Working Group
for the administrative district of Münster

H_2-Ramp-up
in the Technology and User Region

- Industry
- Heat
- Mobility
- International

Our region as the key to transformation:
The future of H_2 in Germany will be decided here

Inhalt

Cluster Assets

Industry

The industrial landscape of the Münster administrative district has a long tradition of working with H_2. H_2 has been produced here for industrial use since 1938. In the course of decarbonization, H_2 will also be needed as an energy source in the future, in all areas of industry and in much larger quantities than before.

Heat

There are around 1.3 million homes in the Münster administrative district, most of which are heated decentrally. Natural gas is currently the most important energy source here. Decarbonization will not be achieved across the board through electrification, especially in the decentralized heat supply, and this is precisely when H_2 can make a contribution to a sustainable and reliable heat supply.

Mobility

The administrative district of Münster offers great potential for the ramp-up of H_2 mobility: not only are there H_2 filling stations suitable for heavy goods vehicles, companies that use H_2-powered buses or refuse collection vehicles and H_2 suppliers that have been on the market for decades, but also manufacturers of H_2 drive systems for trucks, trains and ships.

International

Due to its geographical location between the wind energy-rich north and the North Sea ports in Germany and abroad on the one hand and the energy-intensive business locations on the Rhine and Ruhr on the other, the administrative district of Münster will be the central hub of the future H_2 grids. The majority of demand for sustainable H_2 will only be met by imports in the long term and this will require both cross-border infrastructure and international partnerships. The traditionally close cooperation between the German-Dutch border regions can serve as a supra-regional role model here.

Industry Priorities

1 Timely expansion of the H_2 line infrastructure

The timely expansion of the H_2 core network with the connection of storage facilities, large-scale electrolysers, import ports and hydrogen-capable power plants is necessary. The targeted commissioning date of 2027 must be met so that the conversion of large industrial plants can be carried out as part of the usual renewal cycles.

This also includes the expansion of interconnectors to our neighboring countries. In the short term, more than half of our demand for H_2 will have to be imported, and by 2045, when Germany aims to be climate-neutral, it will even be 90% according to the NRW H_2 import concept. Pipelines are usually the cheapest and safest way to import large volumes of H_2, especially for use in industry.

When building the necessary distribution infrastructure, both the demand for connection points must be determined and satisfied as far as possible and sustainable H_2 must be available in the upstream grid.

2 Development of regional distribution infrastructures

The locations of medium-sized companies are usually not on the routes of the core network, meaning that a regional distribution infrastructure is required. In contrast to the transport network, existing natural gas pipelines are rarely available for reallocation, as they will continue to be needed for natural gas supply for the foreseeable future. In addition, a bivalent grid connection with electrons and molecules must also be maintained in the future for energy-intensive companies.

The current focus on supra-regional transport networks leaves large parts of the SME sector out of access to sustainable H_2 and jeopardizes their competitiveness in the medium term. **We are therefore calling for greater consideration to be given to the regional distribution infrastructure and the promotion of hydrogen use in energy-intensive SMEs as part of the National Hydrogen Strategy.** It is not enough to focus on the regulatory framework. Targeted government support is also needed to close the profitability gaps in the development and expansion of regional distribution networks. The expansion of supra-regional transportation and regional distribution infrastructure must be complementary. Distribution requires an egalitarian marketing model.

Climate protection agreements are a means of strengthening more climate-friendly production processes and thereby advancing the transformation of the economy. However, the current structure hardly grants SMEs any access. As a result, SMEs cannot survive the transformation without massively jeopardizing their competitiveness.

We are therefore calling for the funding instrument of climate protection contracts to be designed in line with the needs of SMEs.

3 Sharpening transformation incentives, protecting entrepreneurial freedom of choice

This means, for example, targeted support for medium-sized H_2 projects:

- Reduced minimum purchase quantities
- Accept cross-cluster mergers of companies so that they can achieve the required purchase volumes (e.g. climate port in Gelsenkirchen, "Klimahafen")
- to enable broader eligibility for funding, which also allows decentralized generation and trailer transport

The current verification obligations would have to be standardized. Funding and CO_2 pricing should be designed in such a way that there is planning certainty for CAPEX and OPEX costs so that viable business models can emerge.

4 Rapid implementation of the H_2-acceleration law without a strict color theory

We expressly welcome the simplifications to the approval procedures contained in the H_2 Acceleration Act, in particular the recognition of an "overriding public interest". **It is now important to implement these changes as quickly as possible in the 4th Federal Immission Control Ordinance and the Environmental Impact Assessment Act. In the long term, the aim remains to use green H_2 as far as possible. Low-CO_2 alternatives should also be allowed to be used for a transitional phase.**

5 Implementing European requirements pragmatically

The quota of 42% green H_2 for the year 2030 and 60% for the year 2035 set out in the third revision of the EU Renewable Energy Directive (RED III) is very ambitious in the opinion of the German Hydrogen Council. **We therefore call for this quota not to be imposed on individual companies, but to be demanded at national level.**

The individual companies have only limited influence on the availability of sustainable H_2. Low-emission H_2 will be needed in the transition period, regardless of the "color theory", in order to test new technologies and operate them economically. At the same time, we are very interested in European coordination and work closely with our neighbors in the Netherlands, Belgium and France.

Industry Facts

Industry in the administrative district of Münster

Industry in the Münster administrative district is at the heart of the transformation to a climate-neutral energy supply. The region is characterized by a high density of industry, particularly in the Emscher-Lippe region. The national H_2 core network will integrate the region nationally and internationally, increasing its importance for the German and European energy infrastructure. Due to its proximity to the North Sea ports of Rotterdam, Antwerp and Wilhelmshaven, the region will become a hub for energy imports.

Basic industry to SMEs

The region is characterized by the basic industry in the Emscher-Lippe region and a strong SME sector, particularly in Münsterland. This combination offers opportunities but also high potential demand for the supply of H_2.

SMEs as the main pillar of the German economy

SMEs have been the mainstay of the German economy for decades. They generate more than half of the gross national product (Destatis 2024) and provide the majority of jobs and apprenticeships. Previous H_2 funding programs have targeted large-scale industry in particular. It is crucial to pay more attention to SMEs in the future. A successful H_2 ramp-up must reach beyond large-scale industry and firmly involve SMEs.

H_2-demand and use in Germany

In its 2023 statement, the National Hydrogen Council assumed a H_2 demand of at least 350 TWh/a for Germany in 2045. In a position paper, the second edition of which was published in March 2024, the Westphalian Energy Institute assumes an energy import requirement of at least 700 TWh/a in Germany in 2045, despite ambitious energy saving targets and the successful expansion of renewable energies.[1)] Energy imports will also reach Germany in the form of H_2 and H_2 carriers (e.g. ammonia, LOHC). If we compare the approximately 700 TWh mentioned above with natural gas imports of 968 TWh in 2023[2)], it becomes clear that H_2 will play a similarly central role in Germany's CO_2-free energy supply as natural gas does today.

Achieving climate neutrality

H_2 is particularly suitable for applications that cannot be operated efficiently using electricity, such as certain industrial processes or heavy commercial vehicles. The development of the necessary infrastructure, including electrolysers and H_2 filling stations, is crucial here. Decentralized electrolysers play an important role and require detailed planning in terms of capacity and costs. Seasons, the day-night rhythm or even dark doldrums require flexibility and influence the profitability of the plants.

1) See, among other things, the second position paper on the energy transition by the Westphalian Energy Institute: https://www.w-hs.de/wei/aktuelles/positionspapier-zur-energiewende.
2) https://www.bundesnetzagentur.de/SharedDocs/Pressemitteilungen/DE/2024/20240104_Gasversorgung2023.html

H_2-Region Emscher-Lippe (H2EL) and Münsterland are key regions for the transformation

The Emscher-Lippe region and Münsterland are key regions for the H_2 economy in Germany. H_2 has been used industrially in these regions for decades and the expansion of green H_2 projects is progressing. The Westphalian University of Applied Sciences and H_2 Herten are important research centers that contribute significantly to the development of hydrogen technologies. Production facilities for fuel cells and other hydrogen-based technologies are also already in place here. Hydrogen has been produced at the Marl Chemical Park since 1938 to supply the chemical industry on the Rhine and Ruhr via pipeline (32,000 t/a). With the construction of a 120 MW electrolyzer by Air Liquide and its connection to the new GETH2-pipeline, green H_2 from Marl will supply the steel industry from 2028 ("green motion steel").

Future prospects and challenges

Münsterland and the Emscher-Lippe region are well positioned to play a pioneering role in the H_2 economy. Nevertheless, there are challenges, particularly in ensuring the availability and economic viability of green H_2. The region benefits from a strong network of industry, research and political initiatives, which together are laying the foundations for a successful transformation towards a sustainable H_2 economy.

Beacons of the H_2 economy

The technology center in Herten with around 80 jobs in the field of H_2 technology has been supplemented by fuel cell production since 2022. Cummins has also been producing stacks for heavy-duty transportation and fuel cell drive systems for trains in Herten since 2022. The number of employees is set to rise to 185 by the end of 2024. Herten will also become the hub for spare parts in Europe. With the production target of 1,000 fuel cells per year from 2025, the largest fuel cell production facility in Europe will be located in the Emscher-Lippe region. This is associated with orders for suppliers who produce hydrogen pumps, hydrogen-capable cable harnesses or control units, for example.

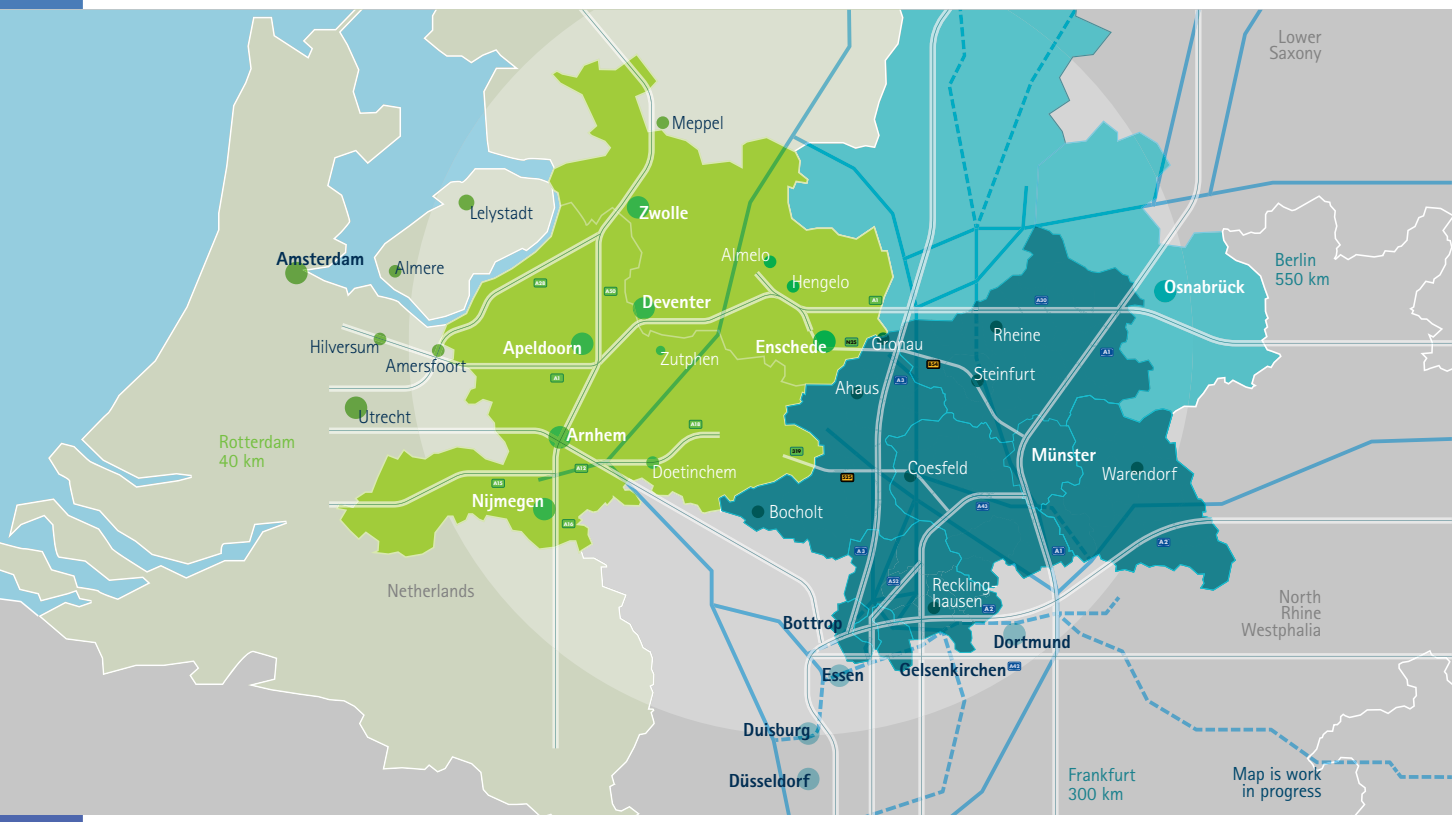
Testing

Energy-intensive companies have formed clusters in Gelsenkirchen ("Klimahafen") and Haltern (H2amSee) to switch their energy supply from natural gas to H_2. Furthermore, H_2 can be added to existing gas networks and gradually reduce their CO_2 footprint. One example of such a bridging technology can be found in the climate port in Gelsenkirchen, where coke oven gas containing H_2 is to be used to generate heat.

Industrial infrastructure

Various projects for the production, storage and distribution of H_2 have been launched in the Münster administrative district. For example, the GET H2 Nukleus project, which is establishing the first regulated grid connection between Lingen and Gelsenkirchen. GET H2 Nukleus is an important building block both for the regional H_2 supply and for the creation of a Germany-wide H_2 network. As part of this network, existing natural gas pipelines in particular are to be rededicated to the transportation of H_2, which means that the existing infrastructure can be used cost-effectively. H_2 is also needed as a storage medium to ensure security of supply

and the stability of the electricity grid as the proportion of fluctuating renewable energies increases. The H_2 itself requires storage, which can take place in cavern storage facilities in Münsterland, for example.



Chemical industry and its synergies

The chemical industry in Marl, Gelsenkirchen, Gladbeck, Castrop-Rauxel, Ibbenbüren and Münster requires H_2 as a raw material and energy source, while also producing membranes, catalysts and high-performance plastics that are needed for the H_2 ramp-up. During chlor-alkali electrolysis and the refining of crude oil, H_2 is produced as a by-product, e.g. 9000 Nm^3 per hour at Vestolit in Marl. In addition to H_2, oxygen is also produced, which is used in large industrial plants. The waste heat from electrolysis can also be fed into heating networks.

Scientific monitoring of the H_2 ramp-up

The district of Münster has a strong research and education infrastructure that makes a decisive contribution to the development of the H_2 economy. Universities such as the Westphalian University of Applied Sciences and Münster University of Applied Sciences offer specialized degree courses and further education programmes in the field of H_2 technology. In addition, the H2 SolutionLab at the Westphalian University of Applied Sciences is a supra-regional center for application development with SMEs. This is essential in order to qualify the required specialists.

Heat Priorities

1 Expansion of the supply infrastructure using existing gas pipelines

The gas infrastructure is a central part of the "community of fate" of heat, electricity and gas networks. **An integrated approach is necessary to ensure a secure, economical and climate-friendly energy supply.** By modernizing existing gas pipelines, the supply can be secured during the transition to climate-neutral alternatives.

Heat supply areas should therefore be designated on the basis of socio-economic criteria and uniform assessment criteria.

2 Reality check and integration of the economy

Industry needs a secure, cost-effective and climate-friendly heat supply. The high costs and uncertainties surrounding H_2 supply currently pose a major challenge here. The expansion of H2 production and use must be carried out together with industry in order to ensure competitiveness and at the same time promote climate-friendly solutions. **The development and adaptation of the infrastructure should always be carried out in coordination with the energy and heat suppliers.**

3 H_2 in the heat supply with utilization of unavoidable waste heat

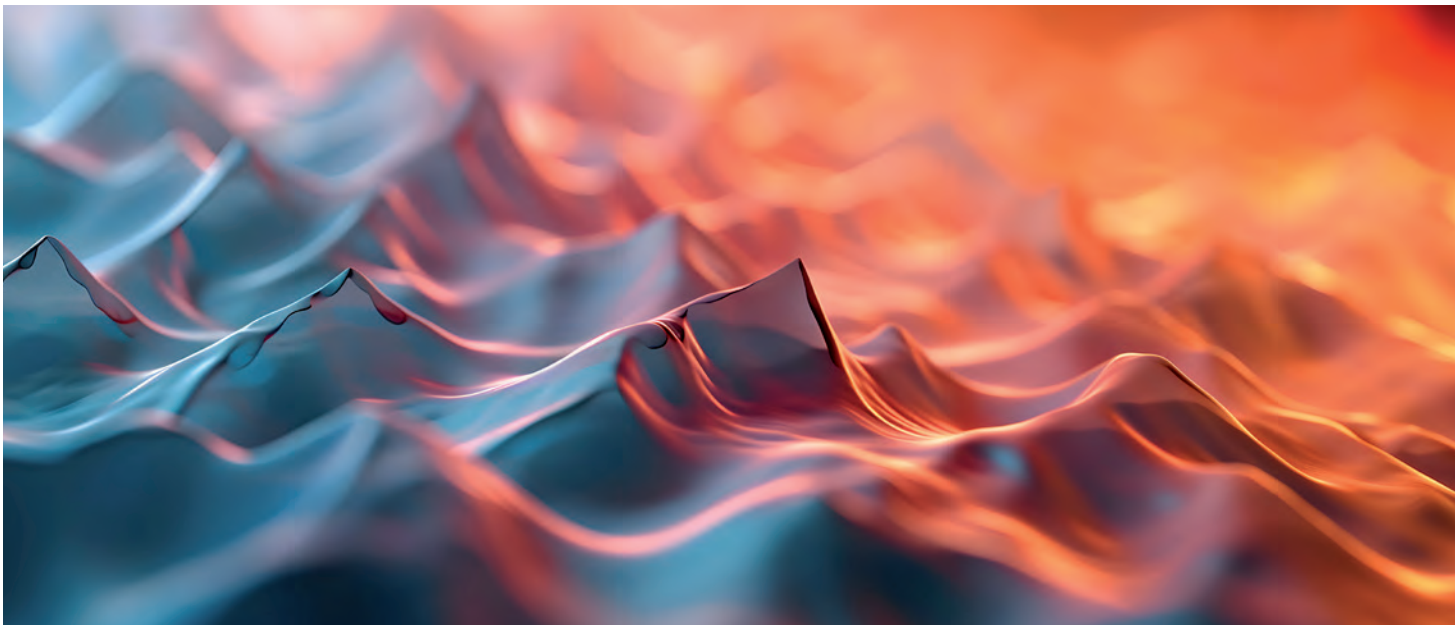
A reliable heat supply requires the permanent availability of one or more energy sources. Sustainable H_2 is currently only available in small quantities, so it does not currently play a role in the heat supply. **H_2 production, storage and use must be expanded in order to make H_2 a viable heat source.**

4 Avoid compulsory connection and use

In order to enable the customized, flexible and efficient use of renewable energies on site, **we are calling for a waiver of the obligation to connect to and use the grid and the promotion of decentralized solutions**. While centralized grids often require extensive infrastructure measures and high investment costs, decentralized H_2 solutions offer a faster and less cost-intensive transition to climate-neutral energy sources during the market ramp-up phase. Companies in rural or inaccessible regions are also less dependent on large-scale grid structures and can control their heat and power supply themselves. This should not prevent the establishment of an efficient municipal heating network (in cities and conurbations).

5 H_2-Heat partnerships

The H_2 infrastructure requires cooperation across local and national borders. The German-Dutch HYNETWORK project serves as a model here. It is upgrading existing gas pipelines for H_2 transportation between the two countries. This cross-border partnership improves access to green H_2 for industrial centers. Such projects strengthen Europe's competitiveness in the global H_2 market and increase security of supply - important steps on the way to a resilient and climate-neutral energy supply.



Heat Facts

Heat, electricity and gas infrastructure community of destiny

The heating, electricity and gas infrastructure together form a community of destiny, as their planning and implementation are closely interlinked. The maintenance and modernization of the gas infrastructure, for example, is directly linked to the development of heating networks and the integration of renewable energies into the electricity grid. Well-coordinated and integrated planning of these infrastructures is crucial to ensure a secure, economical and climate-friendly energy supply. The declared goal is to completely decarbonize the heating sector by 2045. Not only can hydrogen be fed directly into the natural gas grid and burned in adapted burners in the home, but local heating networks can also be coupled with an electrolyser or a central fuel cell whose electricity and waste heat is used. The waste heat from large electrolysers can also be fed into the district heating network.

"Denmark" approach

Denmark is often cited as a pioneer of centralized heat supply. With a share of 65 %, the country has shown how a stable and socio-economically efficient system can be built up over decades.

Regional heat planning in NRW

The use of hydrogen in municipal heat planning is still in the early stages. Analyses of heat planning in NRW emphasize the importance of regional characteristics. At the same time, there are considerable challenges in the financing of heat supply as well as in technical and legal aspects. The heat planning of the municipalities and the regulation for the use of hydrogen by the energy suppliers must be coordinated.

Problem: Availability of hydrogen

There are currently only a few hydrogen production plants in pilot operation in the Münster district. Hydrogen is currently not used to a relevant extent for heat generation, as neither sufficient quantities nor competitive prices are available. In order to change this, the development and implementation of technologies for hydrogen production, storage and use are required.

Legal framework and requirements

The legal basis for municipal heat planning is anchored in the Building Energy Act (GEG) and in the federal (WPG) and state (NRW State Heat Planning Act, currently in the parliamentary process, status: 10/2024) heat planning laws. At the same time, the Energy Efficiency Act (EnEfG) obliges companies to avoid and use waste heat. At the same time, the GEG requires new heating systems to generate at least 65% of heat from renewable energies or unavoidable waste heat from 2026/2028. This has applied to new buildings in new development areas since the beginning of 2024. For all other buildings in municipalities with a population of 100,000 or more, the regulation will apply from 30 June 2026, and in smaller municipalities from 30 June 2028. However, if municipalities have carried out heat planning before the end

of this period and have decided to designate areas for the construction or expansion of heating networks or hydrogen networks (Section 71 (8) sentence 3 GEG), this obligation will apply one month after the official announcement.

Heat supply and H_2

Depending on the regional conditions, different technologies (such as deep geothermal energy, solar thermal energy or heat pumps) are suitable for sustainable district heating. Sustainable H_2 can be an important addition or alternative for decentralized heat supply to industrial consumers.

H_2 is regarded as a key technology that enables the flexible and emission-free use of energy generated from renewable sources. The possibility of converting existing combined heat and power (CHP) plants to hydrogen as part of regular maintenance work reduces investment costs for companies and facilitates the transition to more climate-friendly energy solutions.

Interests of the commercial economy

The economic efficiency of the heat supply is of crucial importance for the regional economy. Companies need a secure, cost-effective and climate-friendly heat supply. Although H_2 offers promising potential, the current high costs and uncertainties of the supply pose considerable risks.

Line infrastructure and decentralized solutions

On the one hand, the existing pipeline infrastructure provides an established basis for the energy supply, but maintaining it can be associated with considerable financial burdens. On the other hand, decentralized solutions, such as the use of green H_2 and biogas in regional production and supply networks, will become increasingly important. Decentralized approaches enable a more flexible and often more climate-friendly energy supply, especially in strategically difficult supply areas. The decision between maintaining and further developing existing infrastructures and implementing decentralized solutions therefore requires careful consideration of the economic, legal and ecological aspects.

Development of an H_2 infrastructure

As there is no obligation to use the respective type of heat supply, actors in decentralized areas could join forces to invest in the construction of a small heat or building network. Also, not all buildings in a heating network area will be connected to the heating network, so other measures will have to be taken to supply heat. Implementation is technically, legally and financially challenging. It requires close cooperation between network operators, approval authorities, commercial customers and citizens.

Mobility Priorities

1 Long-term investment incentives in favor of the H_2 mobility value chain

Targeted and sustainable investment incentives along the entire value chain are crucial in order to anchor H_2 in mobility in the long term. A wide range of measures are required, some of which could be implemented in the short term and without great expense.

In order to promote the use of H_2 heavy-duty vehicles, fuel cell vehicles and vehicles with H_2 combustion engines should be exempt from tolls in the long term and the energy tax on H_2 as fuel should be abolished.

2 Making European requirements more flexible

The European regulations on the production of green H_2, particularly in the context of RED II and Delegated Regulation (EU) 2023/1184, represent significant hurdles for investments in this forward-looking technology. In Germany, these provisions were implemented by the 37th BImSchV, which regulates the production conditions for renewable fuels of non-biogenic origin (RFNBO). The requirements for additionality and simultaneity appear to be particularly problematic here. These requirements significantly slow down the expansion of H_2 production and put H_2 at a disadvantage compared to other technologies, such as battery electric vehicles (BEVs), which do not have to meet such requirements.

There is therefore a need for...

- **an extension of the grandfathering clause (suspension for at least 10 production years for production facilities that go into operation before 2030).**
- **a waiver of the monthly and hourly correlation during the market ramp-up.**

3 Need for reliable funding

Under the current CO_2 pricing of fossil fuels, the variable additional costs of H2 must be bridged in order to make H_2 mobility economically viable. The current main instrument for promoting climate protection, the GHG quota, cannot fulfill this function. Due to the sharp fall in prices, which are now highly volatile, the GHG quota does not provide a stable financing basis for H_2 projects. As a result, the additional costs have to be passed on to end customers, which makes H_2 unattractive.

During the market ramp-up, funding (preferably a combination of OpEx (operating costs) and CapEx (investment costs) funding) is therefore crucial to keep H_2 competitive for end customers at the filling station. As long as economies of scale and learning effects and the associated costs have not been reflected in the supply price, it is essential to resume or continue programs to promote both H_2 infrastructure and H_2 commercial vehicles, regardless of the type of drive.

4 Promotion suitable for SMEs

Only low-bureaucracy funding is effective in driving forward the transition to the H_2 economy. Currently, European and German funding programs are often so complex that SMEs in particular are dependent on external service providers in order to submit funding applications correctly.

We are therefore calling for low-bureaucracy funding regimes that significantly simplify and largely standardize the requirements and verification obligations, particularly with regard to certifications, CO_2 footprint and project details.

At the same time, real incentives for action should be created along the entire value chain in order to sustainably promote investment and innovation in the H_2-economy.

5 H_2 think cross-sectorally, cross-regionally and internationally in mobility

Mobility, industry and renewable energies must be considered and promoted holistically. Separating funding mechanisms between mobility and industry wastes valuable synergies. Mobility must be understood as a supra-regional, cross-border concept, especially in regions such as North Westphalia, which borders on the Netherlands. The expansion of regional H_2 production and the filling station infrastructure can only be successful if it is carried out in parallel and closely coordinated. Electricity connection capacities are already in short supply in Germany and the Netherlands, and the expansion of the electricity grids is stalling. Here, the use of climate-neutral H_2 and its derivatives, e.g. as Power-to-X technology, offers an opportunity to relieve the pressure on the electricity grid.

The administrative district of Münster is only part of a larger puzzle. With the Alternative Fuel Infrastructure Regulation (AFIR), the EU has already created the necessary guidelines to reform mobility across regions.

Mobility Facts

Initial situation

In the early phase of the H_2 market, suitable framework conditions and subsidies are crucial for the success of projects. Medium-sized companies in particular need practical solutions. It is becoming apparent that passenger cars are easier to electrify than commercial vehicles due to their movement profile. The following therefore focuses on H_2 mobility for commercial vehicles. Since air and rail transport play a special role as closed systems, this paper deals with them separately at the end.

Germany's climate targets

In Germany, the transport sector was responsible for around 146 million tons of greenhouse gases in 2023, which accounts for around 22% of national emissions. Emissions in the transport sector are to be reduced to 95 million tons by 2030, with the aim of achieving climate neutrality by 2045 at the latest. The "European Green Deal" aims to reduce emissions in all EU member states by 48% by 2030.

H_2 as a climate-friendly energy source: current status worldwide

Interest in H_2 as an energy source is growing worldwide. Countries such as Japan and South Korea are pioneers and are investing heavily in the development and expansion of H_2 infrastructure, including H_2 mobility. With the EU's Green Deal and H_2 strategy, Europe has formulated clear objectives to promote the use of H_2, particularly in the mobility sector.

Challenges of the H_2 market ramp-up in mobility

The development of H_2 mobility requires investment along the entire value chain: from generation, transportation and intermediate storage through to use by end consumers. In practice, the challenge of stimulating supply and demand at the same time is particularly difficult, as practically all elements along the value chain have to be rebuilt. Experience from the introduction of other alternative fuels shows that the infrastructure in particular must be sufficiently in place as the cornerstone of a change in order to make the new system attractive to end customers. However, without the turnover from the end customer business, there is no incentive to build the infrastructure. This is known as the chicken and egg dilemma, which must be effectively overcome through suitable incentive systems.

Target: 200 H_2 filling stations

There is great potential for H_2 mobility in the Münster administrative district. Due to its proximity to the Netherlands, the two conurbations of the Ruhr area and the Rhine region, as well as Salzbergen, where an H_2 pipeline is to be built, there are important transport hubs here that favor the efficient use of H_2. The Faun company has developed waste collectors which are equipped with fuel cells and batteries and are in use at the depots in Bottrop, Gelsenkirchen, Herten and Recklinghausen; the first five fuel cell buses have been delivered to the Vestische Straßenbahnen, with a further five to follow. Together with the cars of some companies and the first fuel cell trucks, which are used in food distribution according to the "pay to lease" principle, this means that the H2 MOBILITY filling station in Herten has one of the highest utilization rates in Germany. The Westfalen Group is a company headquartered in the region that has been supplying customers with H_2 for 40 years and has been operating a public H2 filling station since 2016. The filling station is one of the few in the region that is also designed for commercial vehicles. The Emscher-Lippe region also has public filling stations in Herten and on the city border between Essen and Gelsenkirchen. Two further H_2 filling stations for commercial vehicles are currently under construction thanks to funding from the state of NRW (MWIKE). There are currently a total of 85 H_2 filling stations in Germany. However, less than half of these stations have a 350 bar refueling system, which is the basic technical requirement for supplying commercial vehicles. There are two H_2 filling stations in Herten that are suitable for refueling commercial vehicles. AGR's new filling station has its own electrolyzer with an output of 3 MW and can refuel 4 trucks or refuse collection vehicles at the same time. This makes it the most powerful H_2 filling station in Germany. The electrolyzer can be operated with H_2 from wind and solar energy as well as with biogenic residues from waste incineration and, in addition to the filling station, also supplies a trailer filling station. The construction of a 10 MW electrolyzer including an H_2 filling station is also planned at the climate port in Gelsenkirchen. The state of NRW has set itself the goal of having a network of around 200 H_2 filling stations by 2030. The fact is, however, that despite great efforts, this target will not be achieved as things stand today.

Costs of H_2 filling stations

An H_2 filling station with a capacity of 2000 kg/day (incl. storage trailer) costs around 6 million euros, while a diesel filling station only costs around 0.8 million euros. These considerable additional investment costs represent one of the greatest challenges for the initial market ramp-up. The EU AFIR Regulation (Regulation on the deployment of alternative fuels infrastructure) acts as a guiding instrument to steer the development across regions and imposes infrastructure requirements on the member states to ensure a nationwide H_2 infrastructure for commercial vehicles, but also for passenger cars. However, there is currently insufficient coverage for refueling commercial vehicles, as most H_2 filling stations are still designed to supply passenger cars.

Challenges in the provision of H_2 vehicles

H_2-commercial vehicles are currently available as fuel cell vehicles (FCEV=Fuel Cell Electric Vehicle) and as internal combustion engines (ICE=Internal Combustion Engine). The range is a key argument in favor of an H_2 drive. Another advantage is the short refueling time of around 15 minutes. One major challenge, however, is the high cost of purchasing the vehicles, which is 3-5 times that of a diesel tractor unit. Due to low and currently practically non-existent subsidies, hardly any vehicles are currently being procured. Manufacturers are failing to reduce costs through scaling. The TCO (= Total Cost of Ownership) for a logistics company is currently approx. 1.5-2 times higher than with the established diesel drive. In addition, H_2 burners were excluded from the previous funding programs. Although these are slightly less efficient and energy tax is payable on the fuel, they are considerably cheaper to purchase.

Technological developments and their impact

Research and development in the field of H_2 technology is progressing continuously. H_2 vehicles, both fuel cell vehicles (FCEV) and internal combustion vehicles (ICE), have made considerable progress in recent years. This progress has a positive effect on the acceptance and thus the market ramp-up of H_2 mobility concepts.

Rail transport and local public transport as pioneers

H_2 is also gaining importance in rail transportation. The Alstom Coradia iLint, the world's first train powered by H_2, is already in use in several European countries. Its fuel cells are produced in the Emscher-Lippe region. In local public transport, cities are increasingly turning to H_2-powered buses. For example, the city of Bottrop has committed to developing sustainable mobility solutions as part of the "InnovationCityRuhr" project, which also includes the introduction of H_2 buses. Five H_2 buses have been in operation in the district of Recklinghausen since 25.08.2024. These developments in the public sector serve as positive examples and pave the way for the wider use of H_2, including in the commercial sector.

Competitiveness and cost reduction

The economic success of H_2 in the mobility sector depends very much on its competitiveness compared to fossil fuels and other alternative drive systems. The costs of green hydrogen are currently still high, but economies of scale and technological advances are expected to significantly reduce costs in the coming years. A study by the International Energy Agency (IEA) predicts that the cost of producing green H_2 could fall by up to 50% by 2030. The costs for infrastructure will also continue to fall with increasing distribution. However, H_2 mobility will only be able to establish itself if fossil fuels become more expensive in the long term, e.g. through significantly higher CO_2 pricing.

International Priorities

1 A cross-border legal framework for H_2

The border region between Germany and the Netherlands offers ideal conditions to act as a testing ground for innovative regulations in the H_2 sector. Both countries face the challenge of aligning their national legislation with the European H_2 directives. The region can play a pioneering role here by testing and adapting experimental regulations that can later be transferred to other regions in Europe. This pragmatic approach would enable faster implementation of H_2 projects and reduce bureaucratic hurdles.

2 Cross-border development of the H_2 infrastructure

A functioning H_2 economy requires a robust and well-connected infrastructure. **The existing H_2 pipeline connections, such as the Dutch Hydrogen Backbone in the Netherlands and the H_2 core network in Germany, must be further expanded.** The integration of storage capacities, such as the salt caverns in Gronau-Epe, is particularly important. The cross-border use of this infrastructure strengthens the resilience of supply chains and enables the large-scale use of H_2 in both countries.

3 Establishment of common educational standards

One of the most important prerequisites for the successful development of an H_2 economy is the training of qualified specialists. There are already initial initiatives in the border region to establish educational standards for academic and vocational training in the H_2 sector. Programs such as the H2!Academy or new courses of study such as "Hydrogen Systems and Renewable Energies" at the Westphalian University of Applied Sciences offer tailor-made qualification paths. **Harmonizing these educational programmes across borders would promote the mobility of skilled workers and strengthen the region's innovative power.**

4 TECH.LAND: Strengthening cross-border cooperation

The success of the H_2 economy depends to a large extent on close cooperation between companies, research institutes and political players. The TECH.LAND program promotes the cross-border exchange of best practice examples and supports the transfer of knowledge between the regions. This networking offers the region competitive advantages and enables shorter development cycles for technologies such as electrolysers and fuel cells.

5 Cross-border H_2 mobility

In order to drive forward the decarbonization of mobility in the border region, a joint mobility concept is needed that optimizes the use of H_2 in various transport sectors - especially in heavy goods transport, shipping and aviation. So far, mobility projects in the region have been largely limited to national initiatives. **We are therefore calling for a joint strategy that takes into account the specific requirements of both countries and thus not only strengthens the logistics infrastructure, but also helps to reduce CO_2 emissions in transport.**

International Facts

Border region

The aim of this section is to provide a comprehensive overview of the current situation, development opportunities and selected problem areas of H_2 in the Germany/Netherlands border region. We want to present ourselves together in the European context with regard to regulation and promotion. The cross-border activities in the field of H_2 are bundled in the Hydrogen Cluster of the TECH.LAND program. This includes players from the regions of North Westphalia (Münsterland, Emscher-Lippe region) and East Netherlands (Overijssel and Gelderland) as parts of the EUREGIO.

TECH.LAND H_2 activities

The TECH.LAND Hydrogen Cluster is managed on the German side by WiN Emscher-Lippe, Kreiswirtschaftsförderung Coesfeld and Technologieförderung Münster and on the Dutch side by the Twente Board and Oost NL. With a broad spectrum of H_2 activities and clusters from business, science and politics, the border region offers great potential for innovation, both nationally and across borders.

H_2-Pipeline infrastructure in the border region

Both in the Netherlands (Dutch Hydrogen Backbone) and in Germany (H_2-Kernnetz), an H_2 pipeline infrastructure is being created, which will be connected at the Vreden border crossing. From there, the H_2 in Germany will be routed through the Münsterland region to the Emscher-Lippe region, the Marl Chemical Park and the refinery in Gelsenkirchen. The region benefits from an already dense natural gas pipeline network, which enables rapid conversion. The region will be one of the first in Europe to be supplied with green H_2 by pipeline on a large scale.

Network platform H2[X]

The EUREGIO, the IHK Nord Westfalen and the Münster district government launched the German-Dutch online platform H2[X] in 2021. H2[X] serves as a central point of contact for organizations involved in the hydrogen economy in the region. The platform offers information on contacts, news, funding opportunities and example projects from the EUREGIO area, the Emscher-Lippe region and parts of the Emsland.

Funding projects

The border region offers great potential for innovation with a wide range of H_2 activities. INTERREG projects are of particular importance here. German and Dutch universities and companies are working on an innovative software-based toolbox for electrolysers in the "BOOST" project until 2027. Since 2023, the "Energy Booster" project has been focusing on training skilled workers in the skilled trades for the overarching topic of the energy transition and thus H_2 as a sub-aspect. In addition, a large number of projects have been and are being implemented in the region with national funding programs.

World Hydrogen 2024

The region is well connected internationally in the field of H_2 and is continuously expanding these networks. May 2024, when representatives from the region came together for the first time as part of the TECH.LAND program at the World Hydrogen in Rotterdam, can be considered the starting point.

Minnesota and Singapore

The strengths of the international cluster in H_2 technologies, fuel cells and electrolysers were also expanded by delegations in Minnesota/USA and Singapore.

International educational approaches

The first H_2-specific educational programs are currently being developed at a national level. With its 9 universities (Universiteit Twente, Wageningen Universiteit, Hogeschool Windesheim, Hogeschool Saxion, Hogeschool van Arnhem en Nijmegen, FH Münster, Hochschule Ruhr West, University of Münster, Westfälische Hochschule), the cross-border region offers an ideal environment for creating common educational standards in the field of H_2. This creates synergy effects, which can be of great importance, especially in times of a shortage of skilled workers. Educational initiatives already exist at academic, industrial and vocational level. At vocational level, the H2!Academy is pursuing the goal of developing a vocational training program for the northern Ruhr region that supports the transformation to H_2 as an energy source. At the same time, the Westphalian University of Applied Sciences is creating a tailor-made offer at academic level with its new bachelor's degree course in "Hydrogen Systems and Renewable Energies".

Cross-border use of resources

The border crossing point of the H_2 transmission networks in Vreden forms the basis for the cross-border use of existing and new infrastructure. This allows regions to connect their H_2 production, use and import ports with each other. For example, H_2 produced or imported in Rotterdam or Eemshaven can be used industrially in Marl and Gelsenkirchen. Storage facilities

close to the border, such as the salt caverns in Gronau-Epe, can serve as a buffer and stabilize the long-distance networks of both countries. In heavy goods transport, joint planning of H_2 filling stations will enable a nationwide network that facilitates the switch to H_2 vehicles for logistics companies in both countries.

Networking of companies

Key technologies for the H_2 economy, such as electrolysis and fuel cell stacks, as well as related technologies for balance-of-plant, peripheral devices (e.g. storage), gas engines and other application technologies are developed, produced and marketed in the border region. More intensive networking and the exchange of knowledge between companies promote shorter development cycles and give the region a competitive edge over others.

Mobility

For mobility to work over long distances, it must be conceived in cross-border terms. However, with a few exceptions, H_2 mobility projects in the region are limited to one country. For the decarbonization of the mobility sector to succeed, a cross-border H_2 mobility concept is needed. This should include the mobility sectors of heavy goods traffic, shipping and air traffic.

Establishment of experimental regulations

Derived from European directives, both countries in the border region are currently updating their national legislation on H_2 (e.g. BImSchV on the German side). This is generally happening independently of each other, which poses particular challenges for border regions. The border region offers an ideal environment for creating and testing experimental regulations between Germany and the Netherlands in this way. The experience gained can be transferred to other border regions and enable faster implementation there.

The position paper was developed on the basis of intensive discussions with experts from the H_2 Working Group of the Münster administrative district. In addition to the members of the consortium, selected experts were involved in specialist dialogs. The documentation of the dialog events and statements were incorporated into the further editing process of the position paper. The consortium would like to thank all participants for their valuable support and the very fruitful exchange.

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