfarm Fryslan to produce, store and distribute hydrogen for the minor industries in the city of Bolsward. of the famous elfstedentocht. The location of the hydrogen plant will be situated close by the city, due to this aspect there are a lot of opportunities to make. This hydrogen will be a great multifunctional part of the plan to make Bolsward an zero emission city by 2035.
The links that are made in this project makes it unique, the links are:

1. Production of hydrogen from a medium size inland windfarm
2. Use of the electricity directly where it goes on the national grid
3. The hydrogen will be use for the high process temperatures of the light industry
4. The heat from the hydrogen plant will be used to get 1.500 house of the natural gas grid
5. The oxygen of the hydrogen will be used for the sewage treatment plant
6. Production water of a nearby dairy factory will be used to produce hydrogen
7. Possibilities are being investigated to create an hydrogen fueling station

The hydrogen plant will be 25MW with a 5 ton hydrogen storage.
This project teaches us that upscaling is possible and that the location of a hydrogen plant is vital to make keep to provide an great ecosystem around is which can make a hydrogen plant an multipurpose system.

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As the leading flow solutions provider for the safe and sustainable transport of fluids, GF Piping Systems creates connections for life. GF supplies high-quality plastic piping systems and related products for industrial applications, water/gas utility and building technology. GF connects resources, technology, and people, enabling positive change for a better future. Creating intelligent products and solutions for every flow application makes our world more connected and ensures the safe preservation and transportation of global (fluid) resources.

We offer holistic solutions for the hydrogen economy: from hydrogen production to storage and transport/distribution to utilization. With many years of experience in the field of gas supply and industrial water treatment we have a comprehensive portfolio of high-quality and reliable solutions for hydrogen technology. For our product lines ELGEF PLUS and MULTI/JOINT 3000® PLUS system we have already received the KIWA certificate AR214 *Suitability of hydrogen gases* and thus offer a complete range for hydrogen distribution.

In the field of hydrogen production, GF Piping Systems can create added value thanks to its broad product portfolio and many years of experience in water treatment, cooling applications and customer-specific product design and prefabrication, which are all efficiency-increasing, weight-saving and corrosion-resistant.

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Platform Groene Hart Werkt! (PGHW) is the regional platform for circular economic initiatives in 'The Green Heart' of the Netherlands. In co-operation with ten townships in the middle of the country PGHW inspires, connects and facilitates entrepreneurs, start-ups, council representatives and students in all circular economy aspects. A major part is dedicated to the hydrogen business.

Building a sustainable economic future means co-operation in many ways. By facilitating and sharing knowledge between partners in our network we contribute to a proper circular economy for our region and country. The hydrogen business is on top of our list. Not only we contributed to some concrete projects but we also work together with an innovation centre and university students on a hydrogen project in the automotive industry: the 'Hydrogen Education Bus'. An animation movie about the meaning and application of hydrogen was made in co-operation with a consultancy and engineering firm and issued by us. This year together with Provincie Zuid-Holland we started a 'regional hydrogen program'. Purpose of this program is to stimulate the hydrogen economy and the use of zero emission energy carriers in our region.

Contact us to see if we can help you with your circular and hydrogen business and ideas!

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GRONINGEN SEAPORTS

Groningen Seaports: Hydrogen hub of Europe. Groningen Seaports is the port authority for the port of Delfzijl, Eemshaven and the adjoining industrial sites. We provide the complete package of port services to industrial and commercial clients. In addition to this, the Eemshaven plays a central role in the development of the energy-related industry.

In this capacity, Groningen Seaports supports and strengthens the production of green hydrogen. There are multiple hydrogen projects in development within the Delfzijl and Eemshaven area. These are projects relating to the construction of electrolysers and hydrogen plants, the creation of specific port facilities, the development of a plastic pipe system ('backbone'), but also the use of hydrogen in public transport and the development of hydrogen filling stations. Groningen Seaports is therefore fully committed to innovation and offers space and facilities for test centres, start-ups, scale-ups, pilot and demo plants.

Europe's biggest green hydrogen project starts in Groningen. A consortium of Gasunie, Groningen Seaports, Shell Nederland, RWE and Equinor is working on the realisation of the NortH2 project: the production of green hydrogen using electricity generated by a gigantic offshore wind farm. The amount of green hydrogen produced, initially at Eemshaven and later possibly also offshore, is expected to be around 800,000 tonnes a year by 2040.

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H2ARVESTER

H2arvester is a circular energy system for a local and/or regional economy: local-for-local & scale-by-scale. Regional employment is leading and is in line with the concept of the 'short-chain': local producers add value to the environment and short chains help to realise the ambitions for a circular system. This is a unique opportunity to contribute to the energy transition to sustainable energy and a sustainable economy at a local and regional level, in addition to the large-scale production of energy.

H2arvester is a partnership for research, product development and realisation of movable and autonomous systems for the generation of solar energy and the production, storage and applications of electricity and hydrogen.

H2arvester was founded by L'orèl Consultancy from Groningen and npk design from Leiden. L'orèl Consultancy, npk design and LTO Noord are the inventors of the H2arvester system and have all the qualifications for energy research, technical development, facilitating pilots and outsourcing the production. H2arvester won the RVO competition 'Solar power in agricultural areas' at the end of 2017.

Selected Dutch (and preferably local) agricultural mechanisation companies are engaged for the production, installation and maintenance of the mobile solar systems. For the realisation of the electrical systems, hydrogen production and storage systems, we collaborate with system suppliers and market leaders in these industries.

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H2 Circular Fuel is a Dutch company. It has specialized in building applications to extract H_2 from H2Fuel ($NaBH_4$), reducing it to $NaBO_2$ and to regenerate this Spent Fuel back to $NaBH_4$.

H2Fuel is a patented technology for the production, storage and release of hydrogen. For its production, no electrolysis is required. The hydrogen is stored under normal atmospheric conditions in a powder. Release takes place without additional energy, using ultrapure water. Not only is one hundred per cent of the hydrogen stored in the powder released but, as a bonus, the same amount of hydrogen is released from the water, as well.

In dry powder form, the hydrogen can be stored for an unlimited period, is in energy terms the maximum attainable result, has no safety risks and, throughout the production process from production through consumption, features no harmful emissions at all. Once the hydrogen has been issued, the residual substances can be returned to the powder state with hydrogen stored in them: this makes H2Fuel the world's first circular fuel. H2Fuel can be deployed in all sectors of society and the economy and, as a result, forms by far the preferable alternative to both fossil fuels and other sustainable alternatives.

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The H2Hub Twente is a meeting point for entrepreneurs, scientists, students and governments to share knowledge on hydrogen technology and work together on innovative technical applications. With this initiative, H2Hub Twente wants to make it possible for SME's to get started with and realise concrete hydrogen projects. The main idea of the Hub is creating so called learning communities on testing and improving different applications of hydrogen technology. The added value of the Hub is to support the energy transition by facilitating breakthroughs through applied research. The Hub is located in a former high-tech factory, which makes it possible to create different lab- and research facilities.

Project examples are:

- HyGenesys: a challenge-based learning community to implement a HYdrogen GENEration SYStem for decentral applications. The community consists of 4 scientists, 6 technicians from different companies and 10-15 students from the Saxion University of Applied Sciences
- High Temperature Applications: development of a combustion technology for special purposes (Bakery, Coffee Roasting, Plastic Production)
- Hy-Oxygen: a researchproject for the use of O2 as residual product of H2-production in wastewater treatment
- Twentolyser: developing an innovative elektrolyser concept in cooperation with the Twente University
- Development of a mini-range extender for specific applications (e.g. drones)

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H_2O Systems Holland (H_2O) designs and produces systems that generate 'Warmth from Water'. Hydrogen extracted from water is widely seen as the most valuable alternative fuel.
H_2O introduces the 'next generation' hydrogen powered home heating systems. The system converts water into hydrogen by low power electrolysis and burn the hydrogen to produce heat.

H_2O systems are designed for consumer use in single home units and in the future also available for multiple units and apartment buildings. The system is developed as an alternative for the currently used fossil fuel powered systems. The system is fully emission (CO_2) free.

The system's unique points are being a 'closed system' that 'on location' and 'on demand' generates hydrogen. Burning hydrogen makes sure the system generates energy and subsequently supplies heat for house warming and tap water.

The critical elements 'closed' and 'on location' imply no transport, no infrastructure nor any storage of gas is required. Dangerous and expensive transport and storage are completely eliminated. The key element 'on demand' implies that the H_2O systems generates hydrogen 'on location' and 'on call' when the consumer turns on the system needing heat or heated tap water. This high potential research company holds the Intellectual Property (IP). Currently worldwide is no comparable system available. The Company's potential is based on international expansion as well as financial performance, shareholder and stakeholder value.

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H2Storage is a 100% Dutch company with experienced executives (from the energy, composites, aviation and automotive sectors) as the driving force behind this successful start-up. By combining our years of experience gained from the aforementioned sectors we developed a viable solution for long term energy storage. We have fulfilled an essential step towards a hydrogen economy by introducing the use of high pressure lightweight composite storage tanks from recyclable material to store hydrogen. Now we have an alternative solution to store more hydrogen under high pressure in the whole supply chain, from production all the way till the end user. This can be realized by type 4 composite cylinders with NWP of 700 bar. Portfolio of H2Storage consists of single lightweight composite cylinders and standard 10-45ft container containing tenfold(s) of these cylinders including the essential appendages for hydrogen storage. The solution to store locally, transport and use locally (e.g. an off-grid (emergency)generator) large quantity of hydrogen. These products are developed according to the International (ISO/ADR/ADN/TPED) and European standards (R134) for the automotive, shipping, stationary and transportation industry.
Currently we are fully involved in, among other things, the SHIP2DRIVE consortium, the realization of a sustainable inland vessel and the realization of a sustainable excavator. Naturally, our role is to realize the most efficient storage and transport of hydrogen systems.

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For Farmers, the soil is their best friend, a gift that needs to be nurtured. That's our belief too, and that's why we help farmers with innovative ways to keep the soil healthy and to maximize their yields at the same time. By developing machines that enable Controlled Traffic Farming and that run on electricity.
Not just another tractor, but a versatile electric powertrain with excellent traction, based on a smart modular chassis, super sight, adjustable track width, ultra-short turning, very fuel-efficient and with GPS 2 cm precision steering. We call it the EOX, and it gives you up to 20% higher yield with lower input and, equally important, a healthier soil. Just by letting the soil do the work.
H2Trac develops and builds electric tractors for the professional market. At the moment 6 people are working full time on the development and construction of the EOX 175. EOX 175 is the first professional electric tractor on the market and ready for series production. EOX 175 was developed by Paul van Ham. Together with his brother Peter-Jan and an investment company, there is an ambitious plan to build five tractors in 2021 and 40 in 2022. H2Trac is located in Arnhem. The new EOX -175 is available with three different energy solutions: a euro6 diesel-range extender, a version that runs entirely on batteries (capacity 6-8 hours) and (from 2022) completely on hydrogen.
A healthy soil was the starting point for our machines. Together with 7 Dutch arable farmers, we have listed all requirements and developed the most innovative tractor since decades. And now we are working with farmers and hydrogen suppliers to organize a local hydrogen network that fits agricultural use.

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The HAN H2Lab is a shared R&D facility, part of the HAN University of Applied Sciences. It is a meeting place for research, education and industry and has a focus on the development, testing and validation of small and intermediate hydrogen applications as well as feasibility studies.

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Hinicio is a strategy consulting firm specialized in sustainable energy, with areas of expertise including hydrogen, renewable energies, energy storage and transport. Since 2007 Hinicio has developed a leading European competence centre on hydrogen and fuel cells. Our team collectively combines many decades of experience in the sector, including working in senior positions with leading industry players.

With offices in the EU, China and Latin America and an extensive partner network in Australia, Canada, USA, Korea, Japan, Hinicio supports customers globally on topics ranging from strategic assessments, innovation and marketing strategies, business plan appraisal, innovative business models development, market and techno-economic feasibility studies, due diligence, etc.

Hinicio has been working for players involved at every step of the value chain, from upstream (industrial gas companies, utilities, O&G companies, TSOs/DSOs), to chemical companies, equipment manufacturers (electrolysers and fuel cells), car makers and suppliers, fleet owners, public and private investors as well as industry associations and public institutions at all levels.

Over the years, Hinicio has developed world-class expertise on the development of infrastructure, a unique proprietary industry database on hydrogen and transport technologies, in-house modelling tools as well as knowledge on the (upcoming) regulatory framework.

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Howden is one of the world's leading manufacturers of air and gas handling solutions. We address the challenges of the energy transition with highly innovative solutions to contribute to the deployment of renewable and low-carbon hydrogen. Hydrogen compression is a key aspect in hydrogen applications to move hydrogen efficiently across the value chain from production to consumption. With over 100 years of experience in the compression of hydrogen, we have developed highly innovative solutions for our customers, optimising the availability, reliability and installation footprint, while reducing the total cost of ownership of operations. 'Advanced compression solutions across the hydrogen value chain' says it all. Whether gasification or electrolysis are involved, we combine innovative technology and worldwide engineering expertise across the hydrogen value chain, from the world's largest centralized operations to smaller scale decentralized applications. Howden compression technology, based on reciprocating pistons and diaphragm compressors, enable large volumes of hydrogen and associated pressures to get the energy values needed. Howden designs and manufactures compression solutions as individually engineered packages to meet the specific demands of unique applications and requirements. Nevertheless, production and life cycle follow our established standards to meet with speed of delivery and life cycle of the compression solutions' requirements. Howden's highly innovative compression solutions can be found at the heart of leading clean hydrogen projects around the world, playing a key role in supporting the global energy transition. We have successfully supplied globally state of the art compression technologies to a large number of projects.

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Hy-Cell is a fuel cell stack and system development partner, with a design team based in The Netherlands and a 20,000m² high-tech manufacturing and R&D site in China. We are specialized in the design, testing and manufacturing of heavy-duty fuel cells for trucks, trains, busses, marine and energy storage solutions. Hy-Cell can provide cell plates, fuel cell stacks, fuel cell systems and do the fuel cell system integration into your product or provide assistance for system integration.
Our experience of over 15 years, plus our holistic approach enables us to make design and manufacturing decisions to minimize the Total Cost of Ownership (TCO) of your application, while guaranteeing high quality, durability and safety.

Our Design & Sales office is based in Arnhem, the Netherlands. From here we design fuel cells and serve our Western customers. Our 20,000m² high-tech manufacturing site is located in Jinan, China. From here we develop, produce and test fuel cells and serve our Asian customers.
Our design team covers all steps of the fuel cell development, allowing us to efficiently support you with the design of the cell plates, stacks and systems. Our experienced production team verifies our designs in-house and produces your high-quality fuel cells and components with state-of-the-art production and testing equipment.

Hy-Cell significantly invested in testing equipment and uses a high-end short and full stack test station up to 200 kW. The test stations, including software, are designed in-house and have extensive safety features to ensure stack and operator safety. Hy-Cell's ISO 9001 compliant plant is equipped with high-tech international test equipment.

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HyCC (the Hydrogen Chemistry Company), is a leading industrial partner for safe and reliable green hydrogen supplies and circular chemistry solutions to enable the transition to zero-carbon industry.

From making sustainable steel to circular jet fuels HyCC believes that green hydrogen is the key to providing a growing population with essential products, with zero emissions to realize more sustainable economic development.

Building on over 100 years of experience in electrolysis and their leadership in safety, HyCC realizes pioneering water electrolysis projects to supply industries with zero-carbon hydrogen from renewable power and water.
The company's 1 gigawatt portfolio includes projects such as:

- Djewels, a 40-megawatt electrolyzer project based on advanced pressurized alkaline technology to help decarbonize industries at the Chemical Park in Delfzijl;
- H2eron, a planned 40-megawatt electrolyzer in Delfzijl to enable the production of sustainable aviation fuel;
- H2-Fifity, a 250-megawatt facility being developed together with bp to reduce emissions from the Rotterdam refining and chemical cluster;
- H2era, the Netherlands's first 500-megawatt green hydrogen plant, located in the port of Amsterdam;
- GreenRoot, an industrial-scale electrolysis project under development with German gas company VNG to enable the decarbonization of central German industries.

HyCC B.V. is a joint venture of the European electrochemical company Nobian and Macquarie's Green Investment Group.

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HyDevCo can be technology supplier, project-partner or developer for decentral hydrogen production for local use. Projects with an extraordinary environmental impact by avoiding NET 12 kg of CO2 emission for each kg of hydrogen produced. We achieve this by using the Hynoca® technology which is capable of converting RED II biomass into 5.0 quality hydrogen and biochar. We ideally place our installations on small plots, next to a petrol station, a factory or housing block where we can provide the hydrogen directly from the plant at a pressure of 8-30 bar. This way we avoid transportation costs and efficiency losses.

The hydrogen can flow directly into the process at a capacity of 30 kg of hydrogen per hour, 720 kg a day. At the production of 30 kg of hydrogen per hour, with a guaranteed availability of 8.000 hours, the yearly need for biomass is 6.400-8.000 ton. The biomass needs to be RED II certified to obtain certified hydrogen and certified biochar. Some interesting biomass examples are, (demolition) wood, short rotation coppice, digestate from a biogas plant, (straw)manure, cereal dust, miscanthus etc. So we convert into hydrogen and biochar. The biochar meets the EBC standards meaning that it qualifies to sell related carbon certificates! At the same time the biochar, at average 1.3 ton / hectare, can be used as a soil amendment to hold water in the superficial layer, to house micro-organisms, reduce the need for fertilisers and binding nitrogen. Let's get in touch!

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We at Hydrogen Powered Solutions (HPS) are convinced of the possibilities of hydrogen to accelerate the achievement of the environmental targets for 2030. We offer solutions and products with hydrogen technology for financially sound conversion and sustainability of heating and combustion/incineration installations or plants. After several years of intensive R&D work, adjustment and assessment, the time has come that HPS can actively contribute to the current environmental problems. The developed hydrogen technology coupled with a combustion appliance such as a gas wall-mounted boiler or add-on burner offers a wide range of options for drastically reducing natural gas consumption and significantly minimizing the CO_2 emissions simultaneously. The Hydrogen Power Unit (HPU) developed for this purpose, in combination with a combustion appliance, is capable of minimizing natural gas consumption by up to 50%.
The new technology offers a wide range of optional and on-demand operational capabilities for the HPU system to meet all requirements . The system is robust, compact, safe and requires no end-user intervention. It is fully automated and can be monitored in real time by H2PS. With remarkable and significant performance and efficiency, you can ensure that natural gas consumption is minimized by up to 50%. At present, the HPU is extensively available and finds its way into housing associations, office complexes. The HPU is committed to further developing and improving its technology to be compatible with all residential or industrial facilities with the best possible expectations.

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The TU Delft Hydro Motion Team is one of the Dream Teams at Delft University of Technology. Our team consists of 25 ambitious students from eleven different fields of study. Our team is fully committed every year to show the applications of our advanced technologies at spectacular races. For over 15 years, we have been designing, building and racing cutting-edge boats driven by sustainable tech. Each year the team builds a new boat made in conjunction with the knowledge of industry experts and the experience of alumni.

With our project we want to work together with the maritime sector to accelerate the transition to green energy. There is still a lot to be gained in this sector and by thinking together with the maritime world and innovating in the field of sustainability, we contribute to a better and greener future. Because only together we can make a change.

This year, we optimize every part of our boat for the use of hydrogen. We will design our boat to excel in endurance, speed and manoeuvrability. To put our boat to the test, we will participate in the Offshore Competition of the Monaco Energy Boat Challenge to become world champions. Our team shows what a multidisciplinary team of driven students can achieve with the right mindset and by combining their strengths. Being the engineers of the future, we take the next step towards a sustainable world.

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Hydron Energy is a technology innovator that develops and manufactures advanced electrolyser stacks for hydrogen production equipment.

Hydron's cutting edge Polymer Electrolyte Membrane Water Electrolyser (PEMWE) technology offers an efficient, cost effective and reliable way to produce hydrogen (and oxygen) out of water and electricity.

Our technology delivers high performance and efficiency, with an exceptional small footprint. Hydron's electrolyser stacks feature a wide operating range and excellent dynamic response, making the technology ideally suited to be coupled to intermittent renewable energy sources. Because of the application of state-of-the-art membranes, hydrogen can be produced at high pressure and purity.

The company's product portfolio consists of a range of electrolyser stack platforms that can be used in various applications: from flexible screener cells for materials development, to robust large capacity stacks for application in industrial processes.

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Hydronex is a subsidiary of the Roelofs Groep and its main activity is to initiate, develop, construct and operate smart energy hubs, in which hydrogen can play a key role. Hydronex strongly believes that local entrepreneurs and joining forces will play an increasing role in the transition to a sustainable new economy, with a focus on future-proofing our energy supply.

In addition to being a developer of renewable energy projects, Hydronex collaborates with strategic partners to create decentralized smart energy hubs. Our hubs establish intelligent connections between the production, distribution, storage, and consumption of renewable energy. Often hydrogen is part of the solution in the optimization towards affordability, continuity, and security of supply, creating a favorable local and regional business climate.

We conduct technical modeling studies to determine if it is feasible to translate concepts into technical designs (concept design, site planning, and visualizations). We also specify the design to accurately assess the costs, benefits, and legal and safety possibilities. In the project's initiation phase, we often act as the driver and initiator. Once a coalition is formed, we commence with the technical-economic feasibility study and organize project management to maintain a positive flow. Hydronex manages permits, financing, stakeholders, and construction supervision. Together with our partners, we build sustainable, affordable, and robust energy systems.

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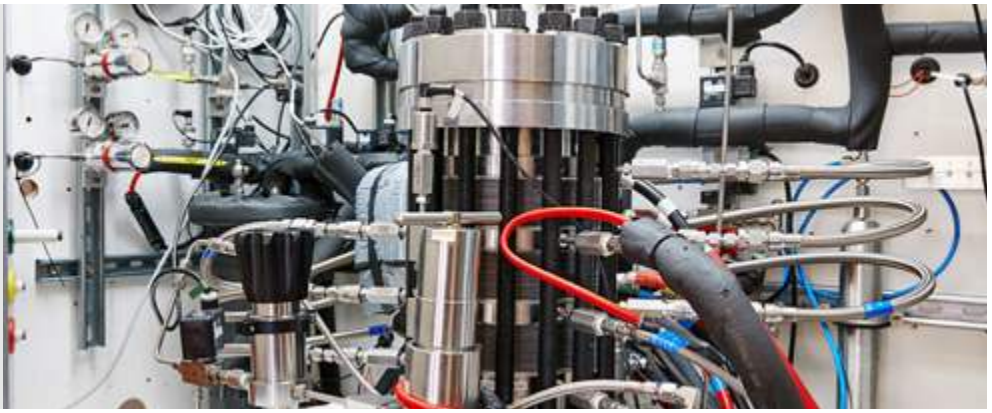

HyET Hydrogen is an international company based in Arnhem, the Netherlands. HyET Hydrogen is a leading SME in the field of electrochemical hydrogen compression, extraction and separation, also referred to as Hydrogen Processing Technologies. HyET Hydrogen was founded in 2008. HyET has introduced the first commercially viable Electrochemical Hydrogen Compressor (EHC) in 2017. HyET enters partnerships with key stakeholders all over the world to develop products with a focus on application within the Hydrogen value chain. HyET's headquarters are located in Arnhem, the Netherlands and is run by an experienced interdisciplinary team. HyET Hydrogen had expanded its focus to the USA with a subsidiary, HyET Hydrogen LLC based in Colorado. HyET's Electrochemical Hydrogen Compression (EHC) is completely silent, safe, cost effective, energy efficient and has no moving parts. The fact that the electrochemical compressor has no moving parts is also advantageous because it avoids wearing of parts which reduces the overall maintenance costs. The absence of moving parts contributes significantly to the reduction of maintenance costs and the prevention of damage, when compared to mechanical compressors. HyET's Electrochemical Hydrogen Processing technologies can significantly lower CAPEX and OPEX in the H_2 supply chain for many existing industrial H_2 markets as well as for the upcoming FCEV markets. Besides compression of Hydrogen, HyET Hydrogen also developed a technology which can extract and purify Hydrogen from mixed gas streams.

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HYGEAR
THE GLOBAL HYDROGEN SOURCE

Our company is built on a vision that Hydrogen will be the fuel of the future. Once this happens, the current supply method of central hydrogen production and delivery by road transportation is no longer an economically viable option.

At HyGear, we developed technologies to generate and recycle hydrogen at the end-users' site. We have been applying these technologies in many different industrial applications over the past decades offering advantages in reliability, cost, and environmental impact.

In years to come, we will continue to focus on these industrial applications as well as grow our install base in hydrogen energy applications and thus become an enabler for a clean and sustainable future.

Most industrial gases in the bulk segment are produced at central locations and delivered to the end-users by road transportation. This method of supply is inefficient and expensive as the amount of gas that can be delivered is bounded by the limitations of the storage capacity on the trailers and distances are often large.

At HyGear, our focus is to downscale gas generation and purification systems to a size that matches the needs of bulk users. This creates independence from suppliers and also the limitations dictated by existing sources.
Our technologies guarantee a major step forward in a more efficient supply of industrial gases and can act as enablers for the upcoming transformation of our energy system towards hydrogen as a carrier.

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HyMatters

Are you looking for a sustainable solution to correct a mismatch between supply and demand of energy? Or do you want to use hydrogen as a sustainable fuel? HyMatters helps you to become more sustainable with an integrated approach between energy production, energy use and grid capacity using hydrogen.

By analysing your specific situation, we will arrive at a hydrogen solution that is in line with your local energy infrastructure. We develop this complete solution for you. From concept to design, up to and including realisation.

Wondering if hydrogen is the energy solution for you? No matter where you are in the process, we can assist you. With these services we offer you customised solutions.

- Hydrogen Course
- Feasibility Study
- Engineering and Implementation
- Monitoring

HyMatters helps you achieve your sustainability goals with an integrated approach between energy production, storage, use and grid capacity using green hydrogen. We can help you achieve your goals via hardware-based, modular solutions, tailored to you needs. We can produce high quality hydrogen, but we can also stabilise your local grid while doing so. We can manage Power Quality issues, for instance through automated dynamic voltage control.

We service a wide arrange of customers like industrial clients and hospitals.

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HyMove
Hydrogen
moves
your world

HyMove is builder and integrator of the most efficient fuel cell systems and integration techniques for heavy-duty applications such as buses in city and regional transport, trucks, construction equipment and inland vessels.

These systems work on hydrogen and oxygen from the air and supply electricity and heat. They only emit water. Due to their high efficiency and long lifespan, the HyMove systems are suitable as the 'heart' of hydrogen applications in transport, construction and shipping. The nitrogen reduction achieved through the use of hydrogen fuel cell systems in vehicles and construction equipment is 100%.

Theo Hendriks is mainly concerned with the question how zero-emission applications can be implemented. This is usually not a question of technology or money, but of bringing together the entire supply chain of committed parties. The transition is not a matter of an individual, it is a change to do together.

The technology that HyMove uses is now mature, ready for the market and can be rolled out. HyMove now has a number of years of experience. These systems have been proven in buses for urban and regional transport in Gelderland. Ten buses are under construction for Münster in Germany.

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hysolar

Hysolar, founded in 2019, focuses on green hydrogen for mobility. In our vision, green hydrogen is a key element in a circular economy. Relying on practical experience in combination with scientific know-how we develop green hydrogen ecosystems, where continuous innovation is crucial. Hysolar activities are threefold:

1. The supply of green hydrogen as of 2021 in Nieuwegein (NL) by opening our public 350 and 700 bar Hysolar / Greenpoint hydrogen refuelling station.
2. Using local solar power and green electricity from the grid, Hysolar realises a 2-2,5 MW electrolyser to supply 250 tons of green hydrogen starting Q2 2023. To make the electrolyser an integrated part of the energy system, it will be utilized for the dispatchable capacity of the national grid operator. Moreover, the residual heat will be used locally to reduce the consumption of natural gas.
3. Innovation and consultancy activities to support businesses, local governments and other parties in their transition towards green hydrogen.

Over the years we have helped municipalities and businesses with our innovation and consultancy activities. We've developed solutions in which grid congestion is solved by producing green hydrogen and we work closely together with an inland shipping company to decarbonize their activities. Last but not least our innovative 'dual fuel' solution has led to the launch of the first tractor on hydrogen. We are busy applying this innovation to other heavy machinery such as excavators.

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Hystream develops and realizes state-of-the-art local green hydrogen solutions. Our objective is to decarbonise society by realising end-to-end green hydrogen solutions for mobility, such as transport, cars, inland shipping and utility buildings. As such, we are committed to realize and manage an emission-free hydrogen value chain that simultaneously creates value for all stakeholders involved in this value chain. Our collaboration with local partners and stakeholders is central to this. In this way we can accelerate the energy transition locally and make industry and mobility more sustainable. Our partners can provide all the necessary elements of the hydrogen value chain.

Our solutions resolve grid congestion problems, provide zero-emission construction power and make hydrogen available on-demand at different locations. Examples of current projects are hydrogen-based stable supply of green electricity whenever and wherever required, the local production of green hydrogen from solar or wind power and the realization of filling stations for the distribution of green hydrogen for cars, busses and trucks in areas where hydrogen is not yet available.

Hystream aims to realize a local public network of hydrogen production and distribution points for different types of users.

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As an industry, transportation was responsible for approximately 26% of worldwide CO_2 emissions in 2018. The mandate is clear: we must transition these vehicles to clean energy to protect the planet and future generations.

That's where Hyzon comes in. Headquartered in Rochester, N.Y, with U.S. operations in the Chicago and Detroit areas and international operations in the Netherlands, Singapore, Australia and China, Hyzon is a leading global supplier of zero-emissions hydrogen fuel cell powered commercial vehicles, including heavy-duty trucks, buses and coaches. Hyzon makes it easy for private and public fleet operators to transition to zero-emission vehicles, helping them meet ambitious environmental standards and contribute to global decarbonization. Hyzon sets the pace for global zero emission trucking.

Hyzon Motors Europe office and production location are located in Winschoten, just outside Groningen (The Netherlands) and close to the German border. At this location Hyzon produces the Hyzon's HyMax series for the European and Australian market.

Visit www.hyzonmotors.com for more information.

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Invest International

Invest International is a financing institution established in 2021 as a joint venture between the Dutch Ministry of Finance (51%) and Dutch development bank FMO (49%).

We offer tailor-made financing and project development expertise to bring projects in emerging markets to fruition and create impact on the SDG's, while serving Dutch interests.
We have a catalytic financing capacity of 2 billion euros, composed of investment capital for public and private projects, as well as grants enabling public infrastructure projects.
Invest International was assigned by the Dutch Government to facilitate and finance Green Hydrogen projects in emerging markets, to contribute to local sustainable development and support the energy transition in Northwestern Europe.

We offer a range of instruments suitable for financing small scale initiatives, medium sized industrial projects as well as large-scale infrastructure projects throughout the Green Hydrogen value chain.
While deploying our funds, we make efforts to engage the expertise of Dutch businesses, demonstrate strong environmental & social commitment and strive for local impact and inclusive growth.

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KAPP
HEAT TRANSFER ENGINEERS

We are Kapp, Heat Transfer Engineers. We not only know every heat exchanger inside and out, but also the industry in all its diversity. In the field of hear transfer, this allows us to go further than anyone else. We design, plan, produce and construct. And we don't leave until everything works. At Kapp, we see it as our mission to accelerate the energy transition by fundamentally improving our clients' processes and projects.

When it comes to heat transfer, we really do have a head start. Like you, we are convinced that green hydrogen will make a major contribution to the energy transition. Developments in the field of hydrogen are rapid, with the number of installations and electrolisers increasing rapidly worldwide. But processes are not yet fully crystallized. Understandably so! People all over the world are looking for the optimum configuration to produce hydrogen as sustainably and efficiently as possible. We have a suitable heat exchanger for every step in hydrogen production. This gives us a real edge, which benefits our customers. That said, knowledge and experience of other experts in the hydrogen sector are essential for us. Our approach in this market is therefore: "Here to teach, here to learn". A philosophy that stems from the realization that time is short and that we can accelerate developments, especially together with other experts from the sector.

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Kenter is a Dutch energy solutions provider, currently serving over 30,000 customers in the Netherlands. Specialized in metering services, energy infrastructure and electric vehicle charging solutions, we help organizations to optimize their energy use and adopt innovative solutions to aid the process.

As a leading energy solutions provider, we're also specialized in hydrogen metering. This can be applied in various ways and with different purposes. For example, when you want to know the exact amount of produced hydrogen.

Kenter is at the heart of today's fast-moving energy world and is ready for a challenging future. As an independent part of Alliander, we are an experienced and knowledge-intensive partner. From the local bakery to large multinationals and from sport clubs to municipalities. They can all count on the expertise of more than 300 specialists working at Kenter.

We provide a complete package of energy services and metering solutions based on an up-to-date understanding of the market and innovative technologies. Would you like to learn more? Contact us by calling +31 (0)88 191 15 55 or send an e-mail to info@kenter.nu.

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Kiemt is a triple helix network organization located at Industriepark Kleefse Waard (IPKW) in Arnhem. As Energy Valley Bureau, Kiemt accelerates the development of innovations for energy transition and circular economy in the Eastern part of the Netherlands.

More than 200 members are participating in this active innovation network, consisting of knowledge institutions, SME's (start- and scale-ups) and (semi-)governmental organizations. These members are frontrunners in the field of energy and/or circular economy. Kiemt accelerates opportunities by scouting and screening of innovations, connecting these with the triple helix network and initiating projects and programs. By doing so, innovative, viable and sustainable products, services and companies arise from their original ideas.

Kiemt programs and organizes a regional hydrogen cluster, consisting of more than 30 SMEs (start-ups and scale-ups) and knowledge institutions. The aim of this cluster is to stimulate innovations for the further development of the East Netherlands as a hydrogen technology research & development region. This facilitates the implementation of hydrogen technology on a large scale and strengthens the regional economy at the same time.

The cluster focuses on:

- Starting up and accelerating initiatives;
- Matchmaking of parties to value chain(s);
- Exchange of knowledge and information.

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Kiwa is a world-leader in Testing, Inspection and Certification (TIC) , Training, Technical Advisory and Consultancy. With a background of more than 90 years in water, energy, and gaseous fuels Kiwa is a knowledge institute, and international quality authority.

Our services in the field of renewable energy production, power2X and hydrogen (low & high pressure) cover the complete value chain: Generation, Transportation, Distribution, Storage and Application of Hydrogen and Sustainable Fuels.

Key Services:

- Wide range of Solar and Hydrogen Testing Facilities 17025 accredited;
- Inspections of Solar, Wind, Sustainable Fuels and Hydrogen installations, including pre-compliance and consultancy inspections;
- Testing, assessment and certification of components and systems like electrolysers, fuel cells, appliances, pressurized tanks and components, pipes, valves and fittings;
- Consultancy supporting R&D programs, tecno-economic feasibility studies, support in innovation and transition, technical due diligence, business and investments planning, pilots design and development, risk analyses, material research, failure analyses, etc;
- Training and qualification of personnel working in the renewable energy production and hydrogen fields.

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KLINGER is the world's leading manufacturer and provider of industrial gaskets and valves. Formed in 1886 as a family enterprise, the pioneers in gasket technology today are a globally active Group of manufacturing, sales and service companies that offer unique know-how and competent on-site consultancy services.
Our know-how, which in the meantime spans more than 130 years, enables us to be fully committed to supplying not just products, but tailored state of the art sealing, fluid control and fluid monitoring solutions, using the latest design and pilot technology.
KLINGER products contribute to the safety of transport, storage and processing of hydrogen. KLINGER gaskets and valves will keep the connections of constructional elements leak tight and impermeable, even for the extremely small molecules of hydrogen.
Leak tightness is essential when handling hydrogen. After all, it can ignite within seconds when coming into contact with oxygen and a spark. All KLINGER gaskets have been tested by TÜV with regards to hydrogen and are recognized as particularly high-quality seals.
From the revolutionary development of the compressed fiber gasket to the advanced sealing material technology and high tech valve solutions of today, development, innovation and problem-solving abilities have always been the pillars of our philosophy.
Our products are 'trusted. worldwide.' as a result of their high reliability, long life cycle and extremely low total cost of ownership.

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The Koedood Marine Group observes an increasing demand for electrification and sustainable inland shipping. Our group is comprised of several specialized companies centred around the development and implementation of future proof marine power trains. Koedood is the largest dealer of Mitsubishi engines in The Netherlands. With an innovative heart Koedood leads the development in the inland marine sector by example. Our group has knowledge stretching far wider than the inland marine sector alone and we are active in all markets involving maritime activities. Koedood now exists for over 40 years and has always been a driving force in the Dutch maritime industry.

Our mission is to maintain a leading role in sustainable technology for the maritime sector. With more than an decade of experience with hybrid systems and almost half a century of experience in the Dutch marine sector, our hydrogen technology can be seamlessly integrated in modern hybrid vessels. Our vision is to develop systems that can sail completely zero-emission on longer routes.

We seek strategic partners and contribute to several hydrogen projects and consortia. In the role of system integrator we take part in the Rh2ine consortium and actively develop hydrogen enabled drive train systems to further green the European waterways.

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Royal Van Twist is a family owned business with a history of more than 180 years. 80 years ago the distributorship for Perkins Engines was acquired. Based on the strong core engine Royal Van Twist started the development for gas fuelled engines 40 years ago. This resulted in the approval as Perkins official gas partner in 2014. The current gas engine range goes from 10 to 1200 kilowatt electrical.
During the 40 years of history we developed a great amount of knowledge with a large variety of gasses as Natural gas, Biogas and LPG. The last 10 years we have focused on gasses with a low methane number, mainly for thermal waste recycling processes. During these processes waste as tires, plastics, MDF and even medical waste is heated to high temperatures resulting in products like nafta (raw gasoline), carbon black, active coal and ash. As by-product a waste gas is produced. This is used as fuel for the gas generator providing electricity to the grid).
As low methane gasses could cause serious engine damage we have developed our own engine control systems. The systems are tested in our state of art in-house test facility.
As hydrogen could be considered as a gas with a low methane number we asked ourselves if it would be possible to use hydrogen as a fuel for our engines. After a positive conclusion from the feasibility study during the first half of 2019 we started the technical design at the end of 2019. The design includes a custom-built hydrogen injection block which is connected to the inlet manifold of the engine. The hydrogen engine was first started in October 2020. The first pre-production engines will be available for trail applications in the first quarter of 2021. Full production will start by the end of 2021.

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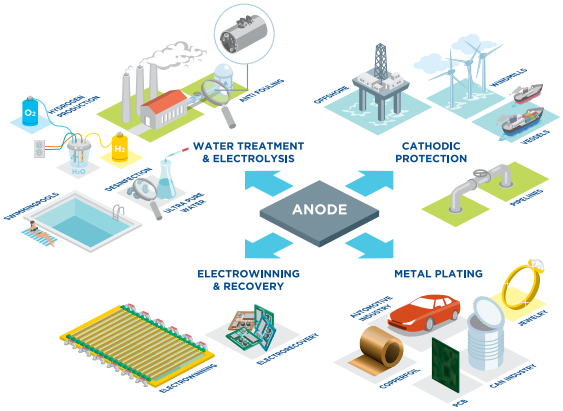

Magneto Special Anodes evoqua

MAGNETO special anodes strives to be the best designer, producer and supplier of titanium anodes for electrochemical applications. Inventor and proud supplier of high-quality titanium anodes and electrochemical cells for a variety of applications, MAGNETO has been catering to the electrochemical industry for more than six decades. We aim to ensure our customers are satisfied with their anodes.

The right anode is key for electrochemical applications. Selecting the correct one can lead to substantial cost savings. MAGNETO understands that your application – whether it's metal plating, water treatment, electro winning, cathodic protection, or hydrogen production – has its unique features. That's why we pride ourselves on our ability to manufacture custom electrodes that meet your requirements, regardless of the specifications. In fact, we're well known in the industry for providing the optimal anode for every individual application.

A green economy will increasingly make use of hydrogen produced by water electrolysis. It is expected that water electrolysis will play a pivotal role in the future energy landscape. MAGNETO produces several components for PEM electrolyser systems in a cost-efficient and flexible manner.

We're committed to designing, manufacturing and supplying titanium anodes for hydrogen production systems that fit your needs, withstands the test of time and reduce your operational costs.

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MAGNUS energy

Magnus Energy offers stability in the ever-evolving European energy transition. The world is changing at an increasingly rapid pace. Europe is integrating its energy markets and including renewable energy sources to future-proof the continent's system. All parties involved need to find common ground, align their objectives, and work together for the common good.

In a recent study (freely accessible)—leveraging our experiences in European electricity market integration projects— we shine a light on the key challenges related to implementation of the EU Hydrogen and Decarbonised Gas Package. Operators will need to develop network codes, standards on hydrogen blending and establish cross-border cooperation. Magnus Energy is well-positioned to support this transition from legislation to operation. We offer:

- Complex program and project management
- Business diplomacy
- IT project and vendor management
- Test coordination
- Stakeholder management
- Advisory on regulation, implementation strategy, business processes and definition of requirements and tooling

By applying 15+ years of experience on complex, cross-border projects, we contribute to building a fully integrated energy union. Our highly committed team offers knowledge, structure, and support to tackle the overarching challenges in the future hydrogen and decarbonised gas infrastructure. All from an impartial standpoint to reach shared goals.

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MarshMcLennan

Marsh is a global leader in insurance broking and risk management. In more than 130 countries, our experts in every facet of risk and across industries help clients to anticipate, quantify, and more fully understand the range of risks they face. In today's increasingly uncertain global business environment, Marsh helps clients to thrive and survive.
We work with clients of all sizes to define, design, and deliver innovative solutions to better quantify and manage risk. To every client interaction we bring an unmatched combination of deep intellectual capital, industry-specific expertise, global experience, and collaboration. We offer risk management, risk consulting, insurance broking, alternative risk financing, and insurance program management services to businesses, government entities, organizations, and individuals around the world.
Marsh JLT Specialty provides flexible project risk management and insurance placement services for the full value chain of hydrogen investments, in combination with other renewable energy sources and Carbon sequestration if required. Our service framework will enable control over risk and insurance issues and is supported by hydrogen and other renewable energy risk engineering capabilities to provide a seamless project to operational risk transfer product that will enhance bankability of your projects. The product will provide comprehensive risk protection around your planned balance sheet.

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MECHATEST SAMPLING SOLUTIONS

Mechatest, is a leading certified manufacturer and worldwide supplier of analyser and sampling solutions specific for the Hydrogen market but in general for the petrochemical, chemical, oil & gas, pharmaceuticals, and power industry.

We offer advice, engineering 3D design and manufacturing capability for the supply of Hydrogen measurement solutions, our solutions are suitable for outdoor use in an industrial environment and ATEX Zone 1 or 2.

Hydrogen (wet gas) analyser or detection systems should be considered for product quality control and/or protection of the environment. The major challenge in measuring hydrogen samples in wet gas in an electrolyser system is to protect the hydrogen sensor and ensure a long service life and high-quality measurement.
The output of the electrolyser is Hydrogen and Oxygen as a gas composition and might be saturated with water vapour. To take in a wet gas a Hydrogen sample is not easy, most sensors for this typical measurement in this acceptable price range are mostly not suitable for wet gasses.

Mechatest designed for the new electrolyser unit a Hydrogen gas measurement solution that allows for analysis of the wet gas Hydrogen stream in Oxygen composition and the Oxygen in Hydrogen composition. For more information go to: www.mechatest.com/hydrogen-measurement/

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Metalot Future Energy Lab aims to accelerate the energy transition by boosting the development and market introduction of promising technologies in the sustainable energy domain. Particular focus is placed on Metal Power: the circular use of iron powder for large-scale import of renewable energy and for which H_2 is the key to convert rust into iron powder that can be combusted later and elsewhere.

Within the Hydrogen domain Metalot Future Energy Lab currently builds the hydrogen community in Southern Netherlands that focusses on the acceleration of experimental Hydrogen technology from TRL 4 and up, for production, storage and application. For this purpose, the Metalot H2 Fieldlab has recently come available for responsible testing of small-scale hydrogen prototypes.

Together we achieve acceleration by:

- Building new value chains together with knowledge institutes, governments and companies;
- Developing joint visions and roadmaps on technology application and adoption in the market.
- Building consortia to work on concrete R&D projects to realize innovative technology and equipment.
- Joint commercialization of potential Intellectual Property.

For more information check out www.metalot.nl or contact us via info@metalot.nl to get in contact with the Hydrogen Community.

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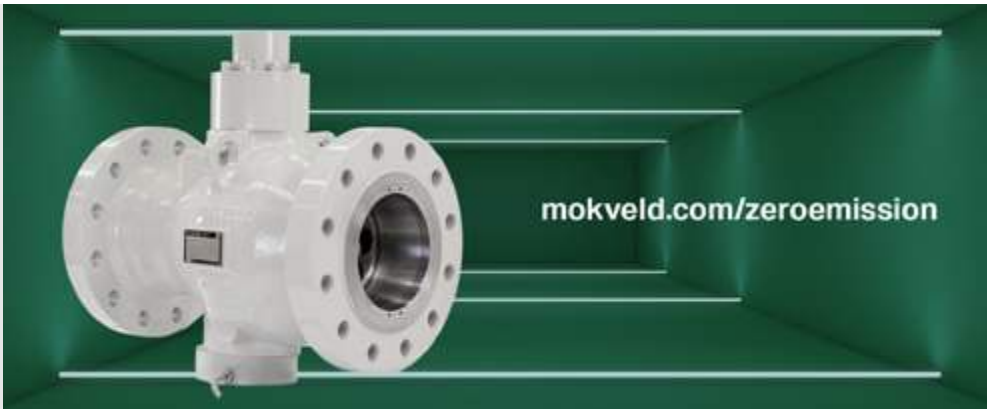

A future with hydrogen fits in the vision of Mokveld Valves in The Netherlands, being that the world's energy, water and material demand can be met in a sustainable way, with a responsible and environmentally safe use of our planet's resources.

Mokveld contributes to this by developing and manufacturing state-of-the-art equipment and services, based on innovative technology and best available techniques. The full scope of Mokveld valves is H_2 ready.

Moreover, the latest innovation of Mokveld is highly suitable for hydrogen: a true zero emission valve! Integration of the actuator inside the valve removes the need for a dynamic stem seals thus eliminating the main potential leak path of common valve designs with external actuators. On top of the zero external leakage throughout the lifetime of the valve, this valve offers very low electric power requirements, extreme accuracy and our well-known axial design with the inherent streamlined flow path, high capacity and low weight. All benefits have a positive effect on the opex and GHG emission reduction scopes allowing energy companies to achieve their net-zero goals. After successful long term field testing technical readiness level 7 was reached. Mokveld is ready to help energy companies to reduce their environmental footprint and to achieve their net-zero goals.

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MTSA Technopower develops decentralized energy management systems that convert green electricity into hydrogen and vice versa to make green energy available 24/7 and to prevent peak loads from solar and wind farms on the electricity grid.

Sun and wind energy is sustainable, CO_2 free and can be generated almost anywhere. On location, however, most of the day's yield is usually produced in just a few hours, while during the rest of the day hardly or no green power is available. Often the 80/20 rule applies.

Another obstacle to the large-scale application of solar and wind energy is the current grid capacity. This is often not sufficient to handle peak production from (planned) wind and solar parks.

MTSA Technopower offers a solution. MTSA Technopower develops product lines for:

- Power to Gas (P2G): Electrolyser systems for the production of green hydrogen in the capacity range of 1-10 MW.
- Gas to Power (G2P): Fuel cell systems for the production of electricity from hydrogen in the capacity range of 0.5-5 MW.
- Power to Power (P2P): Integrated energy management systems that combine hydrogen and electricity production.

Please visit our website: www.mtsa.nl or www.mtsa.nl/lines-of-business/waterstof-technologie

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Historic city centres and energy transition: Where heat pumps fail, and solar PV cannot be used, the Energy Transition for build environment has serious challenges to overcome. This is especially the case in Europe's historic city centres, which are essential for our European culture, identity and economy. Regulations prescribe that historic buildings must be preserved. Modern energy technologies (wall insulation, solar panels, double glazing or floor heating) are not desirable, not allowed or have severe restrictions. Heat pumps cannot be used because low-temperature floor heating will affect building structures. EnerTwin solution: The EnerTwin is the perfect solution to improve the energy efficiency and CO_2 emission reduction of a building. EnerTwin is a small-scale heat and power plant combined in one sustainable device. Its core is a micro turbine that drives a generator. Micro turbines have great advantages in terms of reliability and lifetime, and bring low maintenance, high-efficiency and significant CO_2 emission reduction. EnerTwin is also suitable for clean fuels such as green gas, biomethane and gas mixtures with up to 23% hydrogen, but it can also run on natural gas. By using renewable fuels, 100% green electricity is produced. Moreover, this leads to additional CO_2 emission reductions. Plug and play installation (no renovation required) makes EnerTwin the perfect solution for rapid energy transition of historic buildings. Hydrogen: The EnerTwin is currently CE certified for fuels with up to 23% Hydrogen (mix). It will be adapted to 100% Hydrogen in 2 steps (50%, 100%), while backwards integration is still possible in case a hydrogen infrastructure is not available yet. A 50% Hydrogen solution is expected to be commercially available by the end of 2022.

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MV Energietechniek
Advies & Inspectie

- Concept supplier, answers for your hydrogen related questions
- Hydrogen solutions:
  Production and conversion
  Storage
  Industry
  Mobility
  Built Environment
- Living labs – Learning by doing
- Project supervision and support
- Support and answering your inspection questions:
  PED
  Machinery Directive
  ATEX
  Low Voltage Directive
- Training and workshops

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Nedstack
PEM FUEL CELLS
To be sure.

Nedstack is a leading player in the PEM fuel cell industry with a strategic focus and unique track record on the high power and mission critical domain.

At Nedstack we enable the hydrogen economy by developing, realising, verifying, applying and servicing PEM fuel cell solutions. Our products and services are superior in quality, durability, safety and reliability and are cost competitive. Our responsibility is to be a partner to industry and a partner to society by tailoring our solutions and services to achieve optimal energy efficiency, large scale deployment of zero-emission power systems and balanced power grids.

At Nedstack we are confident that Hydrogen will be a backbone of the future global energy system. The rise of renewables provides for an abundance of excess hydrogen making it a widely available future commodity.

There is an increasing need for electrifying such green hydrogen in both stationary and mobile applications. As this hydrogen economy matures, the market for reliable and durable solutions will emerge.

Hydrogen will power the energy transition and we at Nedstack are strongly committed to develop and industrialize our PEM-technology and -products to enable the hydrogen economy.

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NEPTUNE ENERGY

Neptune Energy is the largest gas producer on the Dutch part of the North Sea. We are experts in producing and transporting molecules; whether those are gas or hydrogen molecules. We are moving towards a climate-neutral energy system that is reliable and affordable. The key lies in the integration of the offshore energy systems on the North Sea. It has an extensive gas infrastructure and offers opportunities for large-scale wind energy, green hydrogen production and CCS. We believe that green hydrogen is vital to the energy transition. That is why we are participating in PosHYdon, the world's first offshore green hydrogen production pilot. The pilot aims to integrate 3 energy systems in the North Sea: offshore wind, offshore gas and hydrogen by producing green hydrogen from seawater on our Q13a-A platform. The aim of the pilot is to gain experience of integrating working energy systems at sea and the production of hydrogen in an offshore environment. "The Netherlands is in a special position as, in addition to an extensive gas infrastructure network, we can harvest large amounts of wind energy in the North Sea, quantities that are also important internationally. The wind energy can be used to generate hydrogen, which can then be transported onshore along with natural gas via existing pipelines for industry, the transport sector and for Dutch homes. PosHYdon is key to accelerating this." In February 2022 Neptune with consortium partner RWE announced the next step towards large scale green hydrogen production further off shore on the North Sea ahead of 2030: H2opZee. We aim to build 300-500MW electrolyser capacity and transport the green hydrogen via an existing pipeline to shore.

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Netherlands Enterprise Agency

The Netherlands Enterprise Agency stimulates entrepreneurs in sustainable, agricultural, innovative and international business. It aims to improve opportunities for entrepreneurs, strengthen their position and help them realise their international ambitions with funding, networking, know-how and compliance with laws and regulations. As a government agency, it operates under the auspices of the Ministry of Economic Affairs and Climate Policy, and its activities are commissioned by the various Dutch ministries and the European Union. The Netherlands Enterprise Agency runs a number of programmes and supports business initiatives with various grant schemes.

Energy and Climate is one of the agency's key topics. The Dutch government is investing billions of euros in energy efficiency, sustainable energy and CO_2 reduction. In line with this, the Netherlands Enterprise Agency supports Dutch and international entrepreneurs and researchers in developing sustainable projects related to energy, climate and the environment. Innovation and public-private partnerships are key to the Dutch approach: the government, private sector, and academia co-operate on topics such as sustainable energy technologies, green materials, built environment, sustainable mobility, chain efficiency, sustainable electricity, new gas, and greenhouses as a source of energy.

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iNettenergy is a pyrolysis technology company with technology ranging from fast pyrolysis, gasification and super critical water gasification. We focus on organic waste as feedstock and small mobile installations with 10 MTPD feedstock. With our PyroGasification technology we produce syngas and biochar. This syngas can be used for electricity production or used in our unique SYN2H technology and converted into hydrogen. The SYN2H reactor is atmospheric and uses a non-catalytic process for converting the syngas. The production capacity is 500 kg/day of H2. The combination of producing renewable hydrogen and store CO2 in the soil using the biochar differentiates this route from the green hydrogen produced using solar/wind . Welcome to the world of orange hydrogen production!.

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NEW COSMOS - BIE
Gas Detection Solutions

New Cosmos - BIE is a manufacturer of stationary and portable gas detection equipment, mixing high qualified gas detectors with smart forms of (wireless) communications suitable for applications in the hydrogen industry as well as for many other types of industries. With more than 60 years of experience in gas detection, New Cosmos – BIE serves beside Europe also customers in the Middle East and Africa.
New Cosmos has gas detection solutions for a variety of applications within the hydrogen market including detection at the fuel cell, filling stations, FCV workshops, hydrogen production, hydrogen storage, residential detection for hydrogen smart meters, hydrogen boilers and hydrogen cookers. Together with our R&D team in Japan we can find the best solution to suite your requirement.

Our mission is to create a safer global environment with a reduced number of accidents.
Our strengths:

- Sensor technology in house
- Over 60 years of experience
- Reliability
- Unique selectivity
- Long lifetime
- Extended range of sensors for different gases

Solutions for the following markets:

- New Energy Markets
- Oil & Gas Exploration
- Chemical & Petrochemical
- Automotive Industry
- Laboratories
- Micro Electronics
- PV Industry

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New Energy Coalition is a continuously growing network and knowledge organisation that aims for a sustainable future by accelerating the energy transition on a national and international level. A triple-helix organisation funded by public and private parties, it connects energy knowledge, policy and markets. New Energy Coalition resulted from the merger of established energy associations, creating a comprehensive coalition of research and educational institutes, leading energy companies and government parties.

The coalition focuses mainly on the development and valorisation of growth potential of the energy sector in the provinces of Groningen, Friesland, Drenthe and Noord-Holland-Noord, the region being a perfect breeding and testing ground for energy innovation. The accumulated knowledge and results are available for the benefit of all.

New Energy Coalition is the catalyst behind Hydrogen Valley, a six-year European programme in which more than thirty public and private parties contribute to the construction of a hydrogen network in the Northern Netherlands. From large-scale production of hydrogen up to expansion of the number of hydrogen vehicles and fuelling stations, and from underground hydrogen storage to heating of residential areas. All these initiatives are being developed within the Hydrogen Valley (www.newenergycoalition.org/en/hydrogen-valley/), which has put the region on the international map as the exemplary region for hydrogen.

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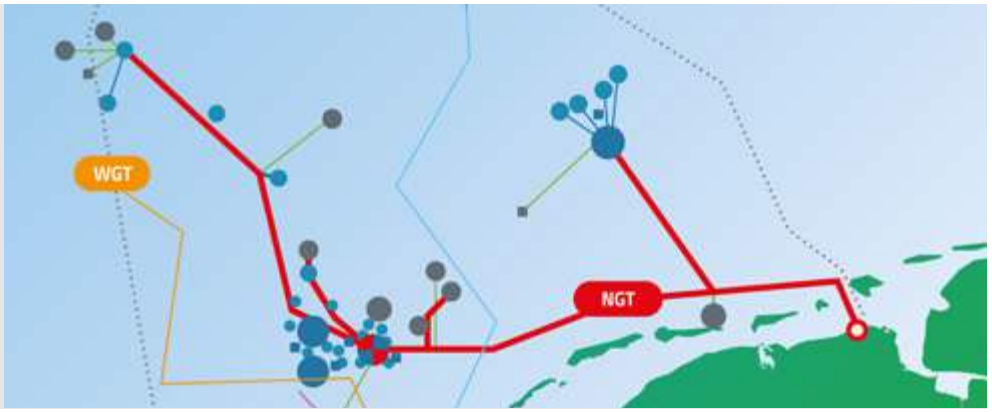

Treatment, Transport and Transition of Gas.

NGT B.V. owns and operates a nearly 500 kilometer network of pipelines in the North Sea. For 50 years we have been successfully transporting natural gas to shore. By transforming the existing infrastructure into an integrated offshore hydrogen backbone, we aim to accelerate the green hydrogen economy.

With natural gas production declining and a new sustainable energy generation growing we aim to reuse our existing pipelines to transport offshore produced green hydrogen from sea to land. Initial research results show that our extensive gas pipeline infrastructure – running from the North Sea UK border to Uithuizen, Groningen – is potentially suitable to transport hydrogen.

The North Sea is becoming a major European hub for sustainable energy. There is an extensive gas infrastructure – like NGT's pipeline system – that can be reused for hydrogen transport. We believe that green hydrogen is vital to the energy transition. Converting wind into green hydrogen offshore and transportation via the existing pipelines to shore opens up a green energy system with many advantages; we can accelerate and scaling up projects while relieving the environment as the infrastructure is already there.

Integrating existing infrastructure is the smart way forward. We join relevant consortia and projects to share knowledge and expertise. Among others, we are member of the European Clean Hydrogen Alliance and consortium partner in PosHYdon. NGT brings energy ashore.

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The Development Agency Noord-Holland Noord (NHN) plays a significant role in the development of the hydrogen economy in the region 'Noord-Holland Noord', located above Amsterdam. NHN is actively involved in promoting the development of sustainable energy solutions, with a focus on hydrogen. Together with a network of stakeholders, including companies, universities, and research institutions, NHN supports the development and implementation of hydrogen technology and infrastructure, such as fueling stations. NHN also assists companies interested in investing in hydrogen technology in the region.

Furthermore, NHN promotes the region as an attractive location for companies involved in the hydrogen value chain. The existing infrastructure of on- and offshore gas and oil pipelines, our experience and knowledge with the generation, processing, storage and transport of energy and the large-scale plans for more sustainable energy, puts the NHN region on the map as hydrogen region of the Netherlands. Together with local and foreign companies, research institutes such as the Faraday Laboratory of TNO in Petten, and operation and maintenance facilities at the Port of Den Helder, we work on the energy for our future, which is expected to include Hydrogen production at the North Sea in combination with the onshore hydrogen production initiative H2-Gateway.

NHN aims to accelerate the growth of the hydrogen economy in our region and beyond for a sustainable energy future.

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NOGAT BV is the owner and operator of a 250 kilometre offshore pipeline system connecting Danish, German and Dutch natural gas fields with the onshore Dutch network with a daily capacity of 36 million Nm^3. With declining natural gas production, NOGAT is working on a new business model to accommodate large scale offshore green hydrogen production. The NOGAT system has the capacity to transport approximately 10 -12 GW of wind power in the form of green hydrogen. A pilot project bringing together offshore wind, hydrogen production and transportation is being prepared at one of the connected platforms and is expected to be on stream in 2026. NOGAT is member of the European Clean Hydrogen Alliance and consortium partner in PosHYdon, H2opZee, North Sea Energy Program 4 and PHD@Sea.

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North Sea Port is taking a lead in the energy and climate transition and playing the hydrogen card. As one of the Europe's ten largest ports and one of the top industrial regions of Western Europe, North Sea Port is in an excellent position to secure a leading role in the production, storage, transit and distribution of green hydrogen as a sustainable energy source and circular raw material. The cross-border port area is already the largest hydrogen cluster within the Benelux countries, producing and consuming 580,000 tonnes of the gas every year. The unique combination of the steel and chemicals industries and the presence of large solar and on/offshore wind farms enable interactions between major players committed to greening and sustainability who are using hydrogen as a lever to that end. Several projects to build electrolysers and installations to convert hydrogen into synthetic fuels and raw materials are at the construction stage and will be operational in the near future. In many cases, these are 'first of their size' projects. North Sea Port and its partners are also further developing the necessary basic pipeline infrastructure to link together supply and demand. They are working towards a marketplace for hydrogen as an indispensable link in a value chain extending beyond the port area. In addition, the port is releasing more than 400 hectares for investments that will reinforce this circular dynamic and pave the way for sustainable economic growth and jobs. The strategy and aims of North Sea Port are in line with the objective shared by Europe, the Netherlands, Belgium and Flanders of a climate-neutral and zero-emission future.

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Our aim is to make Dutch society more sustainable through the development and application of hydrogen technology and fuel cells. We do this by means of the following activities:

Combining strengths: the NWBA combines the strengths of governments, industry and research institutions in order to accelerate the development and application and create opportunities for the Dutch business community.

Sharing knowledge: the NWBA gathers relevant knowledge and shares it with its stakeholders. The NWBA acts as an advisor and knowledge partner in this regard. Training and education is also provided.

Representing: the NWBA represents the Netherlands in European initiatives and conveys the Dutch vision on hydrogen and fuel cell technology both nationally and internationally.

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Due to environmental and climate challenges, the demand for more sustainable mobility is growing. There are good alternatives to petrol and diesel available, but the availability of these alternatives is not yet optimal. NXT Mobility is a total concept to make mobility more sustainable. We offer climate-neutral mobility cards and charging solutions for electric vehicles. With NXT Energy Hubs, our filling stations of the future, we already offer less environmentally and climate-damaging fuels and energy solutions. We increase the availability of more sustainable fuels and make the energy transition locally possible. In addition to traditional fuels, we offer more sustainable variants at our NXT Energy Hubs such as LNG, HVO, electricity and hydrogen. The first hydrogen filling point will be realised mid 2022 at our NXT Energy Hub in Alkmaar. The second will be opened at the end of 2023 at our NXT station in Westzaan.

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OCI Global is a leading global producer and distributor of nitrogen, methanol, and hydrogen products and solutions providing fertilizers, fuels, and feedstock to agricultural, transportation, and industrial customers around the world. OCI's global production capacity spans four continents and comprises 16.7 million metric tons per year. OCI has more than 4,000 employees and is headquartered in the Netherlands.

Key hydrogen projects in development include:

- A world-scale blue ammonia plant in Texas, with low carbon hydrogen and nitrogen supplied by Linde, which is on track to start production in 2025. It will be the first greenfield blue ammonia facility of this scale to come onstream in the United States.
- Our green ammonia project, Egypt Green Hydrogen, Africa's first integrated green hydrogen plant, started commissioning its first unit of 15 MW in November 2022.
- Landmark collaboration with Masdar and ENGIE to study the co-development if a green hydrogen facility in the UAE.
- Expansion of ammonia throughput capacity in the Port of Rotterdam, and a partnership with NortH2 that will see the development of the first large-scale green ammonia and methanol value chains in the Netherlands.
- Evaluating a gasification opportunity at our methanol facility in the Netherlands. This would be the first plant in the Netherlands to transform biomass derived feedstocks into bio-methanol to cater to growing demand in the marine and vehicle fuels markets and the chemicals market.

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Port of Amsterdam

The Port of Amsterdam is currently one of the leading energy hubs in Europe with availability of large scale flexible tank storage terminals, supported by extensive blending infrastructure for oil products, and its role as a supplier of kerosene to Schiphol Airport through a direct pipeline.
The Port of Amsterdam is however strongly committed to play an active role in the transition towards sustainable energy production and use in both local, regional, national and international supply chains. The Port of Amsterdam therefore aims to become the largest hub for the storage, blending and transit of renewable and synthetic fuels in Europe. In addition, it enhances the investment climate for existing and new companies to establish production facilities for these types of fuels.

The port is working closely with different partners to establish new value chains based on for example hydrogen, synthetic kerosene, and methanol. Therefore the proposal presented by the Port of Amsterdam reflects the strategy of the port in the development of creating the 'building blocks' for the Future Fuels Hub containing the following clusters of projects:
Infrastructure projects

- Regional Integrated Backbone (RIB): development of a newly constructed regional hydrogen pipeline connecting production sites (e.g. project Hermes / 100 MW electrolysis with Nouryon and Tata Steel) as well as the national hydrogen backbone, with partner Gasunie.
- Development of a hydrogen distribution network in the port area.
- Development of a (green) CO_2 distribution network in the port.

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Port of Rotterdam

Rotterdam is the largest energy hub in Europe and is a frontrunner in the energy transition. Hydrogen is a key element in this transition. Together with its partners, the Port of Rotterdam is working on a series of projects to develop the production, use, infrastructure, import and transit of hydrogen. The H-vision project is focused on the production of blue hydrogen. Regarding green hydrogen, several companies are making plans to ensure that an electrolysis capacity of 500 MW will be operational by 2025. This capacity has to be scaled up to 2 GW by 2030, among other things by realising 2 GW of additional wind at sea, connected to Rotterdam. For the exchange of hydrogen between companies, there will be a hydrogen pipeline through the port area in 2024. This is a boost for the development of a physical hydrogen market, and so is the realisation of a hydrogen exchange.

Together with a large number of partners, the Port of Rotterdam is examining the import and transit of hydrogen from overseas, to replace the current European energy imports (oil, coal). This is done with parties from many countries, ranging from Iceland to Australia and from the Middle East to South America. To be able to accommodate these imports, the focus is on realizing terminal facilities in Rotterdam and a robust infrastructure to the hinterland, especially hydrogen pipelines to Chemelot and North Rhine-Westphalia. Simultaneously, the application of hydrogen is encouraged, as fuel for industry and the transport sector, and as raw material for chemical products. Current projects include one that is aimed at having 1,000 hydrogen-powered trucks on the road between Rotterdam, North Rhine-Westphalia and Antwerp by 2025, and projects on the use of hydrogen as a fuel for inland shipping.

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POWER2X
LEADING IN ENERGY

Power2X is a project developer and management consultancy for energy transition projects across Europe and North America. The company works with several business partners on new projects in the energy transition. The focus is on sizeable projects in Green and Blue Hydrogen as well as related conversion, storage and end use assets, all with a focus on decarbonization of industry. This also includes projects related to green ammonia, methanol and other derivatives, such as clean fuels. Power2X has a growing team of circa 50 professionals and is headquartered in Amsterdam, the Netherlands. It has a development pipeline of 5 large scale projects, in various stages of development.

Supported projects often imply large-scale greenfield projects, major industrial site redevelopments, and decarbonization of large energy intense assets. In case of a project owner involvement, we look after projects with a CapEx ticket of €250+ million. The current project development pipeline includes:

- Blue and green hydrogen
- Renewable ammonia production (e.g., the Power2XMadoqua project)
- Bio- & e-methanol
- Other derivatives like SAF and rDME

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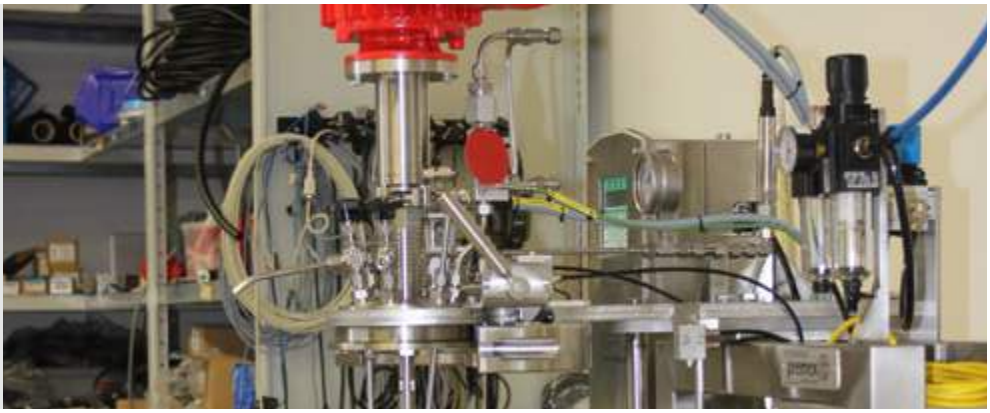

Pro Control
PROCESS AUTOMATION BV

Pro Control is an engineering company with a very clear focus on the delivery of process control (PLC controls) and data acquisition systems for process installations (lab, bench and pilot scale) and skids. We have been doing this for over 20 years and work for well-known organizations active in the world of Chemicals, Oil & Gas, Seed Breeding, Aerospace and Defence.
We distinguish ourselves through our knowledge and expertise of measurement & control technology applied in these demanding and often complex environments. We have knowledge of Siemens, Eurotherm, Honeywell, DeltaV, Rockwell, Beckhoff, Hitachi, Wonderware, iFix, Reliance and National Instruments LabVIEW (we are NI Alliance Partner).
Supplemented with our expertise in the field of measurement and control technology, integration of analytical instrumentation (GC, MS, FTIR, etc.), recipe control, data processing and the fact that we can deliver E&I projects turn-key, makes us a serious discussion partner in the field of automation and control engineering.
To give you some examples:

- For several skid builders active in Petro Chemical environments we are supplying the automation for the process skids they developed. Units have spread all over the world;
- We are an automation partner for a seed breeder in Enkhuizen and we supply turn-key machine controls and carry out extensions/ adjustments/renovations to the automation of existing installations;
- For the space authority we supply the automation (software, cabinet, cabling) of a vacuum set-up in which materials are tested in extreme conditions.

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Proton Ventures is an engineering company specialised in ammonia related technology and products. Proton Ventures is experienced in building and running pressurised and refrigerated ammonia terminals. Therefore our portfolio ranges from liquid chemical storage facilities, De-NO_x and N_2O removal systems up to modular production facilities of green ammonia. Hence, Proton Ventures is an experienced partner when it comes to hydrogen carrier and storage concepts needed for the energy transition. Next to this, Proton Ventures also enables the agricultural industry to switch towards green fertilisers. Whether you need a new facility built from the ground up, or an existing one upgraded, we are happy to be of service. Our team consists of talented developers, design engineers and project managers whom develop, design and execute projects, meeting your requirements and exceeding your expectations.

Our modular ammonia plants are based on our NFuel concept. The feedstock for this ammonia production is power produced from renewable sources (solar, wind turbines, hydro). This new concept allows production of green ammonia in a de-centralised fashion, which can be further used as:

- Nitrogen carrier (fertiliser)
- Hydrogen carrier/storage
- (Combustion) Fuel

As a basic starting point for our designs, Proton Ventures works with three different production capacities. Within this range of the capacities Proton Ventures deals with the supply and demand of the energy market.

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Reducing greenhouse gases is one of the absolute priorities of our time. The province of Noord-Holland as Hydrogen Hub Noord-Holland therefore puts a lot of effort on hydrogen development. We believe that hydrogen is an indispensable element in a carbon-free society. By replacing fossil fuels by hydrogen we also contribute to healthy living environment. In addition, the hydrogen developments can boost our economy and employment, with spin-offs in innovation and knowledge development. Our region can play a strategic role in the new hydrogen economy and can contribute to the climate goals of Europe. All steps in the hydrogen value chain are present in our region. Due to our geographical location at the North Sea, offshore produced green electricity and hydrogen will come ashore at our coasts. This hydrogen will be used in our industrial clusters, Schiphol Airport, ports, agriculture and transportation sector. The province of Noord-Holland supports companies and municipalities in realizing their ambitions regarding sustainable energy and CO_2 reduction. We do this by providing funds and human resources, by bringing parties together, by having research and explorations carried out, by making pilots and projects possible through spatial integration etcetera. The province of Noord-Holland is a member of Europe's Clean Hydrogen Alliance and is part of various partnerships in the field of sustainable energy and CO_2 reduction.

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PURE WATER GROUP

Pure Water Group is a leading manufacturer of advanced and sustainable water purification equipment. We partner with innovative technology suppliers to develop and expand our product range. Core technologies include: Electro Deionization (EDI), Membrane Degassing (MD) and Electro Dialysis Reversal (EDR) which are used for the production of High Purity and Ultra Pure Water or the treatment and recovery of challenging water streams. Pure Water Group cooperate globally with water system integrators who fully rely on our expertise, extensive experience and dedicated support. Pure Water Group: engineering purity.

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pwc

PwC is one of the global leading energy transition tax and advisory firms. We understand the challenges resulting from the fundamental changes to the energy system. For the energy transition hydrogen is an essential energy carrier. Without hydrogen it will be hard to meet the ambitious climate targets. We support both leading companies in the hydrogen industry, as well as Dutch government on the challenges of this quickly developing and innovative industry.

We help solve these important problems, with our broad industry knowledge, deep technical financial expertise and thorough understanding of the technical challenges. We help companies turn their (infrastructure) projects with high capex and uncertainties into a success or assist governments in kickstarting a hydrogen market and infrastructure by tapping into all opportunities to optimise their investments. We assist companies and governments with understanding the challenges related to hydrogen projects and ensure these projects are optimally prepared for access to (equity) funding, green (project) financing, subsidies and other European and local (tax) incentives. With our vast global network, we are also well positioned to help companies expand cross border.

We can support from the early stages (market analyses and -entry studies, feasibility studies, business case set-up), towards the realisation (funding, financing, subsidies) until exploitation (management,reporting and compliance).

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Cluster organization RAI Automotive Industry NL facilitates a network of companies, active in the Dutch Automotive Industry, that maintain and strengthen their international innovative lead through mutual cooperation and collaboration with government and knowledge institutions. Making a social contribution plays an important role and therefore all activities are aimed at realizing the following ambitions:

- Zero emission
- Zero congestion
- Zero accidents

Together with over 30 entities across the Netherlands we facilitate for the development of three hydrogen technologies: hydrogen combustion engines, hydrogen fuel cells, and a next-generation hydrogen refueling infrastructure technology.

These main developments in this project are related to cross-sectoral mobility applications for the automotive, marine, and non-road mobile machinery sectors, and the resulting technical requirements of the products from the end-user's perspective. The project also takes into account legislation and regulations and other market-specific factors. With this, the consortium partners aim to accelerate and improve the transition to sustainable mobility and to strengthen their (international) competitive position on the market for sustainable mobility applications and power units.

RAI Automotive Industry NL is a part of the RAI Vereniging and together represent the interests of the Dutch automotive industry on a national and an international level.

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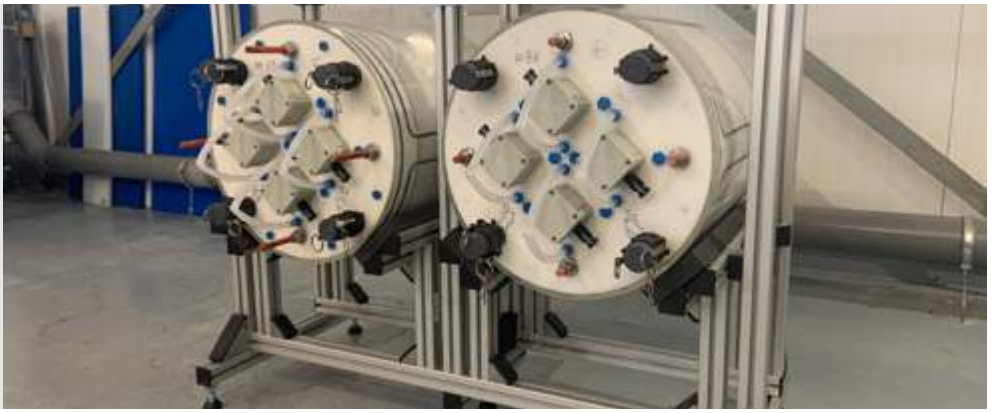

REDstack is an impact scale-up company, developing and implementing technology and membrane-stacks, for per example:

Reversed Electro Dialysis for sustainable and continuous power generation out of 2 waterflows with different salinities. The Pilot-Plant at the Afsluitdijk is running successful, and now ready for upscaling into a 0.5 MW Demonstration-Plant. The stacks generate DC, full continuous and very suitable for feeding directly into Hydrogen Electrolysers.

Electro Dialysis for water desalination. The new developed ED-technology and ED-stacks from REDstack have a significant lower energy consumption than traditional stacks. Industrial Electro Dialysis applications, per example for Nutrient recovery.

The stacks and system-design and supply is done in close cooperation with companies within the group: W&F Technologies and Pure Water Systems.

As REDstack has significant experience in designing and assembling various membrane-stacks, REDstack is a good partner in developing and realizing alkaline Hydrogen Electrolysers.

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Remeha develops innovative and energy-efficient comfort solutions for the indoor climate. With a broad product and service portfolio, for heating, cooling and hot water, we make sustainable comfort solutions accessible to everyone. With more than 500 employees, Remeha gives a contemporary interpretation to the development and production of comfort solutions, with which it has grown into a leading manufacturer in the Netherlands and in Europe. Remeha is one of the main brands within BDR Thermea Group. Remeha has developed the world's first hydrogen boiler and is one at the forefront of the hydrogen transition in the Netherlands. In combination with hybrid heat pumps, the application of hydrogen becomes even more relevant. This makes a reduction in hydrogen consumption of up to 70%, just like with natural gas, achievable. Remeha believes in the application of this energy carrier and therefore invests heavily in hydrogen development:

- 20% hydrogen mixture with Remeha gas boilers: Hydrogen blending is a pragmatic way to quickly make a big step towards the CO_2 targets. In November 2019 various Remeha gas boilers have been certified for the mixture of up to 20% hydrogen.
- 100% hydrogen gas boiler: Remeha Hydra: In June 2019 we had a world premier: a 100% hydrogen boiler used in an existing apartment complex in Rotterdam. In the upcoming years the Remeha Hydra will be used extensively in projects in the Netherlands and abroad.
- Hydrogen ready gas boiler: Remeha and BDR Thermea Group are working on the development of 'hydrogen ready' gas boilers. A hydrogen-ready boiler runs on natural gas, but can be converted to hydrogen relatively easily.

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Resato is a Dutch provider of smart high pressure solutions with the aim to increase the productivity of its worldwide customers. It is our mission to meet and exceed the expectations of our customers. With more than 25 years of experience in high pressure technology, we are equipped with the knowledge to provide reliable and safe solutions. We want to support the hydrogen mobility sector with our high pressure solutions.

Therefore we have developed hydrogen refuelling stations to tackle the 'chicken and egg' dilemma: there is a lack of hydrogen filling stations due to a shortage of hydrogen cars, and vice versa. Resato's vision is to meet this challenge with compact and efficient refuelling solutions that support the development of a hydrogen economy.

For smaller hydrogen-powered vehicle fleets, such as cars and buses, hydrogen is still not readily available. By developing a compact and cost-efficient refuelling station (Fleet Owner Station), the first step has been taken to break through the high investment and make it possible for companies with fleets to refuel with hydrogen.

This way, the number of hydrogen filling points can be increased. When demand grows, the compact stations can be replaced by a centrally located public hydrogen station, where you can refuel your car within 3 minutes. This makes it easy to expand the network by relocating the compact filling stations.

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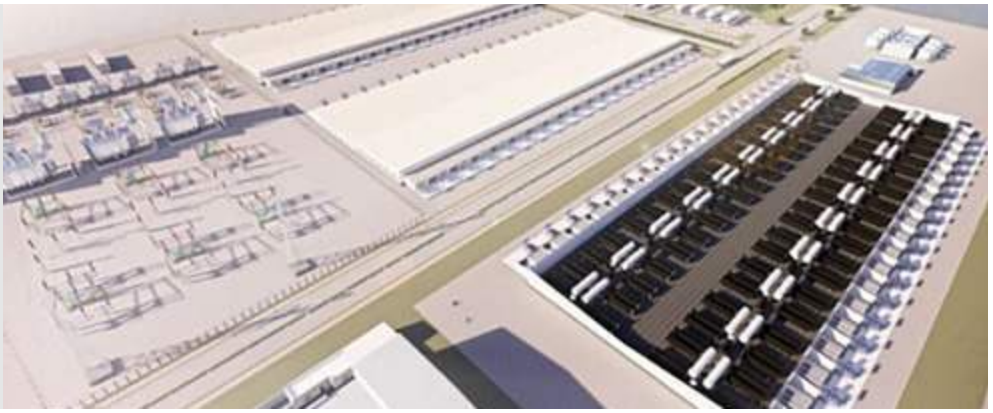

Royal HaskoningDHV has been an independent engineering services, consultancy and project management agency since 1881. Our nearly 6,000 professionals worldwide innovate by collaborating with customers and partners to have a positive impact on people, the environment and the economy.

We advise companies and (semi) governments on all parts of the hydrogen chain, from the first idea to the conceptual design phase. We provide technical-economic feasibility studies in which we involve stakeholders and society. We also provide specific services related to safety, permits, legal and policy advice.

We are active in all parts of the hydrogen chain, including the demand-side options. For us, one of the major challenges is to bring the high level ideas to realisation as many parts of the chain are still in development, both in the technologically as well as organisational and regulatory.

Next to that we understand that hydrogen has a key role in energy transition and complements electricity to have a sustainable energy system. As such, H_2 may be the best option, but in other cases a different solution such as electrification or CCS may be the most optimal option.

RHDHV has carried out over 50 hydrogen projects in various roles. These are projects for the production and import of hydrogen, such as our 1 GW parametric design; transport and storage like a QRA for a H_2 pipeline or in the use phase the development of the business case for H_2 buses.

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With ‘Spatial Atomic Layer Deposition’, SALD has developed a globally unique, patented process for applying functional nanolayers as thin as a single atom on an industrial scale. These conformal nanocoatings are deposited via a self-limiting gas-phase process with web speeds up to 60 meters/min. We can apply it under ambient conditions on nearly any substrate, like metal, glass, wafers, plastics, textiles or membranes.

Spatial ALD process will revolutionize entire industries, including the electrolysis technology industry, the production of battery cells for cars and smartphones, the textile industry, printed electronics (organic computer chips), the new solar energy industry and the packaging industry for consumer goods and convenience food.

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Samotics

Samotics seeks to address the factors that contribute towards an efficient operation of AC-driven rotating assets, and with it reduce electricity consumption and GHG and carbon emissions. AC motors are an integral asset across various industries. These motors however, have critical problems, such as failing unexpectedly, being used inefficiently, and being selected inadequately (right sizing). Energy waste occurs as a result of all three of these factors. Samotics strives to solve these three issues by providing a combined energy and condition monitoring service, called SAM4. SAM4 is a plug-and-play solution and service for critical AC motors and rotating equipment. SAM4 utilizes electrical signature analysis (ESA) and powerful AI-driven algorithms, which use voltage and current data of AC motors and rotating equipment. This data is obtained by plug-and-play, easy to install (and scale), SAM4 hardware, which is installed in the easy to reach and safe environment of the motor control cabinet of the assets, instead of on the assets themselves. To date Samotics has 120+ clients to which energy and condition monitoring services are provided and is monitoring thousands of assets in the field. Moreover, Samotics has multiple global partnerships, amongst others with Schneider Electric. Would you like to get know more about our solution, SAM4, do not hesitate to reach out.

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SAXION UNIVERSITY OF APPLIED SCIENCES

Saxion is an open and accessible university of applied sciences which provides solutions to social issues through education and applied research. The current energy transition is unmistakably a big challenge for society in which Saxion is taking up its role. Both in educating young professionals to support the required work force for the transition, but also by means of application research that brings together researchers, industry and students around energy related topics. The important role of hydrogen in the transition is acknowledged and has a role in the various academies and research groups. This includes technical aspects of the hydrogen applications, but also sociological, economical and legislative aspects that play a role. Within the group of Sustainable Energy Systems, one of the research lines focusses on industrial use of hydrogen, including high temperature heating applications and the generation of green molecules. We are involved in several hydrogen related projects (e.g. RELEASE, GROHW, HYGENESYS and Hydrogen Connect 2020-2030) and are closely working together with the H2Hub Twente fieldlab (Almelo, the Netherlands). Together with the HAN University of Applied Sciences we are a strong applied hydrogen knowledge and research group in the Eastern Netherlands with a strong regional, national and international network.

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SHV ENERGY

SHV Energy is a Netherlands based, family owned multinational distributing LPG, LNG and sustainable fuels servicing the energy needs of over 30 million customers worldwide.

We are proud to provide energy for hundreds of applications, ranging from cooking to heating to powering low-polluting vehicles. Through our local brands including Calor, Primagaz, Ipragaz, Liquigaz, Supergasbras, Xiwei, Supergas and Pinnacle Propane, we serve our customers through our market-leading LPG companies on four continents: Europe, Asia, North and South America. It is our mission to help clients find unique energy combinations, going beyond our responsibility of simply supplying energy.

Everyday we provide people and businesses beyond the gas grid with the opportunity to switch from high-polluting, carbon-intensive fuels to cleaner forms of energy. In 2018, we pioneered the launch of renewable propane (also known as bioLPG) to offer our customers a drop in replacement with up to 80% carbon reduction. Our activities within our Sustainable Fuels team are to explore, encourage and develop solutions for decentral off-grid domestic heating and cooking, industrial process heat and transportation applications. We already operate Hydrogen infrastructure in China and we see long term potential for global growth. Our focus is on collaborative action to tackle the challenges of green hydrogen for off-grid production and usage.

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siapartners

Sia Partners is a next-generation consulting firm focused on delivering superior value and tangible results to its clients as they navigate the digital revolution. Sia Partners was founded in Paris in 1999. Today, Sia Partners is still headquartered in Paris but developed into an organization with over 1800 consultants, active in 31 offices around the world.

With its global expertise in the energy sector and its recognized know-how in business transformations, Sia Partners is able to seize the opportunities offered by hydrogen to its clients from a business and technology perspective. The added value of Sia Partners:

1. Our teams work on projects all along the energy value chain – from strategic to operational steps – and are therefore familiar with a large spectrum of actors/possible partners;
2. Sia Partners' expertise on the energy sector, especially on the stakes of energy transition and;
3. Sia Partners' knowledge on the hydrogen market and the actors of the ecosystem, which is deeply fragmented.

So far, Sia Partners has helped major gas infrastructure companies, energy producers, energy suppliers and research and knowledge institutions on a wide variety of hydrogen projects. Examples of Sia Partners' project focus areas are contextualization and challenges of the hydrogen sector, definition of hydrogen development strategies, support for project management and development of analytical tools.

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SIEMENS energy

Energy systems around the world are undergoing fundamental changes: the balance of fossil fuels and renewable energy sources is shifting. Global demand for energy could increase by around 25 percent by 2040 – and, if we don't act, the amount of climate-damaging greenhouse gases could rise accordingly. The central question is: How can we meet the rising demand for energy worldwide and at the same time protect the climate – and do so in an economically sensible way? Siemens Energy can deliver answers.

We are convinced that a climate-neutral energy supply is not only technologically feasible, but also economically profitable. In this sense, the global energy transformation offers many opportunities that we intend to seize with determination.

We energize society around the world and thus enable successful and sustainable growth – that is our promise, indeed our purpose. As a competent partner and advisor, we want to enable our customers to realize their ambitious goals and commitments. All along the entire energy value chain, we accompany our customers on their way to a more sustainable future – no matter where they are.

Siemens Energy has a complete portfolio of products, solutions and services, ranging from the generation of (renewable) electricity, power transmission, to conversion into (green) hydrogen or e-fuels, including compression and industrial heat production, heat storage and heat recovery solutions. Together with our customers, we energize society worldwide.

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SoluForce®

SoluForce is the originator and technological leader in long length high pressure Reinforced Thermoplastic Pipe systems (RTP, also known as Flexible Composite Pipes or FCP). They are used for many applications, such as hydrocarbons, hydrogen, water, offshore and mining.

The SoluForce RTP system has been certified for hydrogen applications up to 42 bar of operating pressure. Unique in the world of hydrogen transport and a global first. Based on proven technologies, it can be the perfect accelerator to achieve local (green) hydrogen distribution in a fast, flexible and cost-efficient manner.

The SoluForce system is completely flexible, meaning it can go round corners, up hills, down slopes, across gullies, under water and more with ease. Being non-metallic, it is also fully corrosion-free, does not suffer from hydrogen embrittlement and is quick and simple to install.

Reusable and with a significantly lower CO_2 eq. footprint compared to alternatives, this ready to use pipeline solution has a major impact on the feasibility of (green) hydrogen projects and a sustainable energy mix.

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R. Stahl Electromach is an international leading design company with an extensive engineering and manufacturing expertise in explosion proof control systems. Our components and systems can be applied in areas where gas and dust explosions may occur. Therefore, we are the obvious partner of choice for oil, gas, petrochemical and offshore applications such as in refineries and oil and gas.

All safety solutions by R. Stahl Electromach are customer-based and include the development of application software, manufacturing, assembly, testing and on-site commissioning. R Stahl Electromach offers these solutions as full-service packages, from consultation and conceptual design to operation. We also take care of all international certification and providing after-sales support.

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Stork is a value-driven provider of fully integrated operations, maintenance, modifications and asset integrity solutions. By setting new standards of excellence in various sectors, we aim to be the industry reference. Every day, everywhere. Our global network includes our headquarters in the Netherlands, plus operations in the UK, Continental Europe, Americas, Middle East and Asia Pacific. Stork has a global workforce of 18,000 employees.

Stork has more than 60 years' experience in Hydrogen projects and is involved in several green Hydrogen projects. Stork has conducted market studies on Hydrogen for the EU and on various Hydrogen applications for companies. Stork has built the first 1 MW electrolyser in the Netherlands, builds and maintains Hydrogen fuel stations and is frontrunner in Hydrogen and Oxy fuel combustion. Stork was the consortium lead for the development of a hydrogen house heating project in Hoogeveen, involved in energy and Hydrogen partnerships, education and Hydrogen standardization.

Stork is part of Fluor Corporation, one of the world's largest publicly traded engineering, procurement, construction and maintenance companies. Together Fluor and Stork are your partner for total Hydrogen assets lifecycle solutions, from feasibility to construction and maintenance.

With its more than 190 years of industrial experience, Stork is committed to play its leading role in the energy transition, also announced as 'the next great economic revolution'.

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summit engineering
Your partner in CO_2 reduction

"Leaving a world to thrive in for future generations." We want to use our personal energy for that.

Summit Engineering was founded by Arjan Hartemink and Robbert van der Pluijm after a trip to Mount Kilimanjaro. The journey to the top and back, has inspired them in many ways. The glacier at the summit is becoming smaller every year due to global warming. Being confronted with this so closely, was the final push: we have to do something.

Summit Engineering now supports companies and governments with their Energy Savings Programmes and Sustainable Energy Projects. We also share our knowledge with the future generation by teaching classes at universities.

Together we work on reducing CO_2 emissions and on taking steps towards a CO_2 neutral world. Hydrogen can play in important role in achieving this goal.

At Summit Engineering we have experience in the various aspects of the hydrogen supply chain. From production, to transport storage and utilisation in different areas. We provide concrete advice and excellent project support you can count on. Whether you are at the concept phase of your project or already working towards project implementation.

We use our knowledge, experience, as well as our extensive sector network, to provide a tailor-made programme for achieving optimal results.

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SUWOTEC
SUSTAINABLE WORLD TECHNOLOGY

To secure a sustainable future for generations to come, We develop sustainable circular technologies that are inspired by the way nature works.

First understand nature.

Nature has its own unique ways and systems to create, utilize and recycle. These are proven processes, fine-tuned over thousands of years. More often than not, the way we humans have built today's energy and transport infrastructure, however, follows completely contrary ideas. Then, develop game-changers.

Identifying nature's fundamentally efficient and resilient processes, we develop game-changer technologies that are circular by design and feasible over time. Our work must have a positive effect on people and planet, right where it matters most.

One of the game changers is the development of non-corrosive electrodes and membranes. Ongoing development for electrolyzes, fuel cells, batteries, water cleaning and carbon capture. Electrodes with longer life time and not participating in the process. We expect suitable for multiple energy carriers next to hydrogen.

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Swagelok Nederland

Swagelok actively supports companies developing alternative fuel technology for the any industry, designing fluid system components and assemblies for use in hydrogen applications. We not only understand the fluid system performance needs of the industry, but also the complex approval processes and compliance requirements that govern them. We provide solutions that range from easy-to-install tube fittings to custom-designed fluid system assemblies that deliver longlasting performance in hydrogen applications. We also provide fluid system evaluation and advisory services to help customers improve the performance of their existing systems, and we provide product design support for fuel systems in vehicles and filling station infrastructure. Swagelok products and services are also integral to success in transportation industry sectors including shipbuilding, aerospace, and tire manufacturing. Our widely certified fluid system products are the standard choice for use in many military and commercial maritime applications.
At Swagelok, we recognize that safety is often the number one priority of our customers, especially those working with and transporting highly volatile fluids as part of their daily business. We can help you build safety into your fluid system-related practices from installation through routine maintenance. We provide: • A comprehensive program of safety training and competency skills development • Leak-tight fluid system designs based on best practices for operator safety • Evaluation and advisory services that help you address risk factors throughout your fluid systems • High-quality Swagelok components and assemblies engineered and tested to be safe to operate and maintain throughout their lifecycles.

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TEBULO

The sectors for which we carry out our engineering work are Chemicals and Petrochemicals, Offshore, Food, Utilities and Energy, Nuclear, Pharmaceutical, Automotive and Steel industries.

The projects mostly concern front-end engineering processes. However, parts of this, such as studies, risk inventories, basic and detailed engineering are also important activities.

The Engineering projects are multi or single disciplinary, in which Process, Piping, Mechanical, and Electrical Engineering play a leading role. Naturally, civil and structural also have their share.

We are a professionally organized engineering company and have a reputation for providing solutions that go beyond the standard. Tebulo Engineering is active in various markets, based on the broad knowledge gained, we function as a technical partner for our clients.

We do not lose sight of trust and integrity. The great diversity of clients makes it possible to realise innovative multidisciplinary projects that appeal to the imagination. Our working method is aimed at building long-term relationships. Our targeted training program ensures that our people are known with recent developments in the fields. Our designs are in accordance with current standards and legislation.

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Since 1952 Teesing is your long-term partner in the development and delivery of high-quality products and related services for transmitting, regulating, distributing, filtering, purifying, and measuring of gasses and liquids. With offices in Europe, the USA and Asia, Teesing can support you all over the world with a large variety of products and services. We offer a wide range of products related to the refueling of alternative fuels such as CNG, LNG and H2. For gas station we provide fillnozzles, couplings, tubing and filters. For the cars we supply receptacles and check valves.

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Technip Energies (T.EN) is a leading Engineering & Technology company for the energy transition, with leadership positions in LNG, hydrogen and ethylene as well as growing market positions in blue and green hydrogen, sustainable chemistry and CO_2 management. The company benefits from its robust project delivery model supported by extensive technology, products and services offering.

Operating in 34 countries, our 15,000 people are fully committed to bringing our client's innovative projects to life, breaking boundaries to accelerate the energy transition for a better tomorrow.

Technip Energies, headquartered in Paris and registered in the Netherlands, is listed on Euronext Paris with American depositary receipts ('ADRs'). For further information: www.technipenergies.com.

The office in Zoetermeer is Technip Energies' centre of excellence in Hydrogen Technologies. Competences comprise: R&D, product development (e.g. industrial burners able for 100% H_2 firing) as well as the full spectrum of EPC competences through which it offers worldwide proprietary grey, blue and green hydrogen technologies as well as revamps (conversion of grey to blue, plant modernization (e.g. energy efficiency), capacity increase, etc.). Our services include (digital) client support in day-to-day plant operation including furnace/reformer surveys and supply of spares.

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TKI NIEUW GAS
Topsector Energie

Topsector Energy (TSE) is the driving force behind innovations that are necessary for the transition to an affordable, reliable and sustainable energy system. The Dutch Knowledge and Innovation Agenda, as a part of the National Climate Agreement, determines the priorities of the TSE.

The specific innovation agenda of TKI New Gas focuses on the following topics:

- Hydrogen: full hydrogen chain as well as the system role that hydrogen can play;
- Green gases from biomass through different processes, such as digestion, gasification and supercritical water gasification;
- Capture, Utilisation and Storage of CO_2;
- Geo energy, with focus on subsurface innovations regarding energy storage and geothermal energy.

Hydrogen is a cross-cutting theme for the Topsector Energy because it deals with all sectors of our national climate agreement as well as addressing the system role which could be beneficial for all stakeholders in the energy transition.

Our main activities include 3 types of activities:

- roadmapping, such as defining innovation agendas together with Dutch stakeholders;
- facilitating innovators, for example finding partners, matchmaking and access to funding opportunities;
- communication and information on activities, projects, research programmes and relevant developments.

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TNO innovation for life

TNO is an independent research organization. TNO believes in the joint creation of economic and social value. TNO connects people and knowledge to create innovations that boost the competitive strength of industry and the well-being of society in a sustainable way. This is TNO's mission and it is what drives the over 3,200 professionals in their work every day. In 2018 TNO came together with ECN to form a Unit solely dedicated to the energy transition, with 1,000 energy professionals covering the full breadth of knowledge disciplines to support industry and drive sustainable innovations forward to reach their 2050 CO_2 neutral goals.
TNO is one of the leading applied research institutes in the field of hydrogen. More than 15 research departments spread over 5 units are collectively working on innovations along the entire hydrogen value chain from production to infrastructure, storage and final applications. We bring engineers, business analysts and social scientists together to create insights into the future of hydrogen technologies. TNO is involved in over 50 hydrogen related projects in 2020 only. From developing new materials for PEM and SOE in our Faraday lab, test on industrial scale up to 2.500 cm^2, 250 KW in the Hydrohub and in our new power2X fieldlab Rottedam. We work on pre-feasibility and engineering studies for large scale deployment in project such as NortH2 and the Gigawatt project. In the unit Traffic & Transport we work on amongst others fuel cell integration in heavy duty vehicles and energy management. With our facilities it is possible to speed up the R&D process and time to market for the industry.

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to70

To70 is a leading aviation consultancy firm based in the Netherlands with more than 12 offices worldwide. To70 provides environmental, operations, safety and efficiency services to a wide range of stakeholders within the aviation sector. These include airports, public institutions and government bodies as well as air traffic management and private businesses. At To70 we are strongly committed to a sustainable aviation sector, and aspire to work together with our partners and clients to ensure aviation becomes carbon free and future proof.

An increasing area of attention within sustainable aviation is the development of hydrogen fueled aircraft. Although still in the early stages of development, increased public awareness of aviation emissions as well as national and European hydrogen developments are pushing innovation. Besides changes in aircraft, the transition to hydrogen will require the wider aviation ecosystem including airports, regulatory bodies and air traffic management bodies to adapt. At To70, we are able to provide research services and strategy guidance for hydrogen infrastructure, operations, safety and risk management.
Our years of experience, international presence and sustainable vision allow us to support all stakeholders within aviation that aim to develop future hydrogen powered aviation.

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torrgas

Torrgas is a leading technology company in the production of renewable syngas and bio-char. Syngas is the building block of the chemical industry. Torrgas offers viable and profitable opportunity as an alternative for the world's addiction to fossil fuels. After the torrefaction of the waste streams, the Torrgas process converts low value waste into bio-based commodity products with a high added value. Syngas is used for the synthesis of almost any bio-hydrocarbon that are currently produced from fossil fuels; among others in this case Hydrogen.

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TOYOTA
MATERIAL HANDLING

Toyota Material Handling helps businesses of all sizes across Europe meet today's materials handling challenges with a full range of Toyota counterbalanced forklift trucks, BT warehouse equipment, and services and added value solutions, including service contracts, short term rental, used forklift trucks and the Toyota I_Site information service.

Active in more than 30 countries across Europe and with headquarters in Sweden, TMHE has a European Office in Brussels and production centres in Ancenis (France), Bologna (Italy) and Mjölby (Sweden).

With nearly 5,000 service engineers, around 10,800 employees, along with a network of independent distributors and dealers, TMHE is the European regional organisation of Toyota Material Handling Group (TMHG), which is part of Toyota Industries Corporation (TICO) – the global leader in materials handling equipment.
Since the acquisition of Vanderlande and Bastian Solutions, it's TICO's ambition of becoming the first-choice partner in the material handling business as a total solution provider for projects of all sizes.

Our customers are our number-one priority. By staying in close contact with you we can understand your needs and provide the solution, technology, energy, service and financial flexibility that fits your operation. We can do this by working according to TPS and TSC (Toyota Service Concept), and by continuously improving.

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Tradinco Instruments®

Tradinco instruments, is a supplier for sensors, calibration, equipment, services and software. We have an excellent track record since 1963 and have strong links with the process industry and equipment manufacturers. With our knowledge and hands-on experience, we provide expert advice and if necessary we can design and supply custom instrumentation to match requirements in your application. Customizations can range from small modifications on existing equipment and sensors to completely new developed instruments and software. Our calibration test benches and AutoCal+ calibration software are used around the world. With our ISO17025 accredited calibration lab, we offer facilities and knowledge to do research or qualification tests.

Specifically for hydrogen applications, we offer dedicated sensors and can calculate expected service life of pressure transmitters based on the process conditions and advice on the best option for your application. Our sensors are already used for many years in hydrogen installations for the automotive and semiconductor industry. Next to this we offer customized test, measurement and calibration solutions. For more information, please visit our website or contact us via email or phone.

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TSG Group is a Dutch engineering company headquartered in Eindhoven with subsidiary at Brightlands Chemelot Campus. We design, develop and realize new products, special machines and industrial automations including tools and web applications. Portfolio in the field of novel development of sustainable energy systems, is present.

TSG Essempio is active in the field of new products with Industrial & UX Design. We also make use of CAE tools like FEM, CFD and topologic optimization. We create and build prototypes including functional models and proof-of-concepts. We have our own workshop in Eindhoven. We are also experienced in pilot production, ramp up and industrialization. TSG Innoteq has a focus on development and realization of special machines, automation of processes and the tools that come along in this trajectory. This includes automatic packaging lines and custom test equipment. One of the specializations can be found mass production techniques for plastic deformation of metals and in joining and assembly methods.

TSG Engineering provides technical capacity and knowledge for projects at our customers' offices. Finally, sister company Finetic build websites, web portals and web based applications. An inhouse developed CMS called Wenetic, is the stabile and proven system where everything is based on.

Within TSG Group, this combination of expertise, knowledge and skills under one roof, can offer integral solutions for technical challenges and engineering projects.

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TSG Solutions is a global solutions provider. TSG Solutions has a large sales and service network across Europe and Africa. Thousands of TSG engineers and technicians across 30 countries serve our customers promptly and efficiently: Wherever the client is located TSG is around the corner. TSG provides a wide array of solutions combining equipment sales, services and projects to the energy distribution networks both retail and non-retail (industry) aimed at fuelling mobility systems through its six business segments. The business Segment TSG Gas is focusing on solutions for alternative fuels based on gasses CNG, LNG, LPG and Hydrogen. Regarding the hydrogen market, TSG Gas is a system integrator of storage, mobility, marine and industry applications. We can provide several products from electrolysers, hydrogen fuel stations for mobility and marine sector until hydrogen storage systems in an EPC project approach. Storage systems with type 4 CPV up to 500 bar(G) with H_2 capacity of 560 kg complete installed on 20 FT trailer or ISO container. TSG Gas has a high-level service degree and can provide 24/7 services to their customer due to the automated field services system. Currently we are working on several projects mainly focused on hydrogen mobility systems and storage systems. If you have any questions or requests do not hesitate to contact TSG Gas.

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TwynstraGudde is an independent consultancy firm, serving public and private sectors. We build relationships and value chains for hydrogen eco-systems, focusing on decarbonisation of industry and mobility (road, shipping, aerospace). We believe managing transitions is not merely a technological challenge and that social, economic and governance aspects are equally important.

In the hydrogen sector, our strength lies in building and managing public-private partnerships and navigating challenges that come with complex collaborative projects. To foster upscaling of hydrogen innovation, we build on our strong expertise in infrastructure, energy and mobility and provide a variety of services including strategic and project management, feasibility studies, business model development and pilot development.

Our experience in the hydrogen sector ranges from production and infrastructure to end user by executing projects in regional, national and international (NWE, CE) contexts. Using our Cordence Worldwide network and working closely with our international partners, we offer global perspectives and track records to our customers.

Navigating hydrogen innovation in energy and mobility transitions is a complex endeavour. At TwynstraGudde, we are looking forward to help implement hydrogen projects.

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Van Campen Ecotechniek, dealer for GreenMachines streetsweepers in the Netherlands, can deliver the GM500H_2 'Hydrogen' as OEM worldwide.

The streetsweeper is very useful for city cleaning and silent while working, less dust, less heath, less weight, small and compact and with more range, it is a logical application.

If you lack the infrastructure, you can choose the cartridge system with H_2-PODS and simply replace the empty ones when needed. Or you choose for the fixed hydrogen tank system when your city has an H_2 fuelling infrastructure in place.

It's that simple.

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90 VANDOORNE YEARS

Currently hydrogen is not (yet) regulated, however going forward this may change. The government might put rules in place for network management, (third party) access and network tariffs.

Without exception, collaboration between parties (public and private) in hydrogen projects is key. The parameters for this collaboration are set during the first phase of a project and are reflected in joint venture agreements and concession models. In this respect, regulatory limitations, tendering issues, spatial planning, engineering and construction arrangements, state aid and financial issues need to be identified and resolved. Subsequently, agreements must be made regarding source exploitation, grid management, supply, storage and offtake. Each of these issues has its own dynamics and requires close cooperation and coordination, taking into account potential carbon costs, applicable tax credits and subsidy schemes.

Our multi-disciplinary team uses its extensive know-how in all legal areas that are necessary to realise your hydrogen project. The members of our Hydrogen team have many years of experience in the field of energy law regulation and energy contracting, in renewable energy project development, in carbon capture and carbon storage and in (gas) pipeline development. Furthermore we have a proven track record in environmental permitting, spatial planning, finance, taxation, transactional, state aid and construction agreements in connection with infrastructure projects.

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VDL Energy Systems

VDL Groep, headquartered in Eindhoven, the Netherlands, is an international industrial family owned business group. The group consists of 104 operating companies, spread throughout 20 countries, with over 16,500 employees. The VDL companies break down into four divisions: Sub-contracting, Car Assembly, Buses and Coaches and Finished products. (See www.vdlgroep.com). VDL ES is part of the VDL Group and focuses on developing, testing and manufacturing of new products, for power generation and -storage. The objective is to develop environmentally-friendly and innovative hardware and software solutions. Applications for Zero-Emission (ZE) power generation and storage. With a background in packaging of turbines and compressors for the oil and gas industry, we now use our competences to produce Battery Energy Storage Systems (BESS), Fuel Cell systems, Electrolysers, and solutions for Heat Re-Generation. With batteries and fuel cells we create stationary power solutions for energy, utility and maritime industries.
VDL has an extensive knowledge and experience in the field of ZE services. As one of the European Pioneers VDL realized the first introduction of large scale deployment of ZE bus fleets in Europe, VDL has gained a lot of knowledge of the challenges of additional 'beyond the bus' demands. Securing and providing enough clean renewable energy, on specific locations and times needed is the key of daily success. Especially as this is a major driver in the Total Cost of Operation (TCO) and thus the main driver of customer acceptance. The current challenge through the arrival of new ZE services is accelerating the efforts to improve the air quality in the growing cities with Green Energy, with more and more smart technology to be used in stationary and mobile applications.

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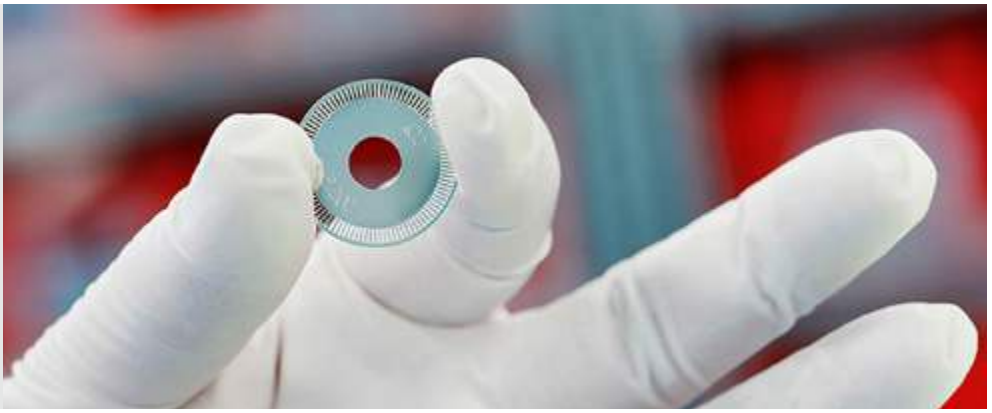

Veco is a world-leading manufacturer of micro-precision metal parts. It serves the world's most innovative, hi-tech companies from industries that demand high quality and precision. To meet customers' specifications and demands, Veco has developed high standards of performance in Electroforming. This technology allows a powerful combination of precision and economical production; for high volumes and prototypes, standard and custom-made products.

Veco's Ni-E³ electrode solutions with surface enlargement up to 20,000 times. With the worldwide ongoing energy transition from fossil into green energy, electrodes are gaining more and more interest. Veco's electrodes solution with its unique properties can be used for Electrolysis, Fuel-cells, and Desalination.

The main difference and advantage of Veco's electrodes is the enlarged surface area that can be achieved. Up to 14 times enlargement has been achieved when this Ni-E³ process is used. In addition, several coatings can be applied that can further result in a surface enlargement of up to 20.000 times resulting in yields that are unprecedented in today's world. The process is sustainable due to zero waste, making it a very cost-effective and future-proof technology in producing Electrodes.

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Vecom is specialist in chemical technical cleaning on-site (worldwide) with over 65 years' experience. We can also carry out metal surface treatments in our metal laundries, located in The Netherlands, Belgium and the United Kingdom.

Vecom focuses on customer and process-specific solutions for complex contaminations and strives to be the best quality service provider in metal surface treatment. Knowledge and experience is combined with flexibility and operational perfection. When it comes to metal surface treatment, Vecom has the knowledge, expertise and equipment to deal with chemicals, metal and waste streams in a responsible way. Safety for people, the environment and your assets are key.

What can Vecom do for the H_2 network? When changing from natural gas to H_2 gas, the existing piping may need to be cleaned depending on fouling. Vecom has the knowhow and experience to chemically clean and/or decontaminate piping systems with a proven method of removal of hydro carbon and sulphur contaminations. Optionally also rust and other inorganic contaminations can be removed. If ultraclean specifications apply, oxygen cleaning and DNV approved methods will be used.

Furthermore, prefab parts for H_2 handling equipment can be pickled and passivated in our metal laundries. If required, the oxygen cleaning method can be applied as well. Please contact our specialists for suitable solutions.
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Visser & Smit Hanab
brengt energie

Visser & Smit Hanab, a VolkerWessels company is highly motivated to realize the energy transition. We have been building underground and above-ground infrastructure and installations in the fields of energy, electricity, water and industry for more than 150 years. Hydrogen related activities are design, built and maintenance of new hydrogen pipeline infrastructure, as well as refurbishing existing natural gas pipelines for built environment, industry and hydrogen refuelling stations. We distinguish ourselves by working with the best in-house professionals such as installers, welders, low, medium and high voltage technicians who enable our clients to make the necessary change to sustainable energy.

Visser & Smit Hanab has its own engineering team with advanced specialist knowledge and the most modern 3D scanning equipment. Our professionals, together with a dedicated network of suppliers and subcontractors, ensure that we get the job done safely, on time and on budget. With respect for people and drive to protect the environment.

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VOLTH2

VoltH2 is committed to developing and operating green hydrogen plants in Europe. The company focuses exclusively on the large-scale production of green hydrogen. This hydrogen is intended for use by local industry and the transport sector.

The first two production facilities are currently being developed in Vlissingen and Terneuzen (the Netherlands). These plants are already licensed and received a substantial SDE++ grant from the Dutch Government. They are expected to be operational in 2025. Scalability has been taken into account in the design of both installations: in the initial phase, each installation will produce nearly 2 million kg (1,890 tonnes) of green hydrogen per year. In time, production will be expanded to grow along with the market for green hydrogen.

Since the spring of 2022, VoltH2 has been developing a third green hydrogen plant in Delfzijl (within Groningen Seaports). At the start-up, which is planned for the end of 2026, VoltH2 anticipates a production capacity of approximately 4 million kg (3,800 tonnes). A first German factory will be located in Wilhelmshaven, Germany's only deep-sea port and primary energy hub.

With the four current locations in the Netherlands and Germany, VoltH2 has a portfolio with a potential production capacity of 500 MW.

VoltH2 is a collaboration between Volt Energy (the company of founder André Jurres), Virya Energy and DIF Capital Partners.

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VONK (fka Ampulz) is a solution provider for Power Conversion, Electrical & Instrumentation and Control & Automation Challenges. Inspired by technological innovations we contribute to a more sustainable society. We are an internationally recognized specialist when it comes to Power Conversion & Power Electronics. With our expert knowledge and extended experience as our foundation, we strive at all times to rise to the challenges of tomorrow. Current developments in the field of energy transition play an important role in this.

The incorporation of large-scale renewable energy sources requires power conversion solutions which can be used on a Megawatt level. The power converter determines the behaviour to the electricity grid, the extent of reactive currents and other power quality issues.

Cooperation with VONK will result in a power supply that exactly fits the electrolyser, with better integration characteristics and the lowest possible cost per kW. We aim for a collaborative approach and use standard building blocks to ensure rapid development for power supplies ranging from 1 to 250+ Megawatt. VONK has developed its own innovative electronics control platform to support our solution. The control platform is the heart of the power converter and is capable of forcing the maximum power point of the electrolyser. With its dedicated communication links it can align energy from fluctuating sources with the electrolyser capacity, to optimize the use of available renewable energy.

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Royal Vopak is the world's leading independent tank storage company. We store vital products with care. With over 400 years of history and a focus on sustainability, we ensure safe, clean and efficient storage and handling of bulk liquid products and gases for our customers. By doing so, we enable the delivery of products that are vital to our economy and daily lives, ranging from chemicals, oils, gases and LNG to biofuels and vegoils. We are determined to develop key infrastructure solutions for the world's changing energy and feedstock systems, while also investing in digitalization and innovation. Vopak is listed on the Euronext Amsterdam and head-quartered in Rotterdam, the Netherlands.

Vopak is exploring how to set up new renewable hydrogen supply chains between production and demand centres in Europe and beyond. Next to pipelines, other infrastructure will be needed to enable safe, substantial, flexible and cost-effective international transportation, storage and distribution of hydrogen. Vopak aims to provide solutions by creating open access terminal infrastructure at both export and import locations. Together with partners in various countries, Vopak aims to develop storage and transportation, using three technologies: Liquid Organic Hydrogen Carriers, Green Ammonia, and Liquefied Hydrogen.

Vopak is also a partner in the H-vision project that aims to substantially reduce emissions of the Rotterdam industry through low-carbon hydrogen. Please visit www.vopak.com.

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VOYEX
Hydrogen Powered

Voyex develops Liquid Organic Hydrogen Carrier (LOHC) technology. With this technology, we bond hydrogen to a safe and easy to use liquid that is similar to diesel in terms of handling and storage. Inside heavy-duty mobility applications, hydrogen is released from the liquid and made available to power engines. The LOHC is circular and can be used hundreds of times to bond and release hydrogen.

Voyex LOHC is characterized by a 'safer-than-diesel' hazard level and efficient conversions through smart heat integration with hydrogen combustion engines. The combination of high hydrogen storage content (+/- 60 kg H2/m3) and usage at atmospheric pressures and room temperatures overcomes major storage and distribution (S&D) challenges associated with the cost and efficiency of conventional hydrogen S&D methods.

With this technology, we aim to provide a substitute for diesel in applications used in building & construction, marine and trucks. Next to using the LOHC as a fuel, it is also perfectly suitable for medium-to-long transport of hydrogen.

Voyex' 3 core activities are synthesis of the LOHC substance from sustainable raw materials, developing technology to bond the hydrogen ('hydrogenation') and releasing the hydrogen ('de-hydrogenation'). We develop our technology in-house in the Netherlands in our labs and offices in Delft. Our aim is to deliver a pilot-scale value chain in 2025 (incl. 10 operational systems in the field) and achieve commercial roll out of all technology components in 2026.

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: VTTI is one of the world's leading storage providers for energy and other essential products like chemicals, with its headquarters in Rotterdam, The Netherlands. Located at major shipping crossroads and supply gateways, VTTI provides over 10 million cubic metres of storage capacity across five continents. VTTI focusses on developing and implementing sustainable solutions, fueling the transition to the energy needs of tomorrow and building the emerging renewable value chain. We focus on transitional and new energy, among which green gas, hydrogen, CO2 capture and other renewable products.

VTTI aims to develop hydrogen import facilities to convert imported green ammonia to green hydrogen to help decarbonize industrial areas as well as hard to abate industrial clusters in north-western Europe through the European hydrogen backbone system.

In addition, VTTI is partnering in green hydrogen conversion projects across the globe, ranging from green ammonia export terminals to, liquid organic hydrogen carriers and establishing green corridors for the marine sector.

VTTI has a long history of providing active solutions in the key energy locations of the world, and we have a proven track record of growth. We have created brand-new, world-class greenfield terminals in locations like Rotterdam and Malaysia while also acquiring, enhancing and revitalising established terminals like in Antwerp.

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wateralliance
accelerating business with WaterCampus

Water Alliance is a unique partnership of public and private companies, government agencies and knowledge institutes involved in the Dutch water technology. We focus on innovative and sustainable water technology that can be used worldwide and support small and medium sized enterprises in the water technology industry in terms of (international) matchmaking, networking and business development. Water Alliance is based at WaterCampus Leeuwarden, the Netherlands. WaterCampus Leeuwarden is the physical core of the Dutch water technology sector and has the ambition to play a sector uniting role for the rest of Europe as well. The WaterCampus is an innovation eco-system, which brings together a complete chain of innovation for water technology, from first ideas to research & development, specialised laboratories, a water application centre and various demo sites to launching customers and ultimately tangible business. We help companies to find the best way through the innovation chain to cover their needs and speed up their developments. WaterCampus stimulates cooperation between (inter)national businesses, knowledge institutes and governments within the water technology sector, in order to create synergy for world class innovation, education and entrepreneurship. This strengthens the global position of the European water technology sector. Additionally, WaterCampus offers a unique research infrastructure, and is a meeting point for scientists and companies from all over Europe. The international cooperation organised and stimulated by WaterCampus Leeuwarden leads to knowledge, talent and entrepreneurship that contribute to solutions for global water problems.

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h2planet Horizon Fuel Cell Netherlands

WE | doubleyouenergy is a sales and engineering startup in Hydrogen systems. WE | doubleyouenergy is the exclusive distributor of H2planet and therefor the distributor of Horizon and further agent of UMOE advanced composites in the Netherlands. H2planet is an Italian company who has been selling and manufacturing Hydrogen systems for the last 17 years, from Electrolyser's for domestic use PEM and Alkaline from 400 Watt units up to 2 MW systems for industrial use. And PEM fuel cells for Educational, Domestic and Industrial use from 20 Watt up to 385 kW. Further H2planet manufactures Metal hydride hydrogen storage cylinders and cartridges and holds patents for this in Europe, USA and China. Horizon ultimately emerged as the world's largest volume producer of fuel cells regardless of size or power level, serving customers in over 65 countries with the widest selection of commercial products in the fuel cell industry, with industry leading technical performances. Over the course of its 17 year history, Horizon went on to spin-off 3 application focused companies, including Horizon Educational – the world's leading clean energy and hydrogen science education company, HES Energy Systems – a global leader in hydrogen-electric aerial mobility solutions, and more recently – HYZON Motors, a fast-growing global leader in hydrogen electric heavy vehicles. UMOE advanced composites is a well known Norwegian company, they deliver type IV pressure vessels for storage of CNG, biogas and hydrogen at production sites, such as electrolysis at windmills or solar/biogas plants, as well as at consumption sites, such as industrial plants or filling stations. UAC pressure vessels are delivered with plastic liner, stainless steel end bosses and composite structure, made of high-strength, lightweight fibreglass and epoxy resin.

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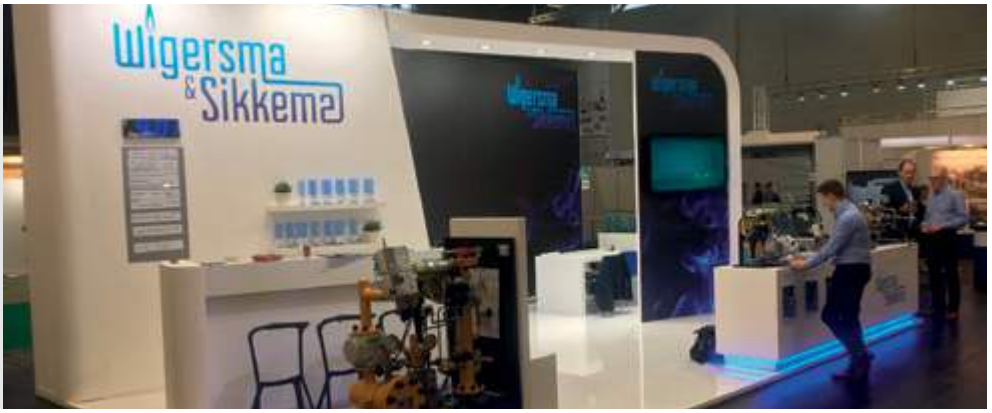

Wigersma & Sikkema B.V., founded in 1921, develops, produces and delivers measurement and control equipment for gas distribution. Products include Electronic Volume Conversion Devices (UNIGAS 300), remote reading systems such as dataloggers and modems (UNICOM 300), gas pressure regulators (RS350S) and inspection systems for gas pressure regulating stations (PLEXOR). With these high-tech products, we are the market leader in the Netherlands and are increasingly gaining a foothold internationally. With years of knowledge and experience and our own R&D and production, we can optimally respond to changes in the market, such as hydrogen and green gas. Wigersma & Sikkema is known for quality products, fast delivery and excellent technical service.
KIWA was commissioned by Netbeheer Nederland to investigate whether existing gas pressure regulation stations for natural gas are suitable for the use with 100% hydrogen. The gas pressure regulation station which was tested had an W&S RS350S DN50 regulator built in. The station was equipped with BMA and BDA system couplings to connect the PLEXOR inspection system. A UNIGAS 300 electronic volume converter was used to measure and record pressure, temperature and flow. For several tests, the PLEXOR inspection system was used. The conclusion is that the station can be operated with 100% hydrogen without modification. Please find the link to the report of KIWA (April 2021) here: https://wigersma-sikkema.com/wp-content/uploads/2021/04/Kiwa-Gas-pressure-regulating-station-for-hydrogen-1.pdf

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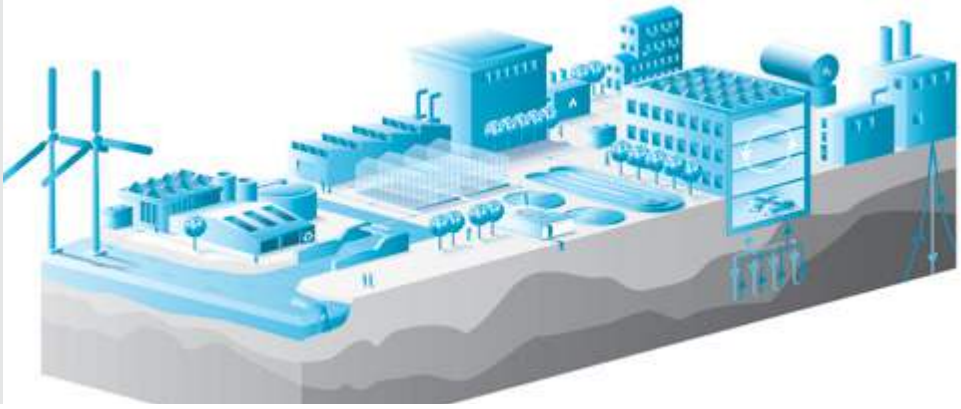

Witteveen+Bos is an international consultancy and engineering firm that offers solutions to complex engineering and societal issues in the fields of energy, water, infrastructure, the environment and construction. We strive to operate at a high-quality, international level of engineering. Our staff of some 1,400 employees work in multidisciplinary project teams on innovative projects all over the world. The energy transition, climate adaptation, flooding problems, healthy cities, the circular economy and large-scale replacement of infrastructure are just some of the major challenges which we can help to overcome. Specifically for hydrogen, Witteveen+Bos offers services on the following topics: system integration, risk assessments (QRA), safety (HAZID/HAZOP), permits, techno-economic feasibility, roadmaps (vision and strategy), innovation, engineering, stakeholder management, grant support, project management and consortium formation.

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WSP is a consulting and engineering firm operating worldwide. In the Netherlands, we have 400 employees working at 10 local offices, offering technical expertise and strategic advice to clients in the sectors Buildings, Infrastructure, Energy, Water and Environment.

Having spent decades working within the gas industry, coupled with our Carbon Capture Utilisation and Storage (CCUS) experience and experience with re-purposing natural gas pipelines to hydrogen pipelines, or engineering new ones, we believe we are strongly positioned to deploy market-leading, clean hydrogen projects for our clients. We have harnessed a multi-disciplinary, global approach when tackling the hydrogen challenge. We understand the complete hydrogen value chain and offer sector-wide expertise and consultancy; with the ability to harness knowledge from a broad range of disciplines and services, as well as internationally. This enables us to advise throughout the design lives of our client projects for hydrogen production, storage, transmission, distribution, and utilisation across multiple sectors.

Hydrogen aligns with our 'Future Ready' innovation programme, which supports our ambition to advise on solutions that are both ready for today and the years to come, giving our clients confidence that we will tailor our approach on a project by project basis to embed sustainability and resilience into our planning and designs.

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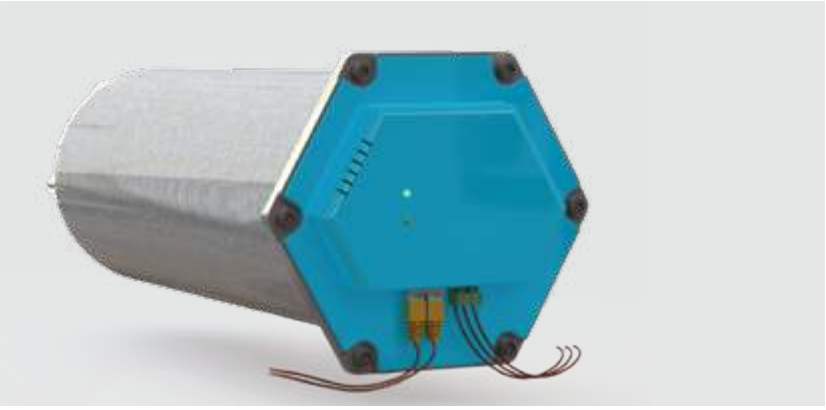

XINTC is shaping the future of hydrogen by developing, producing and marketing modular, scalable industrial alkaline electrolysers (AEL) in the power range from 150kW to 20+ MW at the desired purity and with a variable output pressure between 1 bar (14.5 Psi) and 30 bar (435.1 Psi). XINTC electrolyser systems can be used in a wide variety of applications, ranging from mobility to build environment and industry. They are very well suited for dynamic operation and direct connection to renewable energy sources (PV-field, wind turbines). Each system comprises a family of interconnecting gas modules, supported by all necessary supporting components and auxiliary systems for operational performance and plant safety. Gas modules are equipped with embedded electronics and smart control software, allowing the electrolysis process to run smoothly at maximum efficiency. System design is based on product configuration rather than custom engineered solutions. In order to execute capacity expansion rapidly, XINTC uses modular and standardized components. Time-consuming EPC procedures therefore belong to the past. To satisfy future demand throughput, capacity is expandable in chunks of 3,6kW. Efficiency, low operating costs, ease of use, and high safety standards are key values of XINTC electrolyser systems.

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zepp.solutions develops hydrogen fuel cell systems for clean, mobile power generation. Our systems are based on a highly scalable and modular platform to allow the fast adaption to different use cases and applications. This technology enables the emission-free propulsion or operation of any application, vehicle or vessel without any drawbacks.

We also support concepts and projects with our consulting and engineering services.

Some of the current projects include the development of hydrogen fuel cell powered yard tractors with vehicle OEM Terberg Special Vehicles. These vehicles enable an emission free horizontal container transport in ports and distribution centres. The first prototype is in active operation.

Furthermore, we develop different size fuel cell system solutions for the maritime sector. Examples are the first hydrogen fuel cell powered Watertaxi in the Port of Rotterdam and a scalable, high power fuel cell module for auxiliary or main propulsive power in large vessels and shipping operations.

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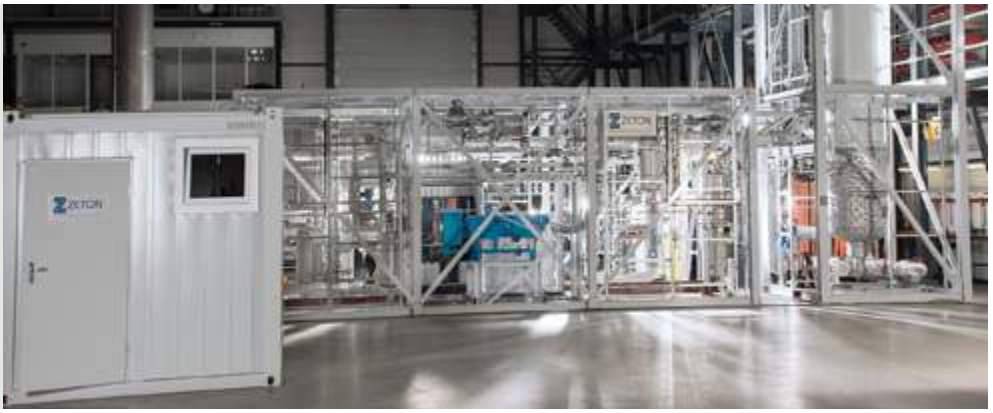

Are you looking for a partner, which provides the expertise in designing and building process systems to prove your scaled-up technology? As the world's leading Designer and Builder of innovative lab scale systems, pilot plants, demonstration plants and small modular production plants, Zeton helps its customers bring their processes from lab to market, faster, with less risk and lower cost.
Our projects are realized in a vast range of industries, amongst which CO_2 utilisation, Pharma, Chemicals, Biobased fuels and chemicals, Petrochemicals, Oil&Gas, Food, Paper & Pulp. In many of these industries projects are realised which use hydrogen either as raw material, intermediate or product.
Our full suite of pilot plant and engineering solutions allows us to deliver scale-specific projects with design, procurement and fabrication executed in parallel – compressing the overall project schedule and maximizing cost-efficiency with our unique project methodology. Your intellectual property is protected as our engineers optimize the design and build of your project, allowing you to take your process technology to market sooner.
With state-of-the-art, integrated design-build facilities in Enschede, The Netherlands, and Burlington, Ontario, Canada, Zeton has successfully completed over 800 projects in 35 countries across six continents. For more information, please visit our website www.zeton.com

ZETON, one partner from early phase concept to real built process plants.

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