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INVESTMENT PLAN FOR HYDROGEN IN THE NORTHERN NETHERLANDS

june 2024

Colophon

The Investment Plan for Hydrogen in the Northern Netherlands is written by HyNorth. The design was done by Studio Ipsi. For the disclaimer, please refer to the appendix of this report.

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Foreword

As part of the global energy transition with an emphasis on reducing harmful emissions, the Northern Netherlands has positioned itself as a leading 'Hydrogen Valley' within Europe. Since the Investment Plan for Hydrogen in the Northern Netherlands 2020 (IP2020), the region has evolved into a hotbed of activities around the hydrogen ecosystem. We now stand on the brink of significant commercial and infrastructural developments, with projects that were once on the drawing board moving into the realization phase.

In 2024, we are also working towards national and European objectives (based on the Climate Agreement[1] & REPowerEU Plan[2])
- 50 publicly accessible hydrogen refueling stations in the Netherlands by 2025.
- 500 MW of installed electrolysis capacity in the Netherlands by 2025.
- Scaling up to 3-4 GW of electrolysis capacity in the Netherlands by 2030.
- 6 GW of electrolysis capacity in Europe by 2024.
- 40 GW of electrolysis capacity in Europe by 2030.

The Northern Netherlands is on the verge of truly shaping the hydrogen infrastructure, with a focus on substantially expanding the capacity for hydrogen production and improving and establishing a robust transport and distribution network to meet the growing demand. The investments are aimed at the realization of green & blue hydrogen production capacity as well as the construction of the associated import, transport, storage, and distribution network to meet future demand.

[1] https://www.rijksoverheid.nl/onderwerpen/klimaatverandering/klimaatakkoord
[2] https://ec.europa.eu/commission/presscorner/detail/en/IP_22_3131

Towards 2030, it is clear that the Northern Netherlands must not only significantly increase its capacity for green hydrogen but also continue to play a key role in the European hydrogen ecosystem. The goal is to serve as a model for other regions and to demonstrate how collaboration within the chain, coupled with innovative technologies and sustainable practices, can accelerate the transition to a hydrogen-driven ecosystem.

The Investment Plan for Hydrogen in the Northern Netherlands 2024 (IP2024) emphasizes the need for continuity in policy and the acceleration of investments in the region. It is essential that we join forces with both local and international partners to achieve the ambitious goals. We invite stakeholders to participate in this dynamic and innovative journey, which will benefit not only the northern region but also the wider world.

The Investment Plan for Hydrogen in the Northern Netherlands 2024 has been made possible with the support of the National Program Groningen, all participating companies, the three northern provinces, and local governments and institutions.

Thank you for your continued support and involvement.
Together, we will continue to work towards a more sustainable future.

René Schutte
Director HyNorth

Summary

The Northern Netherlands strengthens its hydrogen ecosystem with a significant growth of 45% in promising initiatives

Looking back at the plans of IP2020, we can ascertain that significant progress has been made. The number of initiatives has increased substantially (from over 50 to over 80), interest in hydrogen (H2) has risen, and there have been positive developments in regulation and legislation. Additionally, the majority of the JTF budget (47%) has been allocated to the Northern Netherlands.

One of the 10 recommendations in 2020 was the need to appoint a chain coordinator and cluster coordinator for the Northern Netherlands to coordinate the various initiatives and act as an accelerator for the development of the hydrogen ecosystem in the Northern Netherlands. The establishment of HyNorth has fulfilled this need, with the highly attended Good Morning HyNorth network meetings (over 1900 participants since the start) and the HyHub reports (Delfzijl and Hoogeveen) being notable achievements. The announcement by the National Program Groningen that hydrogen will be one of the five focal points for the next 15 years (with HyNorth as the designated partner) is also a positive development.

Since 2020, there has been a clear trend in the Northern Netherlands where the most promising initiatives are being developed at the local level. These include initiatives currently underway in Bolsward, Emmen, Veendam and surroundings, Delfzijl, and Hoogeveen. The remarkable aspect of these initiatives is that they currently rely on local infrastructure, rather than the national infrastructure (storage and transport) that is under construction.

Despite these positive developments in the region, no substantial investment decision has yet been made in the field of green hydrogen. All "major" projects in the region (such as NortH2, ENGIE, RWE, HYCC, VoltH2, and Lhyfe) are currently facing delays, including key infrastructure projects (construction of the H2 backbone via Hynetwork and H2 storage in salt caverns via HyStock). It would be helpful if parties further joined efforts towards FIDs (Final Investment Decisions). Moreover, parties are hesitant to enter into long-term contracts with each other, although this is a crucial precondition.

What's also not helped is the economic headwinds of the past few years (especially in the chemical industry), the enormous cost increases that have occurred since 2020 (partly due to the aftermath of the corona crisis), the developments regarding offshore wind (which is delayed and becoming more expensive), the energy crisis due to the Ukraine war, and - not to be forgotten - the increased financing costs.

These factors have caused the estimated cost of green hydrogen produced in the Netherlands to rise significantly since IP2020, from €3.50 - €5.00 to much higher amounts. This results in business cases that, despite substantial subsidy schemes, cannot be made economically viable. Consequently, long-term contracts (with corresponding price risks) cannot yet be signed. As a result, no positive investment decision has been made for any large-scale electrolyser project in the northern region. Other regions, by the way, are facing similar challenges.

Internationally, however, developments are moving quickly, with the local presence of sustainable generation capabilities being crucial. We recently saw this reflected in the outcome of the first subsidy auction by the European Hydrogen Bank[3], where Spanish and Portuguese projects emerged as winners. The leading position attributed to the Northern Netherlands in 2020 is therefore under pressure.

What should we do to improve this?
It is crucial to insist on chain collaboration so that, in addition to the "smaller" regional projects that certainly contribute to the investment plans, at least one major project can get started and the necessary national infrastructure can be built. Furthermore, we need to make more use of the favorable geographical location, especially the position of Eemshaven/Delfzijl when it comes to landing ammonia as a hydrogen carrier and blue hydrogen, in addition to the connection to national and international infrastructure (especially Northern Germany).

[3] https://ec.europa.eu/commission/presscorner/detail/en/IP_24_2333

In the three northern provinces, we should continue with local initiatives at the HyHub level. These create a lot of learning opportunities, support, and are promising. Moreover, these initiatives are less dependent on national infrastructure, require less financial commitment, and carry fewer risks. Additionally, we should not only focus on green hydrogen from solar and wind but also look at H2 production from biomass or fossil sources in combination with CCS.

Strategic developments

- Scaling up production: The production capacity of (green) hydrogen will increase through new production sites in areas such as Eemshaven and Delfzijl, supported by offshore wind energy projects.
- Infrastructure: Developing a robust infrastructure for the transport and storage of hydrogen, including the further development of Hynetwork between production, storage, and consumption points, and Hystock for the underground storage of hydrogen in salt caverns.
- Industrial collaboration: Strengthened collaboration between companies, government agencies, and educational institutions to promote technological innovations and the commercial rollout of hydrogen projects.
- Regulation and subsidies: Implementing targeted regulations and providing subsidies to stimulate investments in hydrogen technology.

Future vision

Towards 2030, the Northern Netherlands will not only significantly increase its capacity for green hydrogen but also play a key role in the European hydrogen ecosystem by serving as a model for other regions.

Challenges and recommendations

- Investing under current market conditions is difficult. Hydrogen is still too expensive and not competitive, leading to delayed investment decisions.
- Industry needs access to affordable and reliable sustainable energy. Offshore wind development is delayed, while this is crucial for green hydrogen.
- Currently, there is much more supply than demand. Supply and demand need to be brought together more effectively.
- The local approach works well, but a gap threatens national infrastructure development. FIDs on national infrastructure are still missing.
- A range of instruments is needed to jointly complete FID processes (e.g., new NPG subsidy, regional H2Global scheme, FEED stimulation, other incentive measures).
- More attention is needed for grid congestion, transport costs, and water.
- Even more collaboration is needed to realize the chain, despite the complexity.

Clear Opportunities for the Northern Netherlands

- Still growing pipeline of projects in development in the Hydrogen Valley Next Generation.
- Long-term ambitions and investment willingness in the region remain intact despite uncertainties.
- Regional value development through HyHubs works and should align with (inter)national infrastructure and storage in the coming years.
- National transport network and storage will be available in the region in the coming years.
- Besides green hydrogen production, also focus on a significant contribution from ammonia imports and blue hydrogen production (via Eemshaven).
- HyNorth is fully committed to crucial chain coordination and collaboration: Connect to Invest.
- The business community in the Northern Netherlands is closely involved and fully committed to the opportunities that the transition to hydrogen brings. This deserves full support from government agencies and is a tremendous opportunity for the region.

Chain collaboration is the catalyst of the hydrogen ecosystem

1

Developments since the Investment Plan for Hydrogen in the Northern Netherlands 2020

1.1 Starting situation of the Investment Plan for Hydrogen in the Northern Netherlands (IP2020)

Before IP2020, the Northern Netherlands marked its ambition to become a leading region in Europe in the field of hydrogen by launching an extensive investment plan. This plan aimed at creating a fully integrated hydrogen ecosystem, supported by both the public and private sectors.

Key developments and investments

- Infrastructure: Efforts were directed towards building a robust infrastructure for hydrogen production, storage, and distribution, particularly in industrial hubs (such as Delfzijl and Eemshaven).
- Offshore wind capacity: A significant component of the plan was the integration of offshore wind energy projects, intended to supply energy for hydrogen production. The goal was to have a significant capacity of offshore wind energy operational by 2030, specifically targeting the production of green hydrogen.
- Public-private collaboration: The investment plan highlighted the crucial role of collaboration between government agencies, local industries, and educational institutions, aiming to address technological and economic challenges.
- Investments: The total value of projects in the hydrogen pipeline significantly exceeded initial estimates, with a strong focus on both national and European funding opportunities to support these initiatives.

Strategic goals

- Production capacity: The plan sets concrete goals for expanding hydrogen production capacity, with the aim of achieving significant annual production by 2030.
- Economic impact: Besides making the energy supply more sustainable, the plan also aimed at stimulating the local economy by creating new jobs and attracting investments to the region.

Challenges

- Technological barriers: Significant technological challenges needed to be overcome, particularly in terms of efficiency and cost reduction of hydrogen production technologies.
- Regulation and social acceptance: The plan also recognized the need for clear regulatory frameworks and increasing social acceptance and awareness of hydrogen as a key solution for energy transition.

The 2020 investment plan positioned the Northern Netherlands as an ambitious and potential leader in the European hydrogen ecosystem. The strategic choices for infrastructure development, industrial collaboration, and the integration of renewable energy sources were crucial steps towards realizing a sustainable and economically viable hydrogen sector.

Access to essential resources

The Northern Netherlands has access to the following essential resources needed for a competitive hydrogen ecosystem as outlined in IP2020:

- Hydrogen markets;
- Offshore wind potential;
- Strategic locations for hydrogen production;
- Available and extensive infrastructure (pipelines, storage, ports); and
- Expertise in gas and hydrogen.

1.2 What have been the external factors since IP2020

The Northern Netherlands, as a pioneer in developing the hydrogen ecosystem, has reached a phase of consolidation. Amid challenges and changing market dynamics, the region remains committed to progress and innovation, but the sense of urgency seems somewhat diminished. What challenges have we faced in recent years?

Economic and operational challenges

- External headwinds: Economic developments over the past few years have led to delays in investments and decision-making regarding hydrogen projects. Additionally, geopolitical unrest has significantly impacted the energy agenda in Northwest Europe. This calls for a strategic reorientation, where the region explores new avenues to achieve its ambitions.
- Delay in chain development: There is increasing attention to collaboration within the value chain, which is essential. The necessary synergies between producers, transporters, and end-users are not yet fully realized.
- Maintaining competitive position: The region is actively working on establishing FIDs (Final Investment Decisions) and seeking ways to maintain or regain its lead over competitors.
- Transparency issues: The hydrogen market lacks transparency in supply and demand, which makes investors hesitant.
- Price uncertainty: Uncertainty about the price of green hydrogen creates a significant barrier to the feasibility of business cases, as long-term contracts are difficult to secure. Steps are being taken to provide price stability, which is crucial for forming robust business cases and investment certainty.

Infrastructure, Government Policy, and Nij Begun

- Infrastructure gaps: Crucial infrastructure that should form the basis for a thriving hydrogen market is still missing or its construction has not yet begun. The focus is on realizing the necessary infrastructure, a development that runs parallel to building the market.
- Fragmentation of government support: Although there are government initiatives that demonstrate good practices, support is often fragmented and not sufficiently coordinated.
- Groningen Field: Recently, the Groningen field has been closed with numerous consequences. One of the outcomes following the parliamentary inquiry into gas extraction has been the establishment of Nij Begun[4], a new program to provide Groningen and North Drenthe with improved prosperity prospects. Stimulating the hydrogen ecosystem plays a prominent role in this.

Regulation and financing

- Permit issues: The complexity and perceived slowness of the permitting process can be a bottleneck. Efforts are underway to streamline permitting processes, an important step towards accelerating hydrogen projects.
- Subsidy processes: The processes for obtaining subsidies are often lengthy and unclear, which hinders quick action.”

Knowledge and innovation

- Knowledge development: It is crucial to continuously invest in knowledge development. There is a risk that talent and knowledge may drain away if projects are not concretized in the coming years.
- In IP2020, it was estimated that approximately 25,000 FTEs would be created in the entire hydrogen ecosystem in the Northern Netherlands. This estimate largely aligns with current plans and thus requires significant attention to this topic. See also the recent report by GroenvermogenNL[5].

Strategic considerations

- Role of ammonia and blue hydrogen: These topics remain important discussion points within the broader hydrogen debate, given their potential in the energy transition. They are likely to play a significant supplementary role in the shift to a sustainable energy mix.
- Hub-and-Spoke Model: The Hub-and-Spoke model (for further explanation, see H.3) in various cities and regions demonstrates that local initiatives are vital for progress and regional development in creating a hydrogen chain.
- Coordination between different infrastructure initiatives: There appears to be a gap between national infrastructure developments and local solutions, which calls for better coordination.
- Offshore wind development delays: Developments in offshore wind, an essential component for the production of green hydrogen, are facing delays, mainly due to the significant cost increases in recent years. Although government ambitions have been raised, current developments are lagging behind.

[4] https://www.nijbegun.nl/

[5] https://groenvermogennl.org/documents/#

1.3 What has been done with the actions from IP2020

While the core ambitions and directions have remained consistent since 2020, adjustments and modifications in the strategy have occurred in response to both internal and external changes. The Northern Netherlands region continues to commit to the hydrogen transition, but with renewed focus on the speed and manner in which these objectives are achieved.

	LEVEL OF AMBITION TO ACHIEVE	EXPLANATION	2020-2025	2025-2030
Hydrogen production, infrastructure & demand	Ensure a supportive regulatory framework.	RED II and RED III impose restrictions on green hydrogen production. Recent RFNBO implementation in the Netherlands offers some flexibility, but significantly increased grid tariffs, especially for electricity, are a major obstacle.	X	
	Stimulating the growth of hydrogen demand.	This is an important point of focus because demand significantly lags behind production plans. Mandatory blending requirements from regulations would certainly help.		X
	Introducing funds for scaling up hydrogen and supporting instruments.	Many funds are available, such as the recent OWE subsidy for 4 projects in Groningen and Drenthe, and in 2023 the IPCEI subsidy for HyNetherlands, but this has not yet led to final investment decisions.	X	
	Compensating for the initial investment gap for essential infrastructure.	Hynetwork utilizes the scheme to finance upfront costs, and the OWE scheme is also aimed at covering the unprofitable top, but concrete investment decisions are still pending. A positive aspect for the region is the proximity to the national infrastructure (transport & storage).	X	
Offshore wind capacity	Accelerating the development of offshore wind for hydrogen.	Indeed, there is ambition to accelerate to 21 GW, but it remains to be seen if this can be achieved. In terms of scale, only the NorthH2 project comes close, but this project is facing delays.		X
The larger hydrogen ecosystem	Investing in the needs for building the larger hydrogen ecosystem.	Obtaining Hydrogen Valley Status was a major milestone. HyDelta, Entrance, HydroHub Megawatt test center, DNV.	X	
	Transferring intangible assets.	Is already taking place.		X
Overall program management	Allocating the majority of the JTF budget to the Northern Netherlands. Steering the development of the hydrogen ecosystem.	47% of the JTF budget has been allocated to the Northern Netherlands.	X	
	Guiding the development of the hydrogen ecosystem.	HyNorth has been established and plays a pioneering role in the Northern Netherlands to realize the ambitions set out in IP2020. Network meetings are very well attended. The relationship between government and business is actively encouraged.	X	
	Directing a systematic national approach.	HyNorth, realization of value chains still needs to grow. Additionally, more coordination is required.		X

Status
X Red = severe delay
X Orange = experiencing delays
X Green = on track / completed

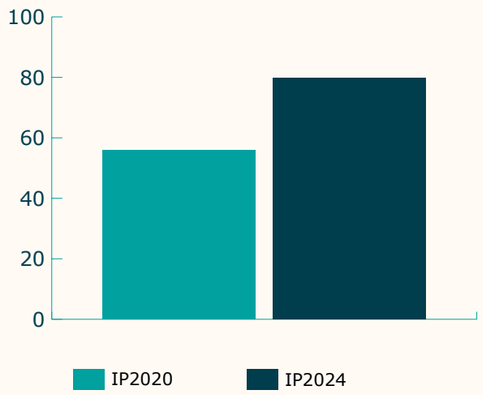
2

Outcomes and findings of IP2024

2.1 Key outcomes of IP2024

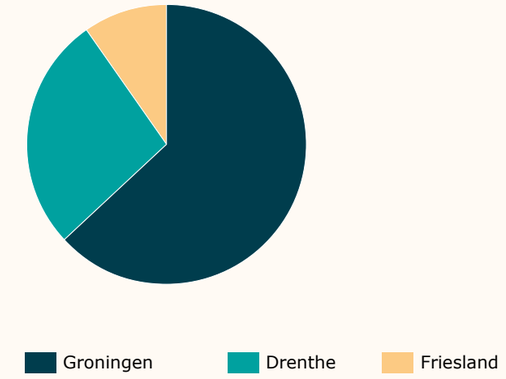
Number of projects has increased by over 45% since IP2020, but demand for hydrogen still lags significantly behind.

Number of projects (excluding knowledge projects)



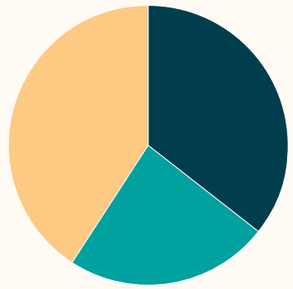
Compared to IP2020, the number of projects has increased from 56 to 81 (+45%), which is a clear positive development. For comparison purposes, we have excluded knowledge projects as we have paid relatively little attention to them in our research. The actual number of projects added since IP2020 (25) is even higher, as some projects from IP2020 have been discontinued or completed.

% of projects per province IP2024



When we look at the distribution of the number of projects across the three northern provinces, we observe that Friesland is lagging behind. However, this province started developing a hydrogen strategy later. Groningen and Drenthe are leading, which is not surprising given the presence of sea ports, industrial clusters in these regions, and the proximity to national infrastructure (Hynetwork and Hystock).

% distribution by value chain position IP2024

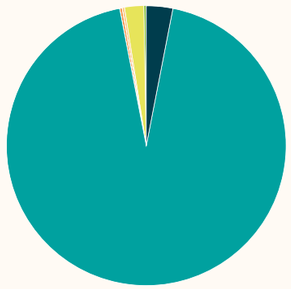


Capacity (ktons/year)

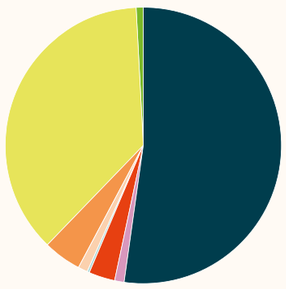
While the number of projects is well-distributed across the entire value chain (left graph), the distribution of capacity is clearly unbalanced. There is significantly more planned production of green hydrogen than there is current demand for hydrogen. It should be noted, however, that many potential hydrogen consumers have not yet disclosed their investment plans (due to confidentiality) and are therefore not included in our investment plan. We are aware of several production projects that are advanced in their business cases and intend to make investment decisions this year, which are currently in (confidential) final discussions with potential buyers, so hopefully this information will become available in the coming months.

Distribution of plans by Hyhubs

Distribution of MW capacity per Hyhub (IP2024)

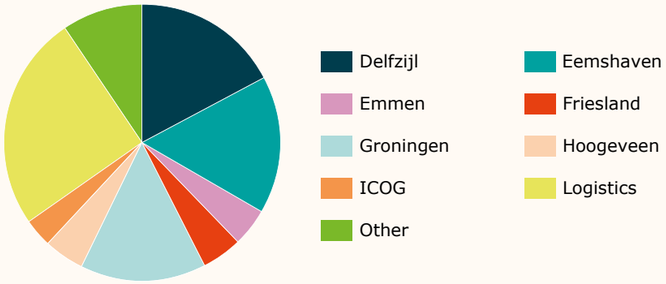


Distribution of MW per Hyhub excluding Eemshaven (IP2024)



As previously mentioned in the report (see page 7), HyNorth has focused on the development of Hyhubs because these are promising areas for the northern region where local-scale hydrogen chains can be established. When we look at the overall distribution of planned production capacity across the different Hyhubs, Eemshaven stands out significantly (left graph). However, most of the planned hydrogen production from Eemshaven will end up outside the region. If we examine the same graph excluding Eemshaven (right graph), we see a large share for Delfzijl, where there is also significant potential for local demand, including with the Chemie Park Delfzijl. Lastly, there is a substantial share for Logistics, which includes all companies in the Northern Netherlands contributing to transport, storage, and mobility and that are not part of any other Hyhub.

distribution of # projects per Hyhub

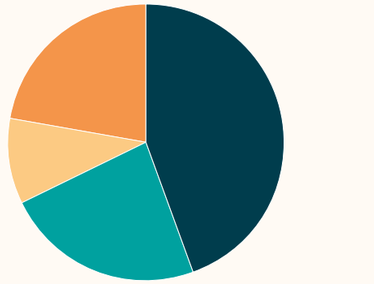


Finally, looking purely at the number of projects per Hyhub, we see a much more balanced distribution in IP2024.

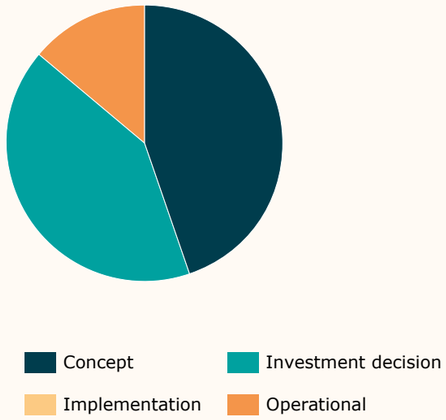
Almost all (larger) projects still in Concept or Investment Decision phase

The current status of the various projects has also been examined. A distinction is made between Concept, Investment Decision, Realization, and Operational phases, with the caveat that a project is considered to have the Investment Decision status if it expects to make a decision within 18 months. The research shows that 25% of all projects are already operational. While this sounds very positive, it is based purely on the number of projects, and mainly concerns smaller projects and demo or test projects from previous years. When looking at the "economic" value of the operational projects, they represent less than 1% of the investment agenda. Moreover, this also means that almost three-quarters of all projects are still in the earlier stages of development and have yet to start.

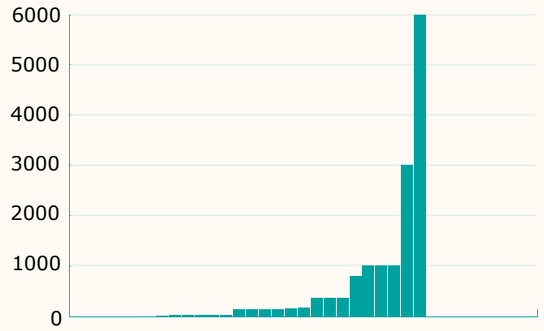
% Distribution by phase IP2024, all projects



% distribution by phase, production projects only (IP2024)



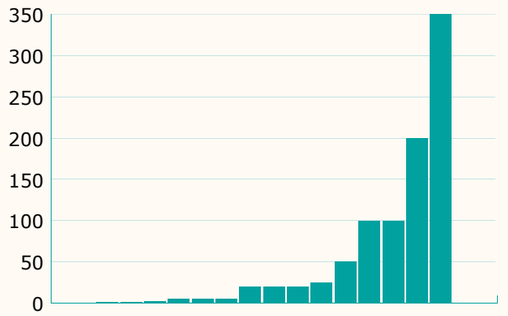
Distribution of all projects by MWe Capacity (IP2024)



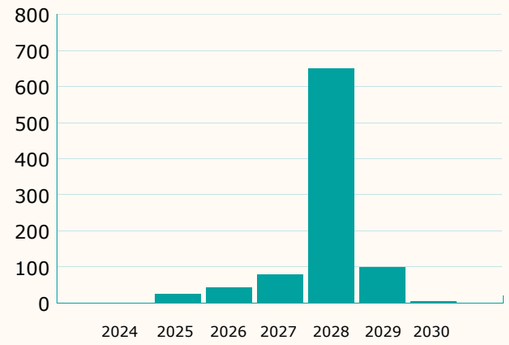
When focusing specifically on production projects, the picture looks quite different. Nearly 90% of all production projects (>€8 billion by 2030) are still in the Concept phase or the Investment Decision phase (left graph). Much will depend on whether these projects proceed in the coming years. Looking at the capacity distribution of all production projects (right graph), we see that the 5 largest projects account for almost 85% of all planned capacity. In other words, these 5 projects (all planned for Eemshaven, including NortH2, H2M, and HyNetherlands) will ultimately play a crucial role in achieving the ambitious goals of the Northern Netherlands.

In IP2024, 16 new production projects have been added

Distribution of all new projects by MWe capacity (IP2024)

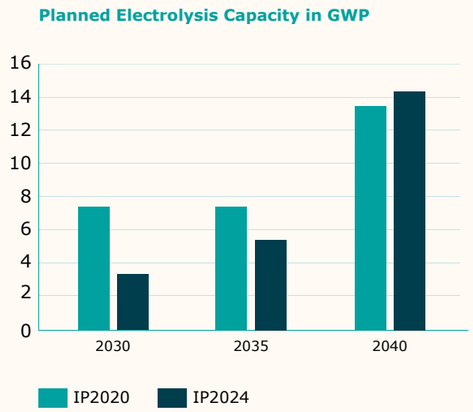


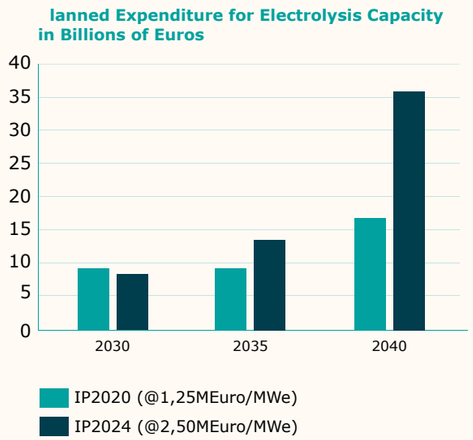
Commissioning of new electrolysis projects IP2024 (in MWe)



While IP2020 primarily focused on large projects that would eventually meet hydrogen needs on an (inter) national scale, IP2024 reveals that over the past few years, a significant number of smaller and more locally oriented projects have emerged, with shorter time horizons. In total, there are 16 projects with a planned electrolysis capacity of over 900 MWe. It is also expected that the hydrogen consumption of these projects will be driven more locally and regionally, and it remains to be seen to what extent these projects will utilize national infrastructure or, for instance, rely more on flexible solutions such as tube trailers or local pipelines and/or storage for transportation.

Short-term delays in plans, but long-term ambitions remain intact. Costs are increasing substantially!





Finally, looking at the development of the plans up to 2040 as described in IP2020 compared to the current plan, we see a clear delay in the short term (at least until 2030) in the left graph. The reasons for this are extensively described elsewhere in this report (e.g., uncertainty, costs), but the long-term ambitions remain intact and have even slightly increased, also taking into account the 16 new production projects included in this report. The translation to costs in the right graph highlights one of the major obstacles. Despite more than halving the planned production capacity up to 2030, costs have barely decreased, primarily because the cost estimates per MWe have doubled, which is likely still on the conservative side (see also Chapter 4.6). Extending this trend to 2035 and 2040 raises significant doubts about whether these plans will ever be realized. Importing low-carbon hydrogen and/or producing blue hydrogen may then become cheaper alternatives.

Each step contributes to the growth of the hydrogen value chain development

2.2 Phase 1: Value chain development of the Northern Netherlands Hydrogen Ecosystem

Since the publication of the IP report in 2020 (IP2020), the Northern Netherlands has made significant strides in developing its hydrogen ecosystem, although not all expectations have been fully met. This first phase was originally planned between 2020 and 2025. The region has established successful innovation hubs and initiated various hydrogen pilot and demonstration projects, such as HydroHub, HyStock, and Ecolution. These initiatives have given a strong boost to the development of the Northern Netherlands hydrogen ecosystem and laid a solid foundation for further expansion.

Updated Status

Between 2020 and 2025, over 35 projects were planned to cover the entire hydrogen value chain. These included demand investments in end-use applications, infrastructure and logistics investments in hydrogen transport and storage, and production investments in offshore wind and hydrogen production capacity. Although these projects have started and some have made progress, the completion and realization of many of these initiatives are still underway, with some facing delays due to various challenges such as financing, technological barriers, or regulatory approvals.

In the mobility sector, for example, where various hydrogen vehicles (including long-distance buses, trucks, ships, and drones) were introduced, along with the necessary hydrogen refueling stations, the practical implementation has not always proceeded as quickly as initially expected. The broader industrial transition from natural gas to green gas and eventually to hydrogen still requires substantial effort and further development.

Regarding infrastructure, IP2020 indicated that the Northern Netherlands hydrogen infrastructure should be completed by 2025, including extensive pipeline networks and storage facilities. Although progress has been made, the completion and operational integration of this infrastructure remain challenging, and the final realization will exceed the original timeline.

The production plans mentioned in IP2020 to install 0.7 GW of offshore wind and 1.25 GW of onshore renewable capacity by 2025 are no longer feasible. The actual installation of these capacities, essential for supporting the anticipated green hydrogen production, is still ongoing and requires continuous attention and investment.

On a positive note, several pilot projects in the built environment (such as Wagenborgen and Hoogeveen) have already started.

These mixed results highlight the complexity and challenges of scaling a sustainable hydrogen ecosystem. While progress in some areas is encouraging, realizing the full potential of the plan requires renewed focus on collaboration, innovation, and, most importantly, patience and persistence. It remains essential for the Northern Netherlands to continue investing in education, research, and development to build the required hydrogen expertise and prepare the region for future successes in a green economy.

IMPLEMENTATION AREAS	ESSENTIAL ACTIONS	2025	>2026
A Hydrogen production, infrastructure, and demand	Accelerating chain development: • Identify priority hydrogen use cases for development before 2025. • Identify cost-effective quick-win use cases that can be implemented in the short term. • Forecast aggregated demand for hydrogen for anticipated use cases that match the supply, and manage hydrogen purchase agreements to make investments less risky. • Encourage more intensive collaboration among all stakeholders within the hydrogen chain, including suppliers, consumers, and logistics partners. • Organize regular networking events and workshops to share best practices and facilitate collaboration.	X	
	Establishing a project pipeline for the Northern Netherlands in the short and long term: • Investigate the challenges and opportunities that the project pipeline will face in the short and long term. • Identify initiatives in the value chain, such as centralizing supply and demand and establishing purchase agreements. • Outline essential areas for realizing planned projects, such as the potential to support regulatory frameworks (e.g., RED III, trading credits, feed-in tariffs).	X	
	Improving transparency: Develop a platform for sharing information on hydrogen supply and demand, including price indications and availability.	X	
	Stimulating long-term contracts: Create a forum for dialogue between green hydrogen producers and potential buyers to explore opportunities for long-term contracts.	X	

IMPLEMENTATION AREAS	ESSENTIAL ACTIONS	2025	>2026
B **Renewable electricity production**	Expand the role of blue hydrogen and ammonia: Launch pilot projects to explore the applications of blue hydrogen and ammonia within the energy transition.	X	X
	Ensure that the scaling up of offshore wind supports the expansion of the entire the Northern Netherlands hydrogen ecosystem, with actions such as: • Developing a minimum feasible timeline for a phased expansion of offshore wind needed to achieve regional hydrogen ambitions by 2030. • Assessing regional electricity grid requirements to determine if the grid needs to be expanded to facilitate the growth of offshore wind. • Evaluating whether hydrogen should be partially produced offshore.	X	
C **The larger hydrogen ecosystem**	Development and implementation of infrastructure: Establish a task force to assess existing infrastructure projects and prioritize the development of new infrastructure. Explore public-private partnerships for the financing and realization of crucial infrastructure projects.	X	
	Implementing Hub-and-Spoke Models: Identify potential hub locations and collaborate with local stakeholders to develop them. Facilitate the establishment of new hubs by providing technical and financial support.	X	

IMPLEMENTATION AREAS	ESSENTIAL ACTIONS	2025	>2026
D **Overall Program Management**	Optimizing government collaboration: • Facilitate streamlined cooperation between local, regional, and national governments to coordinate support for hydrogen projects. Develop a coordinated policy framework that accelerates permit issuance and simplifies subsidy processes.	X	
	HyNorth (independent transformation and coordination office) as the chain manager, with responsibilities such as: • Developing the region's short-term and long-term strategy. • Identifying gaps in the value chain. • Connecting interdependencies within the hydrogen chain.	X	X
	Accelerating knowledge development and retention: • Invest in educational programs and partnerships with technical universities and research institutes. • Establish mentorship programs and internships to develop and retain talent within the sector.	X	

Hydrogen Policy from Local Authorities in the North

The three northern provinces and several municipalities in the Northern Netherlands have outlined the following actions and objectives in their coalition agreements, noting that much local policy is still under development:

Province of Groningen
Groningen is focusing on hydrogen as the key to a sustainable future. The province is investing in hydrogen technology and promoting the development of a hydrogen ecosystem. Additionally, there is an intention to encourage a connection to the HyNetwork for large industrial areas. The goal is to achieve a fully CO2-neutral energy system by 2050.

Hydrogen offers Groningen several benefits:
- Economic opportunities: The hydrogen economy can create new jobs and strengthen the competitive position of the Groningen industry.
- Sustainable energy: Hydrogen is a clean fuel that can replace fossil fuels, significantly reducing CO2 emissions.
- Heating homes: Waste heat from hydrogen production can heat tens of thousands of homes and buildings.

In addition to hydrogen, Groningen focuses on the sustainability of the built environment and industry. Energy savings, alternative heat sources, and circular processes are central. Collaboration with partners is crucial: energy companies, research institutions, and governments work together to realize the energy transition.

Actions:
- Invest in hydrogen technology (electrolyzers, storage systems).
- Develop a hydrogen ecosystem in Eemshaven.
- Promote hydrogen applications in various sectors.
- Sustainability of the built environment (energy savings, alternative heat sources).
- Encourage circular processes in industry.
- Support research and development of new solutions for the energy transition.

Objectives:
- CO2-neutral energy system in Groningen by 2050.
- Stimulate the economy through the hydrogen economy.
- Strengthen the competitive position in sustainable energy.

Province of Drenthe
In the Energy Transition Agenda 'Together Forward,' Drenthe emphasizes: the development of solar and wind energy, energy savings in businesses and industry, a robust energy system with space for hydrogen developments, and energy savings in homes. The province of Drenthe aims to tackle this with determination.

A hydrogen alkaline electrolyzer has also been commissioned at Groningen Airport Eelde to make aviation more sustainable. Additionally, the Energy Hub in Emmen (GZI Next development) will contribute to the CO2 reduction target and accelerate the energy transition in the Emmen region.

Actions:
- Invest in infrastructure and stimulate the production and application of hydrogen.
- Participate in regional initiatives and contribute to European objectives.

Province of Fryslân
Fryslân sees opportunities for hydrogen in the transition to a sustainable energy supply, but the real development of hydrogen in Fryslân is still some time away.
Fryslân collaborates with various partners, such as municipalities, businesses, research institutions, and the provinces of Groningen and Drenthe, to stimulate the hydrogen economy in the region. Together, they aim to develop projects and capitalize on the opportunities that hydrogen offers.

The Northern Netherlands is not acting alone. Nationally, the government continues to invest in innovations and technologies such as green hydrogen and, if necessary, blue hydrogen. The Framework Agreement 2024 is still being developed by the Cabinet.

2.3 Phase 2: Expansion of the Dutch hydrogen ecosystem to Northwest Europe

Since the IP2020 report, the region has made serious efforts to become a central hub for hydrogen production in Northwest Europe. Although major projects have been initiated with the goal of expanding the hydrogen ecosystem by 2030, external factors (COVID-19, the war in Ukraine, etc.) have posed significant obstacles. These challenges have led to delays and revisions of many of the original plans, causing setbacks in the ambition to become a cost-competitive hydrogen production center by 2030.

Updated version
The anticipated increase in addressable hydrogen demand in Northwest Europe from 340 PJ to over 400 PJ by 2030 remains a key objective, but the pathways to achieving this demand have become more complex. The sectors of refining, ammonia production, and iron and steel production continue to be important markets, while new applications such as those in the chemical sector and biofuels are growing more slowly than expected.

The development of the required infrastructure in the Northern Netherlands, which was expected to be completed by 2027, is also experiencing delays. The planning for Hynetwork now indicates that the section of the hydrogen backbone from Eemshaven/Delfzijl to Ommen (with branches to Oude Statenzijl, Veendam/Zuidwending, Emmen, and Vlieghuis) could be operational by late 2027, but the commissioning of HyStock might only take place in 2028.

For the development of the entire hydrogen backbone in the Netherlands, a grant of up to €750 million[6] has been provided.

In terms of production, the challenge to develop significant capacity in green and blue hydrogen by 2030, with the ambition to cover approximately 25% of the hydrogen demand in Northwest Europe, has become more complex due to delays in the installation of the required offshore wind capacity and associated electricity infrastructure.

The financial outlook has also been adjusted, with total planned investments still substantial, but the allocation and timing of these investments are subject to revision as the project pipeline evolves in response to changing market conditions.

Despite these challenges, the Northern Netherlands remains committed to a leading role in the transition to a sustainable hydrogen ecosystem. The region is continuously working on adjusting its strategies and seeking resilient solutions to achieve its goals, while making a significant contribution to reducing CO2 emissions and promoting sustainable energy sources.

[6] https://open.overheid.nl/documenten/ronl-5c57a9ba35fa907dcc805ca0da463dc33b036bb8/pdf

3

Key developments in the Northern Netherlands

3.1 HyNorth and its role in the region

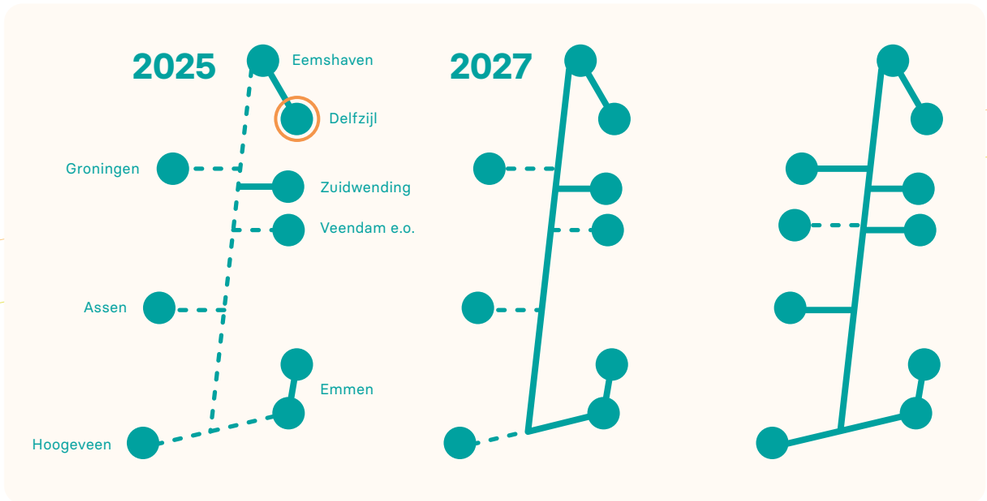
The integrated approach to the value chain
The Northern Netherlands has adopted a systematic approach to creating integrated hydrogen value chains. This approach involves building on integrated ecosystems and a strong 'Triple Helix' of government, industry, and research institutions. Additionally, the recommendation to establish a northern transformation and coordination office has been realized through the creation of the independent foundation HyNorth.

HyNorth
Since its inception, HyNorth has positioned itself as the connector (Connect to Invest) in the transition to a more sustainable energy supply and the development and implementation of hydrogen applications in the Northern Netherlands. The organization has focused on a series of strategic initiatives and milestones that have laid the groundwork for further expansion and innovation.

IP2020 was the catalyst for HyNorth's strategic efforts. This plan emphasized the essential role of low-carbon hydrogen in the energy transition and outlined a future vision for the development of infrastructure and technology. The updated version of this plan includes further details and adjustments addressing the evolving energy market.

HyHub Reports
In implementing its objectives, HyNorth has adopted the so-called Hub & Spoke approach. This means identifying and promoting specific hubs (industry clusters) in the region to actively connect within the hub and, at a later stage, link through the spokes to the regional and national infrastructure.

Hub-and-Spoke Model
Step-by-Step Development of Hydrogen Valley until 2030



For two of these hubs (Delfzijl and Hoogeveen), HyNorth has already published reports that extensively map out the opportunities for regional hydrogen clusters. These reports serve as fundamental studies that not only highlight the feasibility but also the economic benefits of investments in hydrogen infrastructure, proving essential for policymakers, investors, and other stakeholders both within and outside the region.

Growing Involvement (Supported by iTanks)
HyNorth's online presence, particularly on LinkedIn, has experienced rapid growth. With over 800 followers now, the organization has built a vibrant network that regularly shares new insights and knowledge about hydrogen developments. These interactive platforms have helped HyNorth reach a broader audience and increase awareness and support for sustainable hydrogen projects.

Networking Events & Partnerships
The series of Good Morning meetings and other networking events organized by HyNorth have been crucial for strengthening local and regional networks. These events, ranging from small seminars to large promotional days with hundreds of participants, have brought together stakeholders from various sectors. The meetings effectively contribute to knowledge sharing, collaboration stimulation, and deepening the understanding of hydrogen technologies and their applications. HyNorth has also taken the next step to further engage the business community, local governments, and institutions with the launch of various types of partnerships. This lays the foundation for reinforcing HyNorth's role in the coming years.

Future Plans
Looking ahead, HyNorth continues to set ambitious goals. With planned events, such as the HySync meetings focused on deepening knowledge about, among other things, blue hydrogen and grid congestion, HyNorth is well-positioned to expand its impact and accelerate the transition to a sustainable economy.

Since its establishment, HyNorth has not only positioned itself as a key catalyst in the energy transition in the Northern Netherlands but also as an example of how regional initiatives can contribute to national and European sustainability goals. With a solid foundation and a clear vision, the organization remains a key player in the future of sustainable energy.

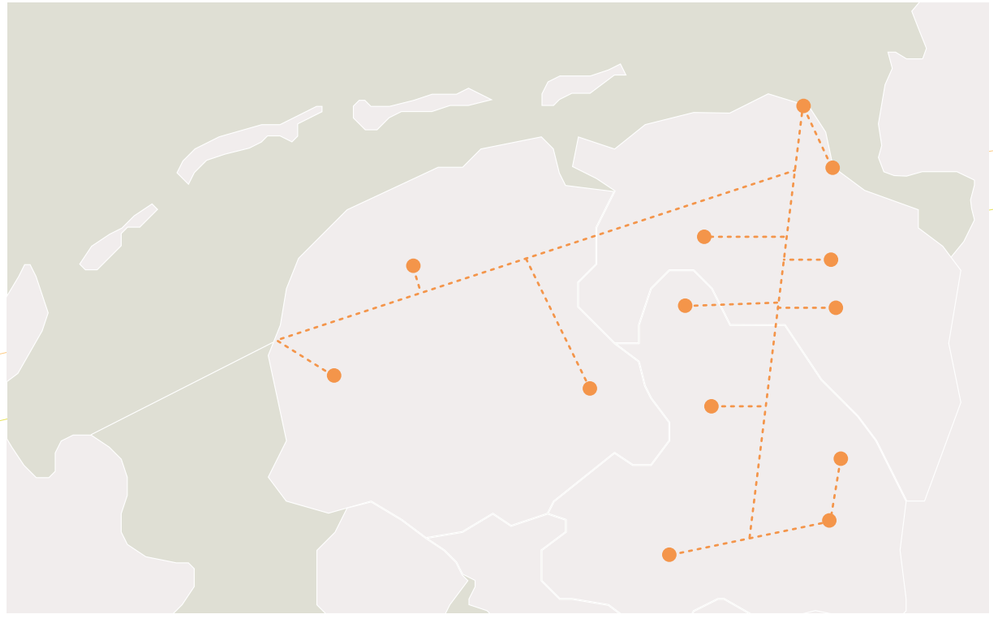
3.2 Hyhybs are pioneers

Step-by-Step Development of Hydrogen Valley Next Generation until 2030

To establish a leading European Hydrogen Valley, the hydrogen chain is being developed using the 'Hub-and-Spoke' model. In the three northern provinces, approximately ten hubs have been identified where the demand and/or supply of hydrogen is being developed.

Phase 1, from now until 2025, focuses on chain development. Key priorities during this period include management, a broad chain approach, and securing financing (both public and private). Phase 2, from 2025 to 2030, is the expansion phase, during which the hydrogen chain will be further developed. This phase requires a national systems approach, large-scale development of demand for (green) hydrogen, and extensive renewable energy from offshore wind.

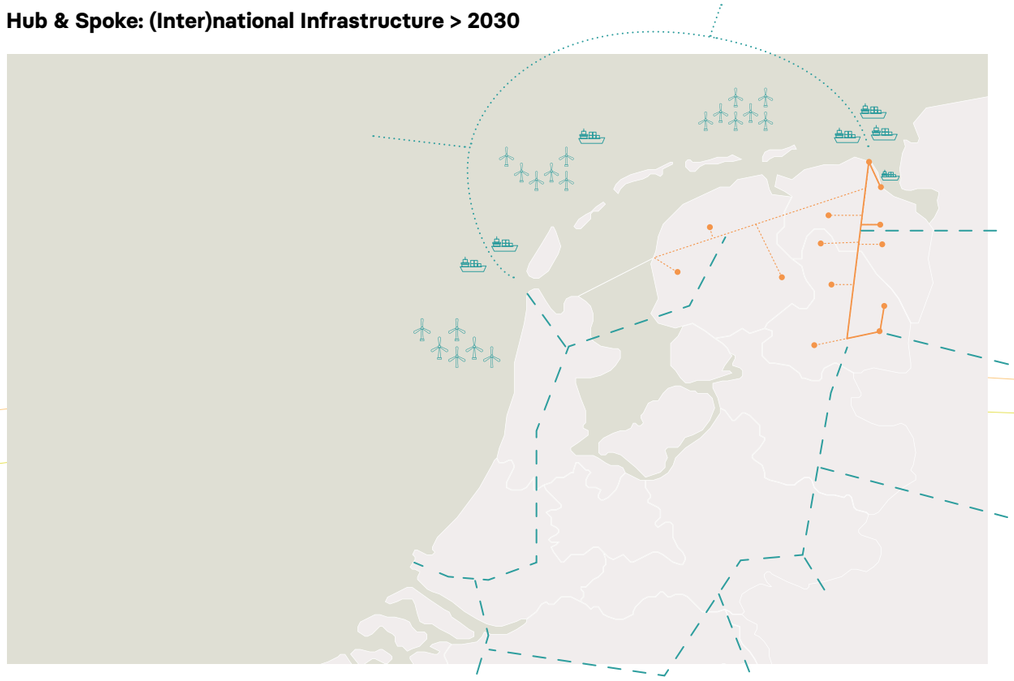
The figure below provides a schematic representation of the various Hyhubs in the Northern Netherlands where hydrogen could play a role. In each of these hubs, there is either supply of or demand for hydrogen, but the hubs are not yet physically connected through pipelines at this stage. There is rarely a hydrogen balance in the hubs, meaning that at any given time there is not equal supply and demand. Surpluses and shortages must therefore be found elsewhere. Currently, due to limited quantities, this is done via tube trailers. The dashed lines in the figure indicate possible future connections. Examples include Hoogeveen, Delfzijl, Bolsward, Wagenborgen, Veendam and surroundings, and Emmen. Additionally, there are initiatives and examples in mobility, logistics, refueling stations, and shipping, with well-known names such as Resato and Holthausen. Education is also consolidating efforts in cities like Leeuwarden, Groningen, and Emmen.



- Since 2020, Hyhubs have emerged in Hoogeveen, Delfzijl, Bolsward, Veendam and surrounding areas, and Emmen.
- Additionally, there are many initiatives and examples in the areas of mobility and logistics, such as GAE, OV Bureau Groningen/Drenthe, refueling stations, and shipping.
- Various SMEs leading the way are based in the region, including Resato, Holthausen, and others.
- Education is consolidating its efforts (see the Groenvermogen report).

From the end of 2027, a section of the hydrogen backbone will be ready for use. This will enable the hubs in Eemshaven, Delfzijl, Veendam, and Emmen to be connected. The gas storage facility at Hystock near Zuidwending (expected in 2028) can also be linked to the hydrogen backbone, as well as connections with Germany and other parts of the Netherlands. The schematic overview below illustrates this.

Hub & Spoke: (Inter)national Infrastructure > 2030



- However, national infrastructure (such as Hynetwerk and Hystock) is still lacking, and the necessary Final Investment Decisions (FID) have not yet been made.
- Additionally, connections to other regions and countries, as well as import possibilities, still need to be established.

Many developments are taking place in the Eemshaven, largely in the field of hydrogen production. The hydrogen is produced from green electricity, from natural gas combined with CCS (blue hydrogen), and also through hydrogen imports, potentially in the form of ammonia. The map below lists the projects, along with their initiators and logistics services.

Overview Hyhub Eemshaven

Overview of parties that are already established in Eemshaven or have announced their plans to do so, and are relevant for building a hydrogen chain.

FACTS & FIGURES

- **Number of Projects: 14**
- **Planned Capacity: 13.3 GW**
- **Estimated Investment Amount: €33 billion (based on €2.5 million per MW capacity)**
- **Employment: 2,820 FTE per year (until 2030)**
- **CO2 Reduction: 1,250 kt/year until 2030 (based on produced green H2 per year)**

The figure below provides a schematic overview of companies that are (or will be) consuming hydrogen and companies that are (or will be) producing hydrogen. The figure is sourced from the Hyhub report for Delfzijl, which was published a year ago. These are significant investments with a major impact on the attractiveness of Delfzijl as a location for green industry, and they also have a substantial effect on employment and greenhouse gas reduction.

In Delfzijl, hydrogen is primarily used as a raw material rather than a fuel. As more producers establish themselves in Delfzijl and their market is also located there, additional local infrastructure will need to be developed.

Overview Hyhub Delfzijl

An overview of parties that are already established in Delfzijl or have announced their plans to do so, and are relevant for building a hydrogen chain.

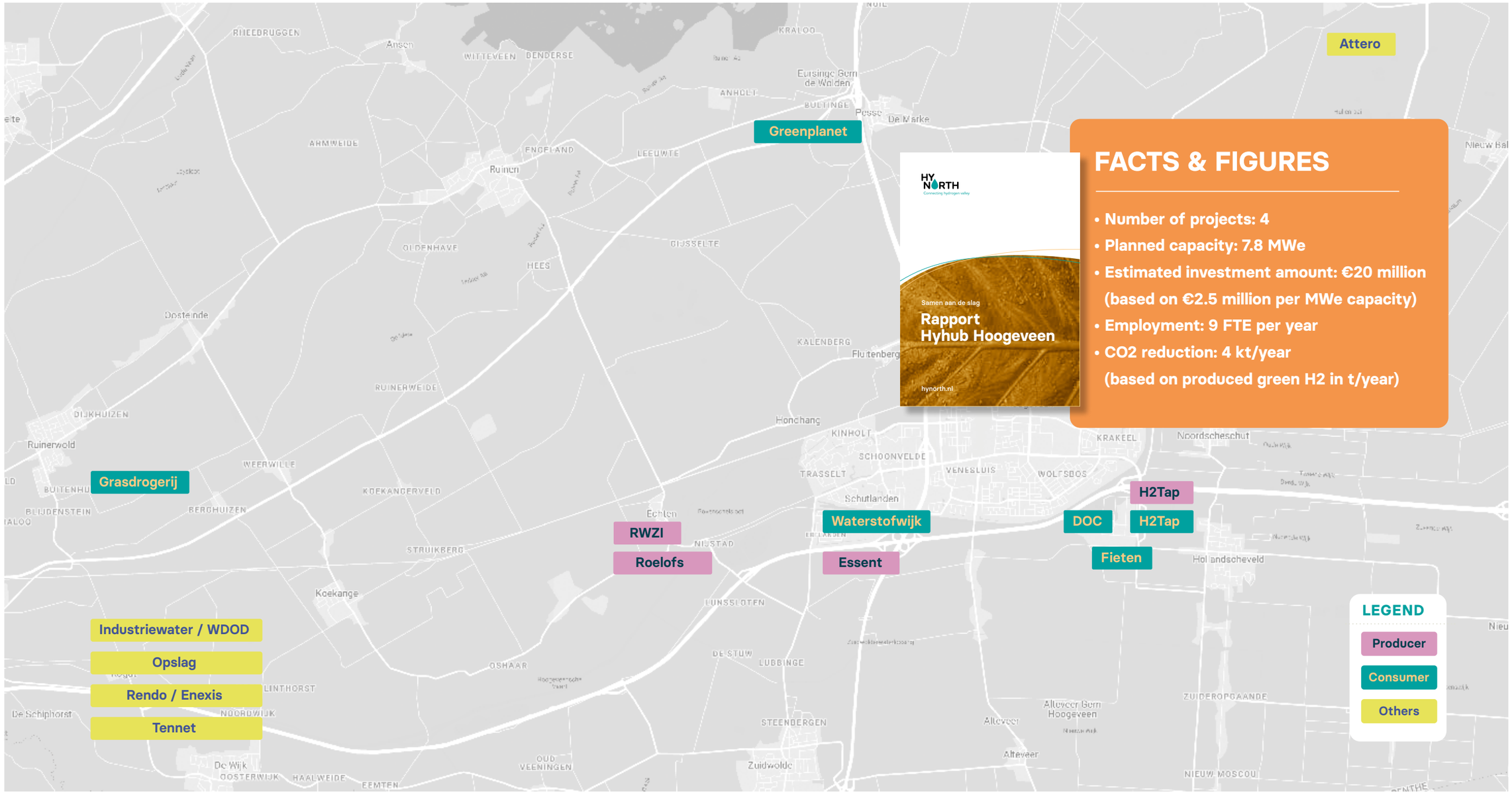
FACTS & FIGURES

- **Number of projects: 16**
- **Planned capacity: 470 MWe**
- **Estimated investment amount: €1.2 billion (based on €2.5 million per MWe capacity)**
- **Employment: 550 full-time equivalents per year**
- **CO2 reduction: 245 kt/year (based on produced green H2 in tons/year)**

Just as for Delfzijl, a Hyhub report for Hoogeveen was also published a year ago.
The figure below is taken from this report.

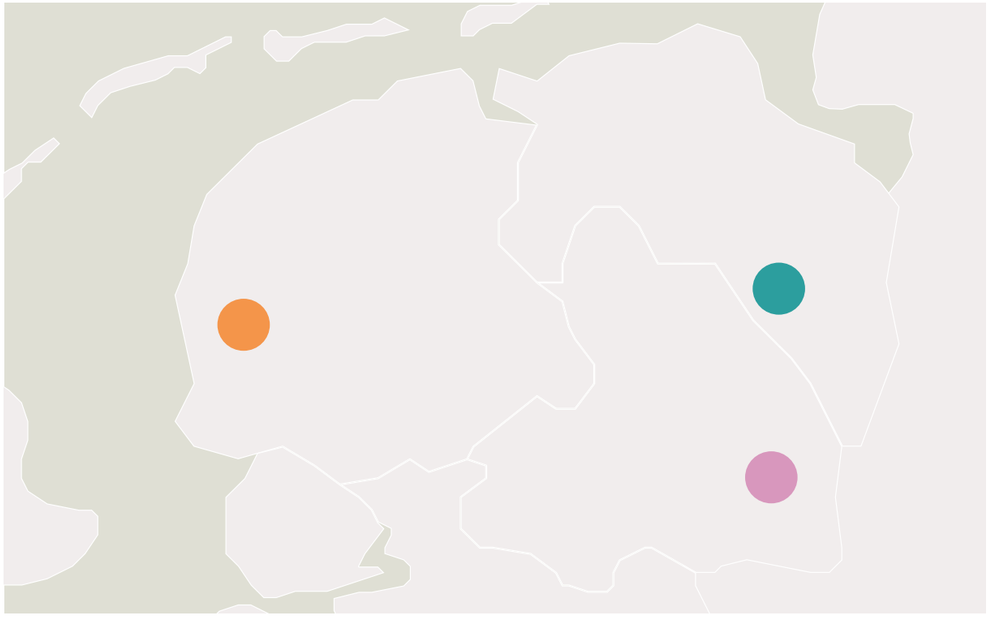
Overview Hyhub Hoogeveen

Overview of parties that are already established in Hoogeveen or have announced plans to do so, and are relevant for building a hydrogen chain.



The current Hyhub developments in the Northern Netherlands are illustrated in the figure below:

- Industry Cluster East & Central Groningen: This is a collaboration of 11 highly diverse energy-intensive companies in the region, working together to achieve their sustainability goals. As Cluster 6, these companies span various sectors, including food, chemicals, glass, brick, and paper/packaging. It is expected that this cluster will be connected to the national hydrogen network.
- Energy City Bolsward: Located in the municipality of Sudwest-Fryslân, this hub features a regional hydrogen production facility with a capacity of 25 MW, a distribution pipeline in Bolsward serving industrial customers, and plans for a future connection to the national hydrogen network.
- The third hub depicted is Emmen: This is a collaboration between the municipality of Emmen, the province of Drenthe, GETEC, Shell, Gasunie, EBN, Engie, and the New Energy Coalition. It is also anticipated that this cluster will be connected to the national hydrogen network.



HyHub Industry Cluster East & Central Groningen (Veendam and surrounding area)
A collaboration of 11 highly diverse energy-intensive companies in the region, working together to achieve their sustainability goals.

As Cluster 6, these companies span 5 sectors: food, chemicals, glass, brick, and paper/packaging.

This cluster will be connected to the national network.

HyHub Energy City Bolsward
Regional hydrogen production (25 MW) in Bolsward, with a distribution pipeline in Bolsward serving industrial customers and beyond. In the future, there will be a connection to the national hydrogen network.

HyHub Emmen and surrounding area
Energy hub: Collaboration between the municipality of Emmen, the province of Drenthe, Shell, GETEC Services, Gasunie, EBN, Engie, and the New Energy Coalition.

The Emmen region will be connected to the national network.

The importance of logistics for the hydrogen market
A market only emerges when demand and supply can be brought together. A producer will only make an investment decision once a buyer for the product has been found. Similarly, a buyer will only make an investment decision once a producer has been identified. Thus, producer and buyer need to find each other, and the agreement will include terms regarding the place and time of delivery. Effective logistics are necessary to ensure the timely and precise delivery. Transportation (place of delivery) can be carried out with tube trailers for limited quantities, but as volumes increase, pipeline transport becomes more economical. Timely delivery will require greater effort when hydrogen is produced from green electricity. Future conditions will be further tightened by RED regulations: hydrogen cannot be produced at all times. Buffering or storing hydrogen is a means to meet the buyer's need for hydrogen at any desired moment. Alternatively, blue hydrogen, which is more controllable in production, can be used. In any case, logistics are essential.

In the Northern Netherlands, various parties are active to take on the role of logistics, either with new assets or existing assets (currently used for natural gas) for hydrogen. The following overview lists parties that could play a role. Some parties, in addition to their logistical function, are also end users.

Here is an overview of parties active in the Northern Netherlands in the fields of mobility, transport, storage, and logistics/infrastructure.

ENEXIS
Green Planet today for tomorrow
GRONINGEN SEAPORTS
HOLTHAUSEN CLEAN TECHNOLOGY
HYNETWORK SERVICES
hystock power to hydrogen
Liander
NAM
NGT Treatment, Transport and Transition of Gas.
NorthGrid
CLEAN FUELS
DUURZAAM DICHTBIJ RENDO
Resato Hydrogen Technology
VERMILION ENERGY

3.3 Subsidy successes for the Northern Netherlands

3.3.1 Four Projects in the Northern Netherlands Receive Largest Share of OWE Subsidy

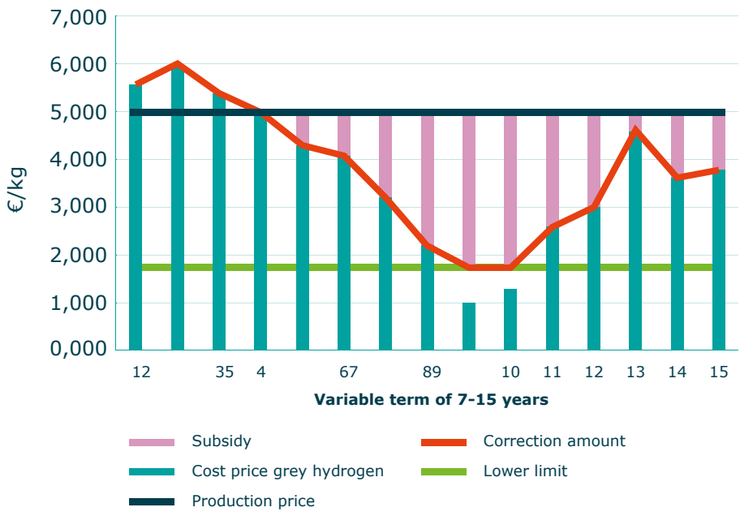
On April 29, 2024, the Dutch government announced that nearly €250 million in subsidies has been awarded through the OWE scheme[7] ('Subsidy Scheme for Scaling Up Fully Renewable Hydrogen Production via Electrolysis') to seven projects, including four in the Northern Netherlands. In the region, these projects are: H2 Hollandia (Nieuw Buinen), Groengas Asset (Groningen), RWE Eemshydrogen (Eemshaven) and VoltH2 (Delfzijl). Together, these projects account for 91 out of the 101 MW of allocated electrolysis capacity.

The OWE scheme was established by the Dutch government in 2023 to bridge the cost gap between renewable and fossil hydrogen ('the unprofitable top') for a period of at least seven to a maximum of fifteen years. Projects must be completed within four years, with the possibility of a one-year extension.

Based on the 101 MW capacity and the €250 million amount, the average subsidy per MW was €2.5 million. The most expensive project to receive a subsidy was €3.2 million/MW.

After the summer of 2024, a new round of the OWE scheme will take place, with €997.2 million available under more flexible conditions.

Example of the operation of the OWE Subsidy, exploitation component



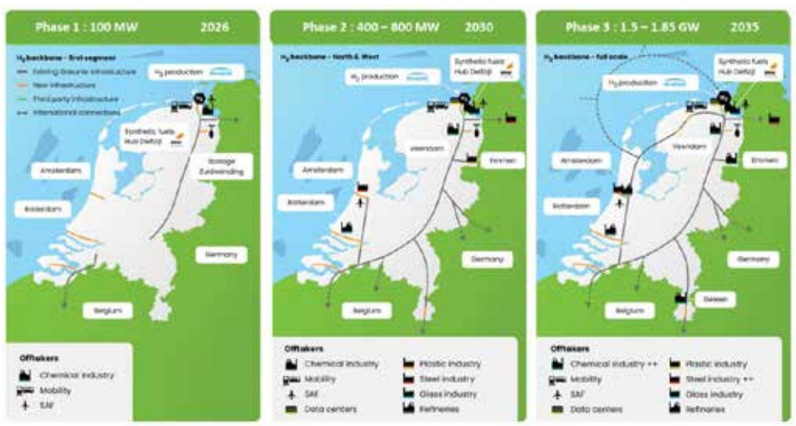
[7] https://www.rvo.nl/subsidies-financiering/owe

3.3.2 IPCEI Grant in the Northern Netherlands to the HyNetherlands Project

IPCEI (Important Project of Common European Interest) Hydrogen was established in 2020 as a tool to aggregate national projects into a single European-scale project. Waves 1 and 2 focused on technology and industry, resulting in December 2022 in the allocation of €783.5 million in subsidies to seven electrolyzer projects in the Netherlands, including HyNetherlands. Waves 3 (Import & Storage) and 4 (Mobility and Transport) are currently underway, with results expected soon.

The HyNetherlands project by ENGIE is a unique initiative where all elements necessary for developing a hydrogen ecosystem in the Northern Netherlands come together. The coastal region offers an abundance of offshore wind energy. There is existing infrastructure aimed at reuse, and the development of the Dutch hydrogen network (Hynetwork) is currently advanced; there is an extensive network of hydrogen pipelines across the Netherlands and beyond. A large underground storage facility (HyStock) is also part of the infrastructure. HyNetherlands will create new jobs and provide retraining for local personnel currently working in the gas industry to acquire skills and techniques related to hydrogen.

HyNetherlands, located at the Eemscentrale site in Eemshaven, was one of the seven projects that received a grant under the IPCEI program in 2023. It was the only project based in the Northern Netherlands. Initially, it involves a 100 MW electrolyzer, powered by a 200 MW offshore wind farm. There are plans to expand this to eventually 1.85 GW by 2035. The CO2 savings in phase 1 are expected to be 140 kt per year.



3.4 Future Position of the Hydrogen Ecosystem in the Northern Netherlands

On the path to a hydrogen-driven future, the Northern Netherlands is on the brink of a transformation with the potential to drastically reshape the energy landscape. The developments and ambitious plans for hydrogen production reveal dynamic progress, with projects collectively encompassing several gigawatts of production capacity. With the goal of achieving this scale in the next five to ten years, a clear roadmap has been outlined for the region to supply about 7% of the current hydrogen demand in the Netherlands, equating to approximately 100 kilotons.

Infrastructure as the Growth Hub
The development extends beyond production alone; infrastructure is a crucial link in the energy supply chain. With new energy streams emerging, the presence of a comprehensive infrastructure for transport and storage is a fundamental component of regional growth. This includes the future storage of hydrogen in Zuidwending, existing waterways, and the realized EemsEnergy-Terminal.

Dual-Track Approach: Aligning Supply and Demand
The future hydrogen value chain faces many challenges, where both the development of demand and supply are critical, with infrastructure as the connecting factor. It requires a coordinated approach to investments and commitment across the entire chain, overcoming the notorious chicken-and-egg situation.

- Track 1: Stimulating Hydrogen Use
  Stimulating hydrogen demand is essential, but projects that lead to a transition from natural gas to sustainable energy carriers are still scarce. The challenges of gradual transition, adjustments in existing processes, and hydrogen supply certainty are recognized and addressed.
- Track 2: Building Hydrogen Supply
  Parallel to demand development, increasing hydrogen supply is equally important. A phased development of production capacity is crucial, as well as integration into the future national hydrogen network and storage facilities. This requires significant investments and long-term investment security.

Future Direction and Action Points
To ensure a future hydrogen ecosystem in the Northern Netherlands, the following points are crucial:

1. Realistic Growth Path:
   A pragmatic growth path must be developed to facilitate the transition to hydrogen as an energy carrier, including the use of transition fuels such as blue hydrogen.

2. Support for System Functions:
   Processes with essential system functions should be exempt from high network costs, possibly through geographical or full exemptions.

3. Operational Subsidies:
   In addition to investment subsidies, the importance of operational subsidies in the startup phase cannot be underestimated, to bridge the gap between grey and low-carbon hydrogen.

4. Acceleration of Infrastructure Development:
   The realization of robust electricity and hydrogen infrastructure must be accelerated to expand the production and market early on.

5. Reduction of Implementation Bottlenecks:
   Practical bottlenecks must be addressed, from realizing mixing connections to facilitating permitting processes.

With these strategic insights and actions, the Northern Netherlands can further develop its hydrogen ecosystem, strengthening its role as a key player in the energy transition.

3.5 Trailblazer National Program Groningen: Hydrogen as a power source for Groningen

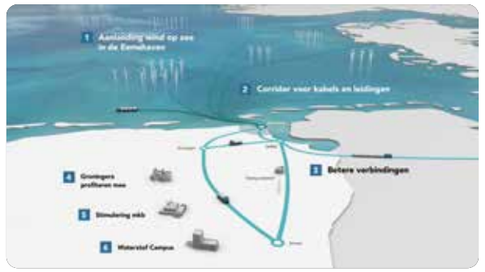
The National Program Groningen (NPG) Trailblazer aims to enhance the broad prosperity indicator for Groningen and the Northern Netherlands. At the request of the National Program Groningen, HyNorth sought to identify additional opportunities to advance hydrogen projects that could further elevate Groningen. The plan, called H2(Voor) Sprong, builds upon the existing Investment Plan Hydrogen the Northern Netherlands 2024. Through the H2(Voor)Sprong program, HyNorth intends to engage both the minds and hearts of the people of Groningen. Hydrogen should not only provide good jobs but also introduce a 'Leisure element'. Hydrogen serves as a means to generate more prosperity and as a tool to enhance the region's reputation, image, and branding as a place to live.

HyNorth has presented six ideas to the NPG: two related to work and education, two addressing broader societal goals, and the last two falling into the Leisure/branding category. In the initial phase, the NPG aims to support the projects presented by HyNorth through organization and feasibility studies, risk analyses, and impact assessments, which will take place in 2024. From 2025 to 2029, projects that show positive outcomes in feasibility studies and analyses can then be implemented. For a description of the 6 H2(Voor)Sprong projects, please refer to Appendix C.

nationaal programma groningen

3.6 New energy for Groningen

With the end of the natural gas era in Groningen, businesses, research institutions, and government bodies have been preparing for some time for a new sustainable economic future for the region. To realize this perspective, a comprehensive plan has been developed consisting of the following points. This plan is currently being further elaborated for the social and economic agenda.



4

Challenges and opportunities

Positive trend despite headwinds
The headwinds of the past few years have, despite the challenges, also presented opportunities within the hydrogen sector in the Northern Netherlands. Although the sector has faced some delays, there is a growing awareness of the need for accelerated action and collaboration in supply chain development.

Governments are showing an increasing willingness to collaborate and are providing support that is becoming more coherent and targeted. Initiatives in places like Bolsward, Emmen, and the Hyhubs in Delfzijl and Hoogeveen illustrate how regional hubs can act as catalysts for the sector by facilitating cooperation between public and private entities. The approach to permits and subsidies is being streamlined to accelerate developments.

Attention to knowledge development within the sector is receiving a boost, with educational institutions and companies working together on innovative solutions. This not only helps retain knowledge within the region but also attracts new talents. The discussion around the role of blue hydrogen and ammonia is seen as an opportunity to diversify the energy landscape, with examples of projects emerging.

4.1 Challenges summarized

The main challenges we currently face are summarized below:

- Investment under Current Market Conditions: Investing is difficult under the current market conditions. Green hydrogen is still too expensive and not competitive, leading to delays in investment decisions (see also 4.4).
- Industry Needs Access to Affordable and Reliable Sustainable Energy: The industry requires access to affordable and reliable sustainable energy.
- Increased Attention Needed for Grid Congestion: More focus is needed on grid congestion (see also 4.5), transportation costs, and water (see also 4.6).
- Offshore Wind Development Delays: Offshore wind development is slowing down, while long-term Power Purchase Agreements (PPAs) are crucial for the production of green hydrogen.
- Surplus of Green Hydrogen Supply: There is currently a surplus of green hydrogen supply compared to demand. Demand and supply need to be better aligned.
- Local Approach vs. National Infrastructure Development: The local approach with Hyhubs is working well, but there is a gap with national infrastructure development. Additionally, although very likely, Final Investment Decisions (FIDs) for national infrastructure are still pending.
- Need for a Range of Instruments for FID Trajectories: A range of instruments is needed to collectively undertake FID trajectories (e.g., the newly announced NPG subsidy, a regional H2Global scheme, FEED stimulation, and other incentive measures).
- Increased Collaboration Required: More collaborative efforts are needed to realize the supply chain, despite its inherent complexity.

4.2 Clear opportunities for the Northern Netherlands

The commitment of frontrunners in the region and the development of hub-and-spoke models highlight the Northern Netherlands' potential as a leading force in the hydrogen ecosystem. By turning challenges into opportunities, the region is on the brink of an energy transition that can be both economically and ecologically sustainable and successful.

The key opportunities we see are:

- The pipeline of projects in development within our Hydrogen Valley Next Generation is expanding from over 50 to over 80.
- The region's long-term ambitions and willingness to invest remain intact despite uncertainties and short-term delays.
- The IP2024 ambitions of 3 GW of electrolysis capacity by 2030 and 14 GW by 2040 substantially contribute to national and European goals. Although the planned investment amount until 2030 has slightly decreased from €9 billion to €8 billion, it is expected to grow rapidly in the following years.
- In addition to domestic production of green hydrogen, there should be a significant focus on importing ammonia and producing blue hydrogen (via Eemshaven & Delfzijl).
- The regional value development through HyHubs is progressing well and needs to align with (inter) national infrastructure and storage in the coming years.
- The advantageous location of the three northern provinces offers ample opportunities in the coming years with the upcoming national transport network in the region and hydrogen storage in Zuidwending. There is tremendous potential for offshore wind to be brought onshore, import and storage opportunities via seaports, substantial plans for electrolyzers with outlets far beyond the region, and the presence and development of extensive energy expertise in the region.
- Businesses in the Northern Netherlands (e.g., Resato, Holthausen Clean Technology, Fieten, Roelofs, Getec, Nedmag, and many others) are deeply involved and fully committed to the opportunities presented by the hydrogen transition. This deserves full support from government agencies.
- Groningen Airport Eelde is actively positioning itself as the first Hydrogen Valley Airport in Europe under the name NXT Airport, focusing on sustainability, innovation, education, and green energy.
- HyNorth is fully committed to crucial chain management and collaboration to leverage all these opportunities for the Northern Netherlands.

4.3 Action agenda 2024 - 2025

	CHALLENGES	ACTIONS
Hydrogen Production & Demand	Currently, there is much more supply than demand.	Stimulating the growth of hydrogen demand.
	There is still a need to better match supply and demand, but transparency often remains lacking.	The publication of this report aims to contribute to this. Additionally, various platforms are being developed to connect demand and supply (e.g., H2opper in Delfzijl, HNS, Lhyfe, and the European Hydrogen Bank).
	Uncertainty about the price of green hydrogen is a major obstacle for business cases and Final Investment Decisions (FID) (long-term contracts are not yet possible).	Temporary government support, such as guarantees or operational subsidies, is needed.
	Uncertainty in demand and supply makes FID difficult.	A range of tools is required to support joint FID processes (e.g., new NPG subsidies, regional H2Global schemes, FEED stimulation, and other incentives).
Hydrogen transport & storage	Crucial infrastructure is still missing in many cases, and FIDs on national infrastructure and storage are still pending. Until planned FIDs later in 2024, producers are unlikely to make FIDs.	Waiting for decisions from Hynetwork and Hystock.
	Uncertainty about the role of distribution (public or private) within the chain.	Collaboration between the national grid operator Hynetwork and local and/or regional network operators needs to be worked out (purity, pressure, balancing).
	Balancing and storage are crucial because the production profile of green electricity is much more variable than the consumption profile (baseload demand). Addressing this imbalance in the system is often underestimated.	Importing ammonia and producing blue hydrogen can help with supply and balancing, so efforts should be directed there as well.
	Purity of hydrogen is a critical factor for transport via the national backbone, but the applicable minimum standard is still uncertain. When a minimum purity of 98% is applied, it may be insufficient for many industrial and mobility applications.	There is an ongoing European discussion to raise this percentage, which will help in the right direction. Quick clarification is desired. Finding more local solutions (matching demand and supply) will help mitigate this problem.
	Consider reusing existing pipelines (see 4.7).	Actively engage and connect with key parties involved in these processes.

	CHALLENGES	ACTIONS
Offshore wind capacity	Access to (offshore) green electricity is essential, but offshore wind development is lagging, while long-term PPAs are crucial for green hydrogen.	Accelerate the development of offshore wind (with landing in Eemshaven) for hydrogen. In 2023, a tender for offshore hydrogen production was already announced[8].
Regulations	Permitting issues, including for above-ground storage, are problematic. Strict regulations apply to above-ground storage over 5000 kg according to the BRZO (Major Accidents Risks Decree). This limit is reached after only a few hours of hydrogen production.	Organize a permitting table and engage with authorities to identify and resolve bottlenecks. Request that authorities appoint a single contact point per Hyhub.
	Regulations and legislation for hydrogen are still under development, and no unified, tested regulations (ACM) are yet in place. This creates uncertainty for taking FID (Final Investment Decision).	Ensure supportive regulatory frameworks.
Preconditions	Access to (industrial) water and other utilities is not guaranteed but is crucial for electrolysis. More attention is needed for grid congestion, transportation costs, and water.	See sections 4.5 – 4.6 for details.
	There is insufficient prioritization by companies for training, staffing, and knowledge.	Advocate for greater attention from organizations like New Energy Coalition and Entrance that can influence the human capital agenda. Also refer to the recent report GroenvermogenNL.
	If FIDs are delayed too long, there is a risk of losing expertise.	Encourage companies to recognize the necessity of "working together" and structure subsidy conditions to make collaboration within the chain a requirement.
	Access to (confidential) information remains challenging. Sensitive business information cannot always be shared publicly.	Local chain coordinators can play a key role in developing and coordinating local plans.
	Greater internal collaboration is needed to realize the chain, despite its complexity.	Work together.

[8] https://www.rvo.nl/onderwerpen/waterstof/interessepeiling-waterstofproductie-op-zee

4.4 The cost of green hydrogen rises significantly further

In the very recent TNO study (Evolution of the levelised cost of Hydrogen based on the proposed electrolyser projects in the Netherlands, 13/5/249)[9], the cost for green hydrogen produced in the Netherlands at a project size of 100MWe – 200MWe is estimated to be in the range of €12 - €14 per kg H2. This estimate includes the costs of H2 transport, storage, and purification, which are assumed to be minimal unless there is underuse or overcapacity of the new hydrogen network, which could lead to rate increases. The recent changes in the EU Renewable Energy Directive (REDIII)[10] have been taken into account.

The mentioned range of €12 - €14 per kg H2 is significantly higher than the range of €6 - €10 per kg reported in the Hyhub Delfzijl report from April 2023.

The increase is primarily due to rising costs for transport (e.g., e-transport costs have not only risen sharply in recent years but are also substantially higher than in neighboring countries, as shown by a recently published study by E-Bridge[11]), costs of green electricity, labor, and financing.

Elsewhere in the report, we mention the increased investment costs for electrolyzers compared to IP2020 (for subsidies). We observed a doubling in assumptions from €1.25 million/MWe to €2.50 million/MWe. Based on the TNO report mentioned above, this assumption may even be on the cautious side.

The recent awarding of OWE subsidies to the 7 projects, including RWE and VoltH2 projects in Eemshaven and Delfzijl, also provides a cost indication for the construction of electrolyzer capacity at the upper end of the range used in this report.

Overall, this means that for the further development of the hydrogen ecosystem, it is crucial to achieve significant cost advantages in the short term due to scaling and gaining experience with more small-scale projects. This should lead to increasingly competitive supply chains and further standardization in terms of design, components, and systems. The import of low-carbon hydrogen (whether using a hydrogen carrier LOHC or ammonia) or the production of blue hydrogen are becoming more prominent as alternatives.

4.5 Hydrogen and grid congestion

Grid congestion typically refers to a shortage of transport capacity in the electricity grid. In recent years, with increasing electrification in the market and growing input of sustainable electricity from solar and wind, this has become a significant issue. This does not mean that there is a shortage of electricity production at certain times; rather, it means that the electricity cannot be transported.

When there is excessive input, temporary electricity storage or conversion to another energy carrier at the point of congestion can offer a solution. Conversely, when there is high demand, temporary storage or conversion from another energy carrier at the point of congestion might be a solution. It is crucial to choose the location carefully.

Conversion to/from hydrogen can be a solution that should be weighed against alternatives. In this evaluation, the costs of conversion, the storage of hydrogen, and the proximity of hydrogen transport (via pipelines) play a role.

4.6 Hydrogen and water

For the production of green hydrogen, the availability of ultra-pure water is essential. This water can be produced from drinking water, but this might limit its large-scale availability. Currently, there are also trials where seawater is treated. In the Netherlands, hydrogen can also be produced from industrial and wastewater, but this will only slightly increase the cost of green hydrogen. See also the recent white paper from CEW.

In addition to hydrogen production in the electrolyzer, oxygen is also produced, which can potentially be utilized.

[9] https://www.tweedekamer.nl/kamerstukken/brieven_regering/detail?id=2024Z09368&did=2024D22078

[10] https://energy.ec.europa.eu/topics/renewable-energy/renewable-energy-directive-targets-and-rules/renewable-energy-directive_en

[11] https://www.rijksoverheid.nl/documenten/rapporten/2024/04/03/e-bridge-report-electricity-cost-assessment-for-large-industry-in-the-netherlands-belgium-germany-and-france-full-report

[12] https://www.cew.nl/white-paper-grootschalige-groene-waterstofproductie-water-als-motor-voor-duurzame-regionale-ontwikkeling/

5

Collaborations

Mission H2 Supports HyNorth with the interactive Waterstofkaart.nl

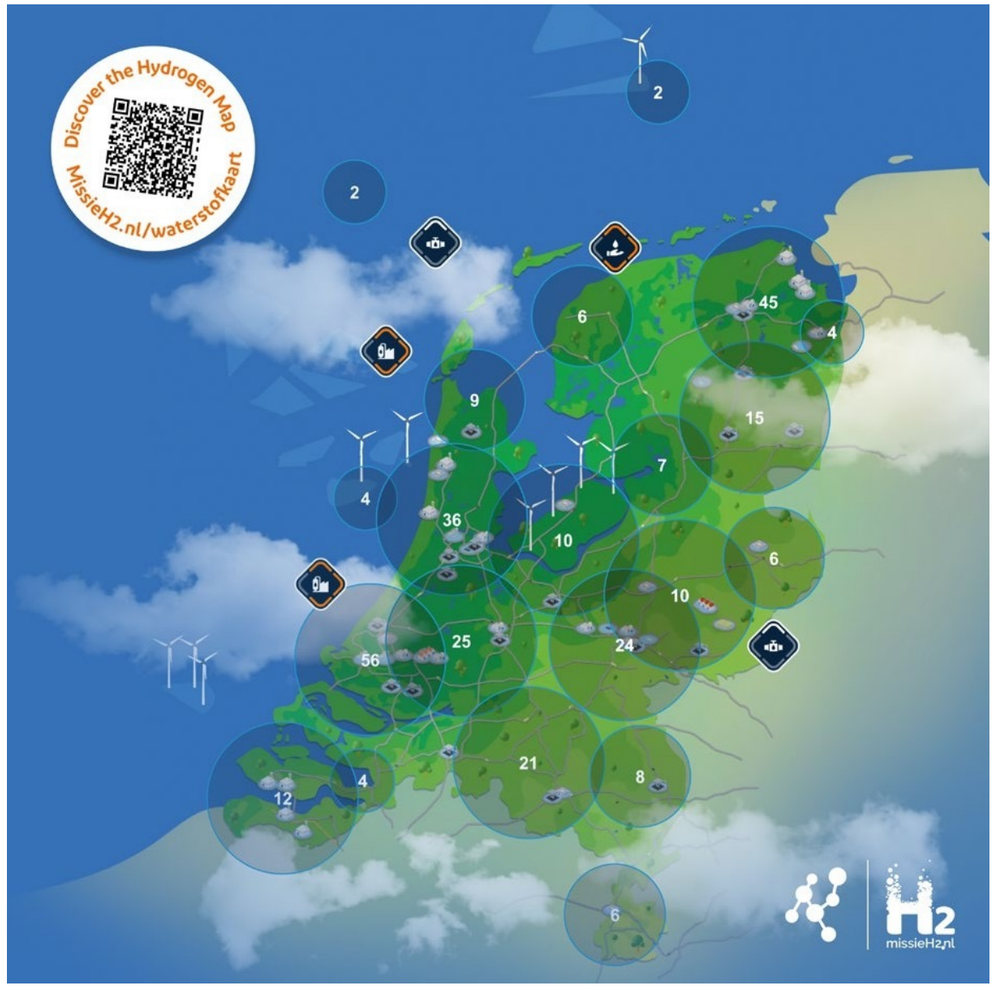
Mission H2 is an initiative by a consortium of Dutch companies aimed at promoting hydrogen development and increasing awareness about the topic. For this research, we have received support from Mission H2.

The hydrogen map, developed by Mission H2 in collaboration with TKI Nieuw Gas, features the most comprehensive and up-to-date map of the Netherlands, showcasing the numerous existing hydrogen initiatives. Additionally, the interactive map provides the unique opportunity to view the development of the Netherlands as the Hydrogen Country 2030 over time.

Scan the QR code below to:

- Discover all projects across the entire hydrogen value chain in the Northern Netherlands and beyond;
- View the current status of each project;
- See how the Netherlands will look as a hydrogen country in 2030; or
- Conduct further research.

Place yourself on the map and register your project at waterstofkaart.missieh2.nl.



6

Appendices

Appendix A: Glossary

BEGRIP	BETEKENIS
ACM	Autoriteit Consument en Markt
ATR	Autothermal Reforming
BRZO	Besluit Risico's Zware Ongevallen
EPC	Engineering Procurement Construction
EZK	(Ministerie van) Economische Zaken en Klimaat
FID	Final Investment Decision
GSP	Groningen Seaports
HNS	Hynetwork Services
IenW	(Ministerie van) Infrastructuur en Waterstaat
JTF	Just Transition Fund
Min.Fin	Ministerie van Financiën
NNL	Noord-Nederland
NOM	Investerings- en Ontwikkelingsmaatschappij voor Noord-Nederland
NPG	Nationaal Programma Groningen
PAS	Programma Aanpak Stikstof
PBV	Project BV
PPA	Power Purchase Agreement
REDIII	Renewable Energy Directive 3
RFO	Ready for Operation
RVO	Rijksdienst voor Ondernemend Nederland
SLA	Service Level Agreement
SMR	Steam Methane Reforming
SNN	Samenwerkingsverband Noord-Nederland
TCO	Transformation & Coordination Office
TRL	Technology Readiness Level
WRR	Wetenschappelijk Raad voor het Regeringsbeleid

Appendix B:
List of hydrogen projects Northern Netherlands 2024

This list was compiled based on individual conversations, emails, or other forms of contact with all the initiators of the projects listed below. Where information is missing from the list, this is due to confidentiality, non-applicable, or unavailable information. All information has been verified with public sources where possible.

	COMPANY NAME	PROJECT	PROVINCE	CAPACITY MWE	PROJECT PHASE	OPERATIONAL	HYHUB
PRODUCTION	Industriecoalitie	Battolyser-pilotinstallatie	Groningen	0,02	Operational		Eemshaven
	Shell, EBN, NEC	EMMHY/Energiehub GZI-Next	Drenthe	4,50	Investment decision	2027	Emmen
	HyCC	Djewels	Groningen	20,00	Investment decision	2027	Delfzijl
	HyCC	H2eron	Groningen	50,00	Concept	2028	Delfzijl
	RWE	Eemshydrogen	Groningen	50,00	Investment decision	2027	Eemshaven
	Engie (afnemers o.a. OCI Methanol, EEW)	HyNetherlands fase 1	Groningen	100,00	Investment decision	2026	Eemshaven
	Engie	HyNetherlands fase 2	Groningen	750,00	Concept	2030	Eemshaven
	Engie	HyNetherlands fase 3	Groningen	1.000,00	Concept	2032	Eemshaven
	D4	Ontwikkelen productie E-methanol	Groningen		Concept	RFO 4Q2029, FID 4Q2026	Delfzijl
	RWE	Energiecentrale Magnum op waterstof fase 1	Groningen		Concept	2028	Eemshaven
	RWE	Energiecentrale Magnum op waterstof fase 2	Groningen		Concept	na 2030	Eemshaven
	SkyNRG	SkyNRG	Groningen		Investment decision	2028	Delfzijl
	Equinor	H2M Eemshaven	Groningen	1.000,00	Investment decision	2029	Eemshaven
	Eneco, Equinor, RWE en Shell Nederland ism Groningen Seaports, Prov Groningen en Gasunie	NortH2 fase 1	Groningen	1.000,00	Concept	2032	Eemshaven
	Eneco, Equinor, RWE en Shell Nederland ism Groningen Seaports, Prov Groningen en Gasunie	NortH2 fase 2	Groningen	3.000,00	Concept	2036	Eemshaven
	Eneco, Equinor, RWE en Shell Nederland ism Groningen Seaports, Prov Groningen en Gasunie	NortH2 fase 3	Groningen	6.000,00	Concept	2040	Eemshaven
	Getec park Emmen	GETEC park	Drenthe	5,00	Concept		Emmen
	Nobian	Nobian (bestaande productie)	Groningen	23,00	Operational		Delfzijl
	Vattenfall	Energiepark Eemshaven-West	Groningen	100,00	Concept	2029	Eemshaven
	Groenleven /Alliander	Sinnenwetterstof	Friesland	1,40	Operational	heden	Friesland
	Novar	H2 Hollandia	Drenthe	5,00	Investment decision	2025	Other
	Lhyfe	LHYFE waterstoffabriek	Groningen	200,00	Investment decision	2028	Delfzijl
	Nederlandse Waterstof Maatschappij ism Provincie Groningen, Friesland Campina, Xintc, Rabobank	H2-Agri Stadskanaal	Groningen	1,20	Concept	2026	IC OG
	VoltH2	VoltH2 - Delfzijl	Groningen	50,00	Investment decision	2027	Delfzijl
	Torrgas	Hycarb	Groningen	100,00	Concept	2028	Delfzijl
	Groningen Airport Eelde ism Groenleven	GRQ Hydrogen Valley Airport	Drenthe	5,00	Concept	2030	Logistics
	Eurus Energy Europe	Oosterhorn Hydrogen	Groningen	20,00	Investment decision	2026	Delfzijl
	WDODelta	RWZI Echten	Drenthe	2,50	Concept	2026	Hoogeveen
	Hydronex (Roelofs)	Energiehub Eeserwold	Drenthe	5,00	Concept	2027	Hoogeveen
	Gemeente SWF	Energiestad Bolsward	Friesland	25,00	Concept	2027	Friesland
	Eures Energy Europe (Toyota Electric Power) met Nedmag als belangrijke afnemer	Eurus Energy Veendam	Groningen	20,00	Investment decision	2025	IC OG
	Getec met Nedmag als belangrijke afnemer	Getec Veendam ism Groenleven	Groningen	20,00	Concept	2026	IC OG
	RWE	Oranjewind electrolyser (OWEL)	Groningen	350,00	Concept	2028	Eemshaven
LOGISTICS	Hynetwork	Waterstof Netwerk Nederland (backbone)	Noord-Nederland		Concept		Logistics
	Hynetwork	Waterstof backbone RIB Noord (detaillering NNL)	Noord-Nederland		Investment decision	Q4 2027	Logistics
	Hystock	demo project Hystock-Nederland	Noord-Nederland	1,00	Operational	2019	Logistics
	Hystock	Hystock 1e caverne	Noord-Nederland		Concept	2028	Logistics
	Hystock	Hystock cavernes 2, 3 en 4	Noord-Nederland		Concept	na 2030	Logistics
	Shell en Greenplanet	Tankstation Green Planet / Shell	Drenthe		Operational		Hoogeveen
	Resato	Ontwikkelt waterstof tankstations	Drenthe				Logistics
	Groningen Seaports	H2Kickstarter / distributienetten	Groningen		Concept		Delfzijl
	H2Tap	H2TAP	Noord-Nederland		Concept	>2030	Logistics

new project in IP2024

new project in IP2024

	COMPANY NAME	PROJECT	PROVINCE	CAPACITY MWE	PROJECT PHASE	OPERA-TIONAL	HYHUB
LOGISTICS	HyFly	HyFly Waterstofdrone	Friesland		Realisation	2025	Logistics
	provincie Groningen, RWE, ENGIE, Groningen Seaports	H2 Kickstarter	Groningen				Delfzijl
	NGT (Neptune)	NoordGasTransport (NGT)	Groningen		Concept		Eemshaven
	Baringa, ENTRANCE, Kikkersadvies, SINZ, Net-Zero-NL	H2opper	Groningen		Concept	2026	Delfzijl
DEMAND	Holthausen	Tankstation Holthausen Energy Point Groningen	Groningen	2,50	Operational		Groningen
	Stichting Wadduurzaam	H2 Ecolution	Groningen		Operational		Other
	Gemeente Hoogeveen	Waterstofwijk Hoogeveen	Drenthe	0,34	Investment decision	eerste woningen september 2024	Hoogeveen
	Holthausen Clean Technology	Fabriek voor brandstof-cellen en waterstof voertuigen Holthausen Clean Technology	Groningen		Operational		Groningen
	Hyzon	Handelsmaatschappij voor waterstoftrucks	Groningen		Concept		Groningen
	OV-bureau Groningen Drenthe, Qbuzz	20 Bussen OV-bureau Groningen Drenthe	Groningen		Operational		Groningen
	NPRC, Nouryon, HyEnergy, Transstore, Lenten Scheepvaart	Weva	Groningen		Operational		Delfzijl
	Provincie Groningen	Waterstoftreinen Arriva	Groningen		Investment decision	2026/ 2027	Groningen
	NES	Bijmenging waterstof in gasnet Ameland	Friesland		Operational		Friesland
	Corre Energy	CAES - energieopslag met perslucht	Groningen	320,00	Concept	2029	Logistics
	WaterstofNet	REVIVE Groningen	Groningen		Operational		Groningen
	OV Bureau Groningen Drenthe	HRS busstalling Peizerweg, Groningen	Groningen		Operational		Groningen
	Orange Gas	Orange Gas Clean Fuels Assen	Drenthe		Operational	2023	Logistics
	OV-Bureau Groningen Drenthe icm Qbuzz	10 waterstofbussen Emmen	Drenthe		Operational		Emmen
	OV-Bureau Groningen Drenthe icm Qbuzz	HRS Emmen	Drenthe		Operational		Emmen
	FME	Green shipping Waddenzee	Groningen / Friesland		Realisation	2030	Logistics
	Koninklijke Oosterhof Holman	GWW Waterstof	Groningen	0,10	Realisation	>2030	Groningen
	Verborg group	Eerste fase bestaat uit Realisation van de bio raffinage activiteiten	Groningen		Concept		Delfzijl
	NorthC	Noodstroom op waterstof voor datacenter	Groningen	0,50	Operational	heden	Groningen

	COMPANY NAME	PROJECT	PROVINCE	CAPACITY MWE	PROJECT PHASE	OPERA-TIONAL	HYHUB
DEMAND	Van Dam Shipping	LH2 Vessel	Groningen		Investment decision	>2026	Logistics
	Groningen Airport Eelde	WAviatER	Drenthe	0,01	Realisation	heden	Logistics
	Gemeente Groningen	REVIVE Noordenveld	Drenthe		Operational		Groningen
	woonstichting Groninger Huis	Waterstofwijk Wagen-borgen	Groningen		Realisation	2025	Groningen
	Holthausen Clean Technology	Waterstoftruck Baas Blijham	Groningen		Realisation	2026	Groningen
	Groningen Airport Eelde ism Holthausen Clean Technology	Waterstof Ground Power Unit	Drenthe		Operational		Logistics
	Groningen Airport Eelde	TotalEnergies Groningen Airport Eelde	Drenthe		Investment decision	2026	Logistics
	Groningen Airport Eelde	NXT Airport	Drenthe		Operational		Logistics
	Het Nieuwe Ambt	Het Nieuwe Ambt op waterstof	Groningen		Concept	2026	Other
	Fieten	Fieten Nieuw-Amsterdam	Drenthe		Concept	2030	Logistics
	Fieten	Fieten Hoogeveen-Oost	Drenthe		Concept	2030	Logistics
	Fieten	Fieten Beilen	Drenthe		Concept	2030	Logistics
	Impact Hydrogen	HyCooker	Groningen		Investment decision	2025	Groningen
	Net Zero Hydrogen	Net Zero Hydrogen	Groningen		Concept		Delfzijl
	Rechteind Hydrogen	Rechteind hydrogen	Friesland		Concept	2026	Friesland
	OV-Bureau Groningen Drenthe icm Qbuzz	8-persoons M1 OV bus <3500 kg op waterstof	Groningen		Realisation	2024	Logistics
KNOWLEDGE	ISPT Hydrohub Inno-vation Program & partners	Hydrohub	Groningen		Operational		Other
	Gasunie, provincie Drenthe, provincie Groningen, Groningen Seaports, partners	HyNorth	Noord-Ne-derland		Operational		Other
	Entrance	EnTranCe	Groningen		Operational		Other
	REDstack	Blue energy Afsluitdijk	Friesland		Operational		Other

new project in IP2024

Appendix C: National Program Groningen Hydrogen as a driving force for Groningen

The Nationaal Programma Groningen (NPG) Breakthrough aims to enhance the broad welfare indicator for Groningen and the Northern Netherlands. At the request of the Nationaal Programma Groningen, HyNorth has been exploring ways to add value to hydrogen projects, aiming for Groningen to make an additional breakthrough.
In the first phase, NPG intends to support the projects presented by HyNorth with organization, feasibility studies, risk analyses, and impact assessments. This support will be provided in 2024. From 2025 to 2029, the following six projects, which are expected to be positive based on feasibility studies and analyses, can be undertaken.

H2(Voor)Sprong 1: Jules Verne Academy
The Jules Verne Academy, the Harvard for energy education. It is unquestionable that a completely new sector like hydrogen will create jobs. For workers in Groningen to benefit, appropriate training and experience are required. Therefore, HyNorth proposes an upskilling and training program focused on hydrogen, green chemistry, and other green gases due to their strong connection with hydrogen.

With Rijksuniversiteit and Hanzehogeschool as leading institutions, HyNorth proposes the establishment of an institute that should become the Harvard of energy. A promising start has already been made with the creation of the Wubbo Ockels School of Energy and Climate. The Jules Verne Academy seeks to enhance the field of education. At these academies for top talent, for example, housed in the architecturally impressive Gasunie building, international top scientists collaborate, scholarships are available for international top talent, summer courses at the highest level are offered, and research projects on hydrogen are initiated. Why Jules Verne Academy? Because he predicted in 1874 that hydrogen might become extremely important for humanity.

Status: The study for the Jules Verne Academy, in collaboration with Hydrogen Valley Campus Europe, has been described and submitted to NPG under the HVCEB concept (linking education/training/knowledge development with employment).

H2(Voor)Sprong 2: H2Carroussel
H2Carroussel, learn-work programs for aspiring hydrogen specialists. This initiative also focuses on work and training related to hydrogen. H2Carroussel is a program aimed at (vocational) mbo, hbo, and academic-trained employees who want to retrain or upskill to become hydrogen specialists through school-work pathways set up by companies and educational institutions.

The H2Carroussel aims to ensure that there are enough hands available in the region to carry out the work in numerous hydrogen projects. Additionally, an attractive range of work-learn programs can help retain (international) students in the region. H2Carroussel plans to start with 25 SMEs, growing to approximately 200.

Status: No budget available yet.

H2(Voor)Sprong 3: IederZ'NdeelH2
IederZ'NdeelH2, hydrogen revenues for all Groningen residents. Every resident of Groningen can become a free member of this energy cooperative. The cooperative will have access to one or two empty salt caverns where hydrogen will be stored. The rental income from the storage in the caverns and the markups on hydrogen sold outside the provinces will be for the cooperative. This income can be used to fund social, sustainable, or cultural projects in the province.

Status: A request for a feasibility study by HyNorth has been prepared and is awaiting approval from NPG.

H2(Voor)Sprong 4: H2GRO-Fund
H2GRO-Fund, a fund to stimulate innovative hydrogen projects. The hydrogen innovation fund H2GRO-Fund provides vouchers to stimulate regional startups and innovative investment projects for product development. The fund focuses on the medium term of 5 to 10 years. H2GRO-Fund supports the innovation process. There is a clear link with the Jules Verne Academy and H2Carroussel. HyNorth sees the Campus Eemsdelta Groningen as a suitable location to establish the fund's management office. Over time, income from returns or patents and royalties can sustain the fund.

Status: No budget available yet.

H2(Voor)Sprong 5: MgH2 Hill
MgH2 Hill, hydrogen production, recreation, and education. Inspired by the highly successful project Copenhill in Copenhagen (www.copenhill.dk), the planned hydrogen production site near Veendam could be combined with an artificial hill for skiing, mountain biking, hiking, climbing, and other recreational activities. Potential additional features could include a magnesium wellness center and a hydrogen knowledge and visitor center. The combination of sports, knowledge, and wellness could attract approximately 50,000 visitors per year. Additionally, a training and education center focusing on energy could also find a suitable place there.

Status: No budget available yet.

H2(Voor)Sprong 6: XperienceH2
XperienceH2, an experience center in the Eemshaven. XperienceH2 is a multi-experience center that not only highlights hydrogen but also the economic and ecological development of the Eemsdelta, the Wadden Sea, and the River Ems. Exhibitions on (hydrogen) technology and ecology will showcase how the region is evolving economically and ecologically. In addition to its tourist function, the experience center will also provide space for office and meeting locations, as well as lecture halls for businesses and educational institutions.

Status: No budget available yet.

Appendix D: Sources

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Disclaimer

This report is the result of research into the challenges of establishing a hydrogen ecosystem in the region.
The report contains only information that was gathered with consent through interviews or is publicly available.
The images in the report are, to the best of our knowledge, free of copyright.
The information is up to date as of May 1, 2024.
We thank all parties who contributed to this research and appreciate their time and effort.

Investment Plan for Hydrogen in the
Northern Netherlands, June 2024

Partners HyNorth

nationaal programma groningen

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