REGIONAL HYDROGEN INITIATIVES

Interreg North Sea

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EHRIN

This report provides an overview of projects and intiatives for developing the hydrogen markets in our regions: Leine-Weser (German), Skane (Sweden) and Drenthe (The Netherlands).

Hydrogen ambitions and initiatives

This report covers EHRIN activity number 6: Take stock of regional Hydrogen ambitions and initiatives. Identify current regional H2 ambitions and relevant initiatives in the three partner-regions by each of the EHRIN partners.

Region of Leine-Weser

The region of Leine-Weser in Lower Saxony (Germany) includes 7 districts (Diepholz, Hameln-Pyrmont, Hildesheim, Holzminden, Nienburg/ Weser, Schaumburg and the Region of Hannover, including the capital city of Hannover) with 2.1 Million inhabitants and an area of 9.060 km².

To understand the ambitions and initiatives concerning hydrogen in this region it is important to take into consideration that there is a variety of highly different players. At least four different ministries of Lower Saxony are involved in hydrogen:

- Ministry of Economic Affairs, Transport, Housing and Digitalisation
- Ministry for the Environment, Energy and Climate Protection
- Ministry for Science and Culture
- Ministry of Federal and European Affairs and Regional Development

Additionally, there are federal organizations like the Innovation Center of Lower Saxony or subordinated federal authorities like the office for regional development Leine and Weser region. Municipalities do play a big role in hydrogen projects as well as they hold the guaranteed right of municipal self-administration by the constitution and thus are responsible for topics like heat-planning or infrastructure. Finally, the Hydrogen activities in Lower Saxony are strongly influenced by the ministries of the federal republic of Germany.

Beside these governmental stakeholders there are players like chambers (chamber of commerce, chamber of Crafts…) associations and universities.

This leads to a very complex stakeholder structure and includes one main task of networking for every organization concerning hydrogen.

Regional ambitions and initiatives

(1) Generation H2, Hannover

- The initiative “Generation H2” was founded in 2021 as a common start to strengthen the hydrogen technology in this region. In cooperation with the Leibniz University and several companies the regional authorities invented a regional hydrogen plan. Main topics are Networking, Education & Qualification, Business Development, Regional funding for companies, H2-Use-Cases for companies, Infrastructure-Building.
- *Initiator: Region of Hannover*
- https://www.wirtschaftsfoerderung-hannover.de/de/Handlungsfelder/Klimaschutz_und_Energieeffizienz/Generation_H2/Initiative_H2.php

(2) Hydrogen Region Schaumburg

- The district of Schaumburg was one of only nine regions in Germany which was chosen 2019 as a "HyStarter-region" in the federal programm "HyLand". HyLand contains three different programms with different aims (HyStarter: Development of a regional strategy / HyPerformer: Development of Hydrogen-Projects / HyExperts: Building and Implementation of Hydrogen-Projects). After the strategic development process in the end of 2020 the district presented a regional concept as a hydrogen region. Beside this the district decided to create the position "hydrogen manager" for this region.
  Main topics are building infrastructure (especially for mobility), generating H2 from waste material and networking.
- *Initiator: District of Schaumburg*
- https://www.hy.land/
- https://energieagentur-shg.de/wasserstoff/wasserstoffregion/

Relevant interregional/national ambitions and initiatives

(3) H2.N.O.N. - Hyrogen Network Northeast Lower Saxony

- H2.N.O.N. was founded in 2018 and contains more than 140 members in 2024. The strategic positions are:
  i. The region is a producer for renewable energies.
  ii. There are transmission lines for electricity and gas and specific transport infrastructure like sea harbours, railway and highways.
  iii. There are salt caverns for mass-storage of gas available.
  iv. Energy will be imported through the sea harbours.
  v. Technology excellence of companies.
  vi. Focus on agriculture and food production.
  vii. Using established cooperation between municipalities.

  The region is inventing a "H2-regio-Hub-strategy" to match supply and demand for inventing regional basic structures.
- *Initiator: 11 Districts in the northeast of Lower Saxony together with the local chamber of commerce and several companies.*
- https://www.h2non.de/

(4) Hydrogen Alliance Southern Lower Saxony

- Based on the regional strategy for southern Lower Saxony 2020-2025 the foundation of southern lower Saxony pushed the development of the Hydrogen Alliance Lower Saxony. The aim is to create a stakeholder network to bundle activities and the strength of this region for inventing hydrogen technology. This will lead to an empowerment of economic competitiveness for this region as a hydrogen model region. There are more than 40 members from economy and administration in this alliance.
- *Initiator: Foundation of southern Lower Saxony*
- https://www.suedniedersachsenstiftung.de/projekte/wasserstoff-allianz/

(5) Hydrogen Network Lower Saxony

- Lead by the office from the climate protection and energy agency lower Saxony (KEAN) the hydrogen network Lower Saxony advises and supports the stakeholder for building a hydrogen economy in Lower Saxony. It cooperates with different associations and organisations.

Furthermore, it is a platform for exchange for all different stakeholder networks in the state of Lower Saxony.

- *Initiator: Ministry* for the Environment, Energy and Climate Protection
- https://www.wasserstoff-niedersachsen.de/

Region of Skåne

Sweden is divided into 21 regions, where Skåne if the southernmost one with population of 1,3 million. Population is concentrated to the western cost and 3 largest cities of the region: Malmö, Lund and Helsingborg. One of the main characteristics of Skåne in terms of energy usage and generation is its increasing focus on renewable energy sources and sustainable practices. Skåne is actively transitioning towards a more sustainable and environmentally friendly energy system. The region aims to reduce greenhouse gas emissions, decrease reliance on fossil fuels, and transition towards a more sustainable energy future. Skåne has also ambitious program for cutting the climate impacting emissions. Climate goals for Skåne by 2030 should greenhouse gas emissions be at least 80 percent lower than in 1990. Likewise by 2023 should greenhouse gas emissions from consumption in Skåne be a maximum of 5 metric tons of carbon dioxide equivalents per person per year.

Hydrogen has currently very limited use in Skåne, where two industrial actors are producing and using hydrogen internal in their processes. Potential for hydrogen production and usage is however growing. Production through electrolyses is currently limited due to limitation in the electricity transition, something that is a subject for many stakeholders and is expected to gradually be solved. When is come to use the heavy-duty transport sector is usually pointed as potentially interesting as Skåne is an important region for heavy transport. On long term the CCU (Carbon Capture and Utilisation) is pointed as a sector that can substantially drive usage of hydrogen.

Skåne is facing a high demand for electricity, however local electricity production does not meet this demand, necessitating significant imports (at least 70%) from other regions and countries. Reliance on external sources creates vulnerabilities in the system and demand a stable local production. There is a significant push towards development of renewable energy, such as off shore wind farms and solar power. However, even the electricity grid in Skåne needs modernization to enhance capacity and stability to handle the future renewable inputs and fluctuations in production effectively.

Regional ambitions and initiatives

(6) Industrial production and used of hydrogen

- Höganäs AB has a 33% share of world metal powder production. Hydrogen is used in production processes and produced on site by methane reforming. Company has a climate goal of zero emissions in 2030. Climatic ambitions are driving company to seek solutions to natural gas and considerations of switching to biogas or to electrolyses, neither of which is withing the reach in the closest future. All locally produced biogas is currently heavily prebook by transportation companies and switching to electrolyses is limited by the limitations in electricity grid capacity.
- *Initiator: Höganäs AB*
- *https://www.hoganas.com/en/*

(7) Hydrogen used in chemical industry

- Kemira AB is a chemical company that produces and then uses hydrogen in own industrial processes for production of hydrogen peroxide.
- *Initiator: Kemira AB*
- *Links to relevant background information (website/documents, etc.)*

(8) Hydrobust

- A Municipality real estate and housing company has invested in self-sufficient small scale energy system with hydrogen in focus. Investment in solar cell and wind turbine made it possible to decouple from the widely known problem of the grid capacity and invest in hydrogen production.

- *Initiator: Sjöbohem*
- *https://hydrobust.se/, https://www.svt.se/nyheter/lokalt/skane/sa-fungerar-ett-vatgashus; https://www.svt.se/nyheter/lokalt/skane/har-ar-huset-som-ar-sjalvforsorjande-pa-el-och-varme;*

(9) Trelleborgs Energi

- A municipal energy company has ambitions to drive development towards hydrogen production on a level of initially 50-200 MW what corresponds to ca 5000- 20 000 tons H2 /year. Production is coupled to investment in own off shore wind production. Use of hydrogen was planned to be coupled to ammonia production and connection to the planned pipelines connection to the northwest hydrogen cluster. A recent feasibility study points to H2 of 500-1000 MW would be interesting. There is however no decision made in which scale the development will take.
- *Initiator: Municipality of Trelleborg*
- *https://trelleborgsenergi.se/energilosningar/vatgas/*

(10) Öresundskraft

- Municipality owned utility company with focus on heat and power production. It has an ambition to invest in production of hydrogen for industrial customers and specifically to produce e-fuels. Production of hydrogen for transportation is deemed to be connected to larger investment in infrastructure (compressors, distribution) and therefore not prioroitised. The company has an ambition to invest in ca 800 MW plant in Helsingborg. As the company is actively producing heat through combustion, CCU is deemed to be very interesting on the heat production site, coupled to production of green methane.
- *Initiator: Öresundskraft*
- *Links to relevant background information (website/documents, etc.)*

(11) Kraftringen

- Municipality owned utility company. Interested in investing in robust local systems. One example will be an investment in small scale solar and wind production coupled to hydrogen. In such smaller scale project where hydrogen is going to be produced via electrolyses and heat used in a low temperature heating net used for heating of houses.
- *Initiator: Kraftringen*
- *Links to relevant background information (website/documents, etc.)*

(12) Uniper

- Energy and utility company that is generally driving couple of projects connected to hydrogen, all of them located in northern Sweden. Company has however ambitions to invest in hydrogen in Skåne, however there are for the moment limited by the current low capacity of electricity grid and/or lack of local energy production.
- *Initiator: Uniper*

Relevant interregional/national ambitions and initiatives

(13) National hydrogen strategy

- Sweden hac currently no strategy for hydrogen, but recently the Swedish Energy Agency was commissioned to work out a strategy proposal. The proposal highlights the importance of hydrogen in the future energy systems and indicates that the way should be paved by two goals: firstly to facilitate for production of 5 GW by the 2030 and then to facilitate for production of following 10 GW in 2045.
- *Initiator: national government*
- *Links to relevant background information (website/documents, etc.)*

(14) Fossil Free Sweden initiative and it's H2 strategy

- Fossilfritt Sverige (Fossil Free Sweden) is an initiative started the government and is a national cooperation of companies, municipalities, regional governments that aims at making Sweden a fossil free country.
- Strategy lists all significant current H2 initiatives in country and based on this H2 production potential suggests a future goal of 8GW electrolyse capacity in 2045. This goal means that permitting processes should be made more efficient and less time consuming but even that the electricity production should be increased by at least 55 TWh.
- *Initiator: Fossilfritt Sverige*
- Vätgasstrategi för fossilfri konkurrenskraft - Fossilfritt Sverige

(15) Regional Climate and energy strategy

- Climate and energy strategy for Skåne is the regional policy document describing energy ambitions and related climate ambitions and measures. The current version of policy is about to be updated, where hydrogen is going to become part of energy outlook. Update process is initiated, final version expected under 2025.
- *Initiator: Länsstyrelsen Skåne*
- *https://catalog.lansstyrelsen.se/store/18/resource/DM_2018__18*

(16) Baltic Sea Hydrogen Collector

- European Commission announced Nordic Hydrogen Route and Baltic Sea Hydrogen Collector as PCI-projects. PCI-status for cross border infrastructure projects underlines great importance of the initiative for the green energy transition of Europe.
- *Initiator: Nordion Energi*
- The Baltic Sea Hydrogen Collector

Province of Drenthe

The province of Drenthe, alongside with the provinces of Groningen and Friesland, forms *the* energy region of the Netherlands. Where the energy landscape was once dominated by peat, oil and gas, we are currently developing a sustainable and multifaceted energy region. We have the right innovative projects, know-how and infrastructure to attain this. To create conditions for subsequent developments, we lead projects and facilitate wherever necessary. There is a reason why we are the very first European Hydrogen Valley. The province of Drenthe works towards the realisation of the whole hydrogen network: Hydrogen production, hydrogen transportation and the application of hydrogen in industry, mobility and the built environment. We will also consider where we could combine potential hydrogen developments to attain fully operational hydrogen networks.

We do this with several partners and a diverse collection of initiators are working on or have already finished projects. A number of projects are partly financed by the province of Drenthe and/or the European Union. We are also working hard to attain new national and European resources and projects for Drenthe. Additionally, for the topic of hydrogen we make an active effort from public affairs, to for example set up incentive schemes, clear guidelines and regulations. The lead position of the province of Drenthe offers opportunities for the provinces' industrial sector. There are already companies that produce products in the hydrogen economy. All this necessitates professionals that are both educated and available, which is why Drenthe is committed to hydrogen education together with the Greenwise Campus. The above elaborates on opportunities, whereas the biggest challenge is the ramp up of operational hydrogen networks.

Regional ambitions and initiatives

(17) Heavenn – Hydrogen Valley Northern Netherlands

- Northern Netherlands – Hydrogen Valley
  The Northern Netherlands has become the first region in Europe to become a so-called hydrogen valley. The region's grant application was approved by the Fuel Cells and Hydrogen Joint Undertaking (FCH JU) of the European Commission. It concerns a subsidy of €20 million with a public-private co-financing of €70 million, totalling €90 million. This subsidy funds hydrogen projects in the Northern Netherlands in the period of 2020-2026. The project is called HEAVENN (H2 Energy Applications (in) Valley Environments (for) Northern Netherlands) and comprises a wide arrange of hydrogen initiatives aimed to set up a hydrogen backbone for the Netherlands and Europe more widely. In the context of HEAVENN multiple hydrogen mobility initiatives are ongoing. For example hydrogen refuelling stations and hydrogen fleet promotion.
- *Initiators: consortium of several organisations.*
- More information

(18) HyTrEc2

- The HyTrEc2 project brought together eight organizations with an interest or experience in H2 to collaborate on developing a strategy and initiatives for the entire NSR. This will support the further use of hydrogen fuel cell electric vehicles (FCEVs) in the North Sea Region.

  Partners from Britain, Germany, the Netherlands, Sweden and Norway are working together to support the use of hydrogen in the transport and energy sectors in the NSR
- *Initiators: Aberdeen City Council, Aberdeenshire Council, CENEX, RISE, The Artic University of Norway (UiT), Atene Kom, Municipality of Groningen, Province of Drenthe*

- More information

(19) Public transport busses

- Public transport company Qbuzz has 30 hydrogen buses operational in the provinces of Groningen and Drenthe. The use of hydrogen buses also involves two hydrogen refuelling stations, located in Emmen and Groningen.
- *Initiators: public transport authority Groningen-Drenthe, Qbuzz, provinces of Groningen and Drenthe.*
- More information

(20) Hydrogen refuelling stations (in Drenthe)

- Drenthe aims to facilitate green hydrogen mobility by constructing the refuelling infrastructure to accommodate hydrogen mobility. There are already several hydrogen refuelling stations operational and more in the funnel. The province is in cooperation with both public and private entities to facilitate hydrogen mobility by installing its required infrastructure. In 2023, Drenthe has reached out to potential partners and has received nine respondents of parties interested in making hydrogen refuelling infrastructure sites. They indicated that they need to have 80% of their CAPEX subsidised in order to make a hydrogen refuelling station financially feasible and to close the business case. These partners would then along with Drenthe apply for CEF AFIF subsidies which are European subsidy measures. This European measure would subsidise the total costs of hydrogen refuelling infrastructure by 30%. On top of this European subsidy there is €125 million reserved by the Dutch government for subsidising hydrogen refuelling infrastructure.
- *Initiator:* Province of Drenthe, private partners.
- *Links to relevant background information (website/documents, etc.)*

(21) Upscaling hydrogen fleets

- The province of Drenthe aims to accelerate hydrogen mobility through various initiatives. There are several components to attaining a green hydrogen mobility system, of which two will be discussed here. First, there must be sufficient refuelling infrastructure. According to the Alternative Fuels Infrastructure Regulation there must be a hydrogen refuelling station every 200 kilometres along the “core Ten-T” roads. This will require constructing sufficient hydrogen refuelling stations at strategic locations to ensure hydrogen mobility across the Netherlands. Attaining this infrastructure requires a certain (daily) consumption of hydrogen, which necessitates a sufficiently large fleet of hydrogen-powered vehicles. Therefore, the hydrogen-powered fleet requires hydrogen infrastructure and the infrastructure requires a hydrogen-powered fleet. It’s therefore imperative that both the facilities and the consumers of these hydrogen facilities are sufficient.
- *Initiator:* Province of Drenthe, HyNetwork Services
- More information

(22) Hydrogen in Aviation – Groningen Airport Eelde

- As a part of the Hydrogen Valley Northern Netherlands, Eelde airport is building pilots projects to participate with hydrogen initiatives. The airport has constructed a solar field that will produce electricity that might be used for hydrogen production in the future. One pilot at Eelde is the Ground Power Unit (GPU) that will facilitate hydrogen experimentation.
- *Initiator:* Groningen Airport Eelde, Province of Drenthe, European Union
- More information

(23) H2Tap

- H2tap aligns with the Hydrogen Backbone to deliver hydrogen against as low a cost as possible. The initiative aims to deliver hydrogen for residential, industrial and mobility purposes and would increase hydrogen infrastructure in the Netherlands. The H2tap locations deliver 300 and 500 bar.
- *Initiator:* H2tap B.V.
- *Links to relevant background information (website/documents, etc.)*

(24) Nedersaksenlijn

- The Nedersaksenlijn is a planned railway track between Groningen and Enschede, passing through Emmen. Aside from the economic potential of linking the Northern Netherlands with the Eastern Netherlands, the line is also part of the imagined European Hydrogen Backbone as for the possibility of hydrogen-powered trains riding along the route. As Groningen aims to have regional trains running on hydrogen in the future, these could also ride over the Nedersaksenlijn.
- *Initiator:*
- *Links to relevant background information (website/documents, etc.)*

(25) Hydrogen train pilot Northern-Netherlands

- The province of Groningen, the Dutch railway operator ProRail, the Dutch government and Arriva have a formulated ambition to make railway transportation in the Northern-Netherlands emissions-free. The province of Groningen, Arriva, ProRail, Alstom and Engie conducted a pilot project in 2020 with a hydrogen-powered train. This experiment was a first-of-its-kind in the Netherlands and the goal was to gain more practical experience with hydrogen trains by the five partner organisations. Especially because hydrogen-powered trains would accommodate emissions-free transportation without having to invest heavily in overhead lines. The hydrogen train ran at night without passengers between the stations of Groningen and Leeuwarden. The rest was run multiple times, including the refuelling of the hydrogen train. The test was a success, with the train running on-time with efficient fuel consumption, acceleration and braking. The refuelling of the green hydrogen went quicker than expected and was carried out safely. An additional benefit of hydrogen trains over the current diesel trains is that they are 50% quieter, which adds to the benefits of a hydrogen train aside from being zero-emissions. There are plans to have four hydrogen-powered trains running on the regional track in the Northern-Netherlands by the end of 2027. The trains will be used on the existing routes Delfzijl-Groningen-Veendam and incidentally also on the other rail lines in Groningen and towards Leer. The province of Groningen and Arriva also want to use the trains for future expansion or adjustment of the track in Groningen, for example on a planned rail route from Veendam to Stadskanaal.
- *Initiator: Province of Groningen, Arriva, ProRail, Alstom, Engie*
- *Links to relevant background information (website/documents, etc.)*

Relevant interregional/national ambitions and initiatives

(26) Northern Netherlands hydrogen investment plan

- The Northern Netherlands hydrogen investment plan is a plan that presents the vision and strategy of the region to become a leading European hydrogen ecosystem by 2030. The plan includes investments totalling up to €9 billion and could secure or create up to 100,000 jobs in the hydrogen sector by 2050. The plan also outlines a roadmap with specific projects and actions to achieve the hydrogen potential of the region, such as:

- Producing offshore hydrogen from wind and solar energy
- Developing hydrogen transport and storage infrastructure, including pipelines, terminals, and underground storage
- Creating hydrogen hubs and clusters, where hydrogen can be used for various applications, such as industry, mobility, heating, and power generation
- Promoting innovation and cooperation in the hydrogen sector, both nationally and internationally The plan aims to contribute to the Dutch and European climate targets by reducing greenhouse gas emissions increasing hydrogen uptake. The plan is supported by the European Commission and the Fuel Cells Hydrogen Joint Undertaking, which have recognized the Northern Netherlands as the leading European hydrogen valley.

- *Initiator:* There is a large number of partners involved in this plan.
- More information

(27) Hydrogen Backbone

- A network of pipelines that will transport carbon-free hydrogen across the Netherlands and other European countries, connecting regions with abundant renewable energy sources and high industrial demand. The network will consist of repurposed gas pipelines and new pipelines specifically produced for hydrogen transport. The network will enable the large-scale deployment of carbon-free hydrogen, which can replace fossil fuels in various hard to abate sectors and applications. The network will also enable the import and export of carbon-free hydrogen, thus diversifying the energy sources and increasing cross-border hydrogen cooperation. The network will require the modification of the existing gas pipelines and the construction of new pipelines to be able to transport hydrogen instead of methane. The network will also require the mobilization of sufficient funds and incentives for the hydrogen projects, as well as collective action from multiple governments to be successful. Alignment and collaboration among all relevant hydrogen stakeholders is also of the utmost importance, as each stakeholder fulfils a different role in the construction of the Hydrogen Backbone. The network is planned to be implemented in phases, with the first phase expected to be completed by 2027.
- *Initiator: Hynetwork Services, owned by Gasunie N.V.*
- More information

(28) SWiM

- Subsidieregeling Waterstof in Mobiliteit (SWiM) (subsidy measure for hydrogen mobility), is a subsidy measure introduced by the Dutch ministry of Infrastructure and Water management. The measure aims to kickstart the adoption of hydrogen applications in mobility. There are two kinds of applications this subsidy comprises of: vehicles and infrastructure. The Dutch government identified a stalemate between vehicles and infrastructure adoption. Namely, that the uptake of hydrogen vehicles cannot accelerate without the hydrogen infrastructure for refuelling purposes. On the other hand, investments in hydrogen infrastructure will not proceed without hydrogen vehicles to absorb the hydrogen. The government has formulated a prioritisation to align the subsidy with the so-called urban nodes as described by the European Union.
- *Initiator:* Dutch ministry of Infrastructure and Water management.
- More information

(29) AanZET

- The Aanschafsubsidie Zero-Emissie Trucks (AanZET) is a subsidy scheme for entrepreneurs and non-profit organizations who want to buy or financial-lease a new, fully emission-free (zero-emission) truck. The scheme aims to stimulate the transition to clean and sustainable mobility in the transport sector. The scheme is funded by the

Ministry of Infrastructure and Water Management and administered by the Netherlands Enterprise Agency (RVO). The scheme was open for applications from April 4, 2023 to December 29, 2023, initially. However, as the total budget of € 57.4 million was exhausted instantly, the scheme is now closed. The subsidy amount is a percentage of the sales price of the emission-free truck chassis, excluding VAT. The percentage and the maximum subsidy amount vary depending on the vehicle category and the type of enterprise. The table below shows the subsidy rates and amounts for each category and type of enterprise.

- *Initiator:* Ministry of Infrastructure and Water Management, Netherlands Enterprise Agency (RVO).
- *Links to relevant background information (website/documents, etc.)*
- More information

(30) Subsidieregeling Schoon en Emissieloos Bouwmaterieel

The Subsidieregeling Schoon en Emissieloos Bouwmaterieel (SSEB) is a subsidy scheme for clean and emission-free construction equipment. The scheme is for:

- Construction companies that want to buy new emission-free construction machines, such as excavators, mixers, and vehicles, for their own use.
- Companies that want to retrofit existing construction machines and vehicles to make them emission-free or emission-reduced.
- Companies that want to develop innovative ideas to improve emission-free construction machines and the charging infrastructure.

The scheme is funded by the Ministry of Infrastructure and Water Management and administered by the Netherlands Enterprise Agency (RVO). The scheme is open for applications from May 9, 2023 to October 31, 2023, or until the budget is exhausted. The budget has €42 million for SSEB Aanschaf for purchasing new emission-free construction machines; €14 million for retrofitting existing machines and €4 million for 'SSEB innovative',

- *Initiator:* Ministry of Infrastructure and Water Management.
- More information

(31) Pilot hydrogen train Northern Netherlands

The province of Groningen, the Dutch railway operator ProRail, the Dutch government and Arriva have a formulated ambition to make railway transportation in the Northern-Netherlands emissions-free.

The province of Groningen, Arriva, ProRail, Alstom and Engie conducted a pilot project in 2020 with a hydrogen-powered train. This experiment was a first-of-its-kind in the Netherlands and the goal was to gain more practical experience with hydrogen trains by the five partner organisations. Especially because hydrogen-powered trains would accommodate emissions-free transportation without having to invest heavily in overhead lines. The hydrogen train ran at night without passengers between the stations of Groningen and Leeuwarden. The rest was run multiple times, including the refuelling of the hydrogen train. The test was a success, with the train running on-time with efficient fuel consumption, acceleration and braking. The refuelling of the green hydrogen went quicker than expected and was carried out safely. An additional benefit of hydrogen trains over the current diesel trains is that they are 50% quieter, which adds to the benefits of a hydrogen train aside from being zero-emissions.

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- *Initiator:* province of Groningen, Arriva, ProRail, Alstom, Engie.
- More information