



Green PowerNL HCA Roadmap Region Northwest.

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Roadmap Northwest Region



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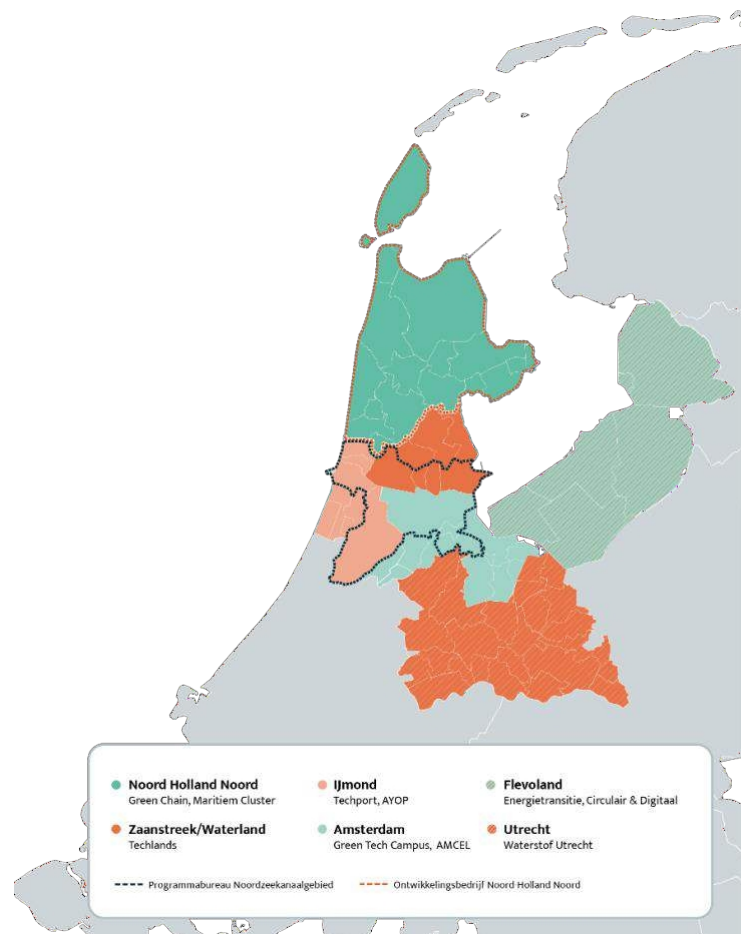
Acronyms List

	HC= Human Capital
	HCA-GVNL= Human Capital Agenda GroenvermogenNL - pillar 4 of
NGF GVNL HIP=	High Impact PPP
	LLO= Lifelong Development
	LOHCs= Liquid Organic Hydrogen
Carriers MRA=	Metropolitan Region of Amsterdam
	NGF= National Growth Fund
	P&D= Pilots & Demos
	PPP= Public Private Partnership
	RC= regional campus
	RES= Regional Energy Strategy
	R&D= Research & Development
	RWC= Regional Work Center
	SPT= Service Point Engineering.
	MRA= Metropolitan Region of Amsterdam
	NZKG= North Sea Canal Area: MRA port area - from Amsterdam to the IJmond.
NHN=	North Holland North

Management summary

In 2023, the province of North Holland was awarded European Hydrogen Valley Status, the Flevoland Hydrogen Valley (FLHY) platform was established in Flevoland, and the province of Utrecht concluded the "Waterstof Utrecht" covenant. Region North-West is characterized by ambitions across the full breadth of the hydrogen chain: from green hydrogen production at sea or on land, import, storage and transit of green hydrogen in the port of Amsterdam, hydrogen as a raw material for the steel industry and as an energy carrier for the Zaan industry, heavy transport and mobility, air traffic, agricultural applications and electricity production. The region will be connected to the hydrogen backbone.

This broad ambition also creates a broad and extensive demand for human capital. Estimates range from 10 to 16,000 additional people per year to realize the sustainability and greening of the region over the next decade. With the Manifesto Working and Developing 2030, an important movement is underway in North Holland from 2020 to work together to create a resilient technical and technological labor market. Pivotal in the implementation are regional High Impact PPPs and for the hydrogen transition, the program office Noordzeekanaalgebied, the development company Noord-Holland Noord, in Flevoland FLHY and in Utrecht the parties affiliated with the covenant Waterstof Utrecht play an important role. This roadmap describes six regional clusters of (High Impact) PPPs, each with its own substantive focus.



From these regional clusters, a large number of transition initiatives are underway: R&D projects, Pilots and Demos, learning communities, lab facilities, education modules, campuses, etc.. You can read more details in chapters 1, 3 and the appendices. The ambition of program HCA GroenvermogenNL is to work together with these regional clusters and transition initiatives towards a responsive infrastructure for working, innovating and learning for the hydrogen and energy transition. Program HCA GroenvermogenNL and the regional liaisons appointed from the program fulfill a connecting, driving and, where necessary, directing role, also establishing the connection and substantive elaboration and cooperation with the national program components: the hydrogen knowledge platform, the teacher professionalization program, modules and profiles, and Make Hydrogen Work. These program components are explained in Chapter 3: deepening cooperation.

Shortening time-to-job as the "highest impact" sets the course for the activities and operationalization described in Chapter 3. Activities aimed at deepening collaboration and developing a responsive infrastructure for working, innovating and learning.

Deepening collaboration

Initiate and supervise hands-on design research for educational concepts and other pilot elements of the envisioned responsive infrastructure based on transition initiatives in Northwest region.

Facilitate meeting and connecting regional initiatives with national initiatives from HCA GVNL and initiatives from other GVNL regions. Consider connecting Learning Communities with the same content focus or exchanging educational materials.

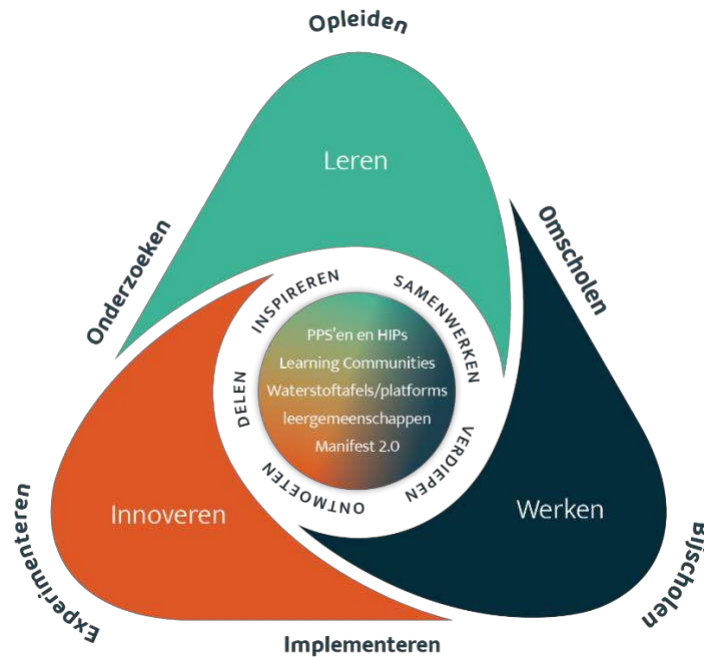
Ensure the interconnection and coordination between transition initiatives in the region to achieve a coherent approach between the various investment programs. Among other things by writing a position paper commissioned by the regional directors of MBO and HBO.

Ensure the connection, exchange, cross-pollination and collaboration between regional transition initiatives and the national elements of the Green PowerNL program.

The liaison team is working with representatives of the identified regional clusters and the three provinces toward an outline of activities and outcomes for a regional infrastructure. This outline forms the input for the sandpit process envisioned in the next phase of HCA-GVNL.

WIL: Working, Innovating, Learning

Learning communities, PPPs, Platforms and tables, and learning communities are vehicles to connect working, innovating and learning. The next phase will look at, among other things, how e.g. learning communities in the North West region contribute to fulfilling the human capital agenda and how effective the learning community approach is for that purpose.



Existing test and lab facilities we want to match training modules for both full-time education and LLO offerings. This will include exploring the possibility of sharing facilities and establishing an optimal lab infrastructure for hydrogen education in the region.

The ambition is to collaborate with the other regional liaisons and regions to develop and test educational offers for vocational and skills profiles required for the hydrogen transition. The collaboration should ensure alignment on content, avoid duplication in development of educational offerings and accessibility of educational offerings for everyone who wants to be trained to fulfill a role in the hydrogen transition.

The liaison team Northwest region also provides a region representative for the national coordinating team on teacher professionalism.

Along the knowledge and innovation table and the hydrogen table of the North Sea Canal Area and the hydrogen platforms of Utrecht and Flevoland, connections are being sought with R&D packages and learning communities to bring newly developed knowledge to education as quickly as possible.

The activities from chapter three and the development of skills- and competency-oriented training and recruiting lead to an increase in:

- Offering training and education modules for the hydrogen transition
- Number of participants in training and education offerings: from students in initial education to professionals and lateral entrants.
- Number of companies participating in learning communities, PPPs and HIPs.

National HCA Green PowerNL

The Netherlands, along with the rest of the world, faces an immense climate challenge. The fossil-based society and industry must be converted. The Netherlands does this with green hydrogen, the "green power". GroenvermogenNL is the program for this green power with which the Netherlands wants to make industry more sustainable and build an attractive business climate that goes hand in hand with contributing to the climate goals. With an integrated approach, GroenvermogenNL ensures a powerful national innovation ecosystem for hydrogen production and applications.

This ecosystem is partly already in place and includes companies and knowledge institutions involved in the energy, chemical and manufacturing sectors. The aim is to make better use of the knowledge and skills through smart solutions, thus realizing and accelerating the hydrogen transition. GroenvermogenNL believes it can achieve this by having companies and knowledge institutions in the aforementioned sectors work together strategically on common goals within four specific pillars. To strengthen the ecosystem and bring the Netherlands into the European leading group, the following pillars have been defined:

1. Research & Development; TRL-wide innovation program, encouraging both short-term applied research (see also Pilots and Demos pillars) and long-term fundamental research.
2. Pilot projects; the realization of pilot hydrogen projects on a smaller scale and small demonstrations.
3. Demonstration projects; the realization of hydrogen projects on a serious scale
4. Human Capital Agenda, sufficient well-trained people and active regions able to mobilize human capital.

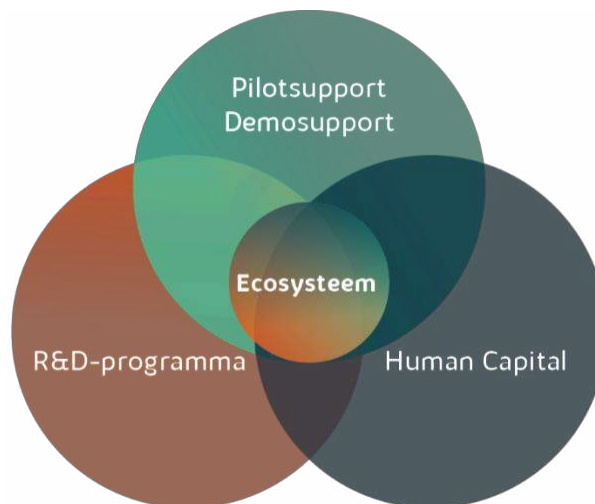


Figure 1.1: Coherence of program lines Green PowerNL.

Pillar 4, the Human Capital Agenda (HCA), is, as articulated in the core document 'Bridge to the Future', the 'enabler' for the ambitious activities regarding the production and transport, storage & transshipment of hydrogen and the application of hydrogen in industry, mobility & transport and the built environment.' Prerequisite for success of these ambitious activities is:

"the adequate availability of professionals with knowledge and skills of hydrogen and its application."

This requires that new and necessary knowledge be made readily available both in mainstream education and for the education and training of professionals already working or wanting to work in the hydrogen transition. It also states that "more attention must be paid in education and training to learning to innovate and renew as a basic competency. Given the task, these programs will need to be able to operate with scale. They will need to be agile in content and design, because of the rapid developments in hydrogen." The HCA GroenvermogenNL consists of several work streams that together should lead to the realization of the above condition. This is clearly shown in Figure 0.2.

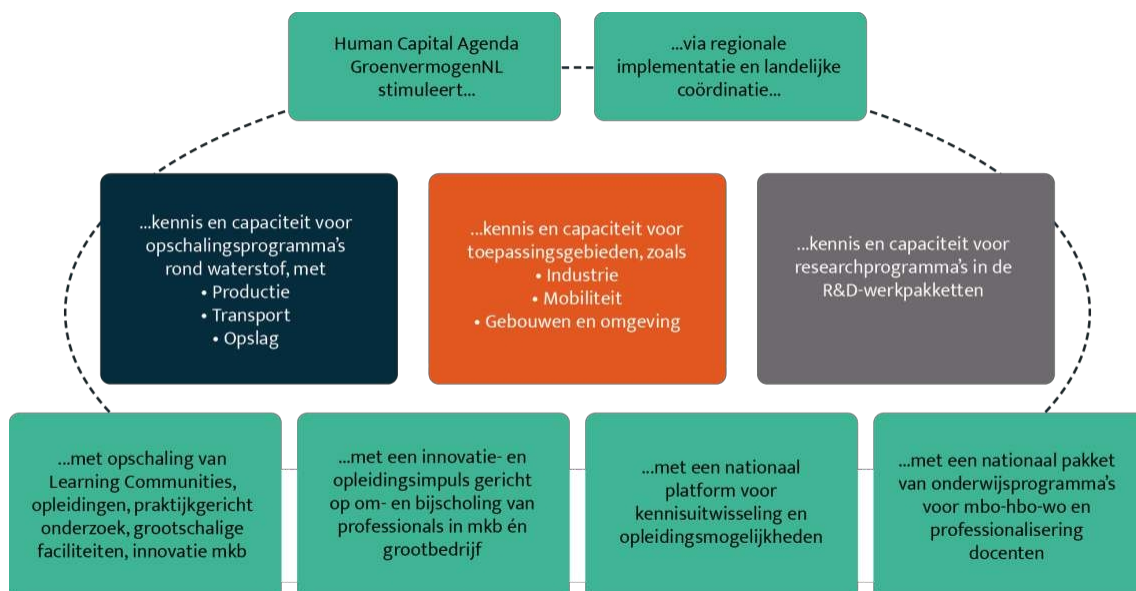


Figure 1.2: Overview "Realizing sufficient HCA for hydrogen transition" © HCA-GVNL.

Specifically, HCA GroenvermogenNL identifies five related work streams:

1. Knowledge areas mapped.
2. Realizing and scaling up Learning Communities and Mobilizing Regions.
3. National Knowledge Platform knowledge exchange and training opportunities.
4. National Package of Educational Programs Hydrogen.
5. Innovation impulse SME and training impulse business.

For the realization of these work streams, a period of four years is foreseen with a start-up year within it, falling under the Regieorgaan SIA scheme "Regional Liaisons and Learning Communities 2022," in which the following three core activities were carried out:

Workstream 2: Realizing and scaling up Learning Communities and Mobilizing Regions.

- Appointment of regional liaisons and development of regional roadmaps.
- Develop and implement start-up activities for scaling up learning communities.

Workstream 3: National Knowledge Platform, knowledge exchange and training opportunities

- The realization of a National Hydrogen Knowledge Platform.

The present document concerns the outcome of Work Stream 2 on mobilizing the North-West region: a roadmap for the Human Capital Agenda in the provinces of North Holland, Flevoland and Utrecht.



1. Reconnaissance environment

1.1 The existing ecosystem

Major ambitions and challenges with regard to HCA GroenvermogenNL are emerging in the North-West region: from Den Helder, the Kop van Noord-Holland, the North Sea Canal area, the Port of Amsterdam to the Zaanstreek, Schiphol, the metropolitan region of Amsterdam, province of Flevoland and Utrecht. This chapter describes the existing ecosystem.

The liaison team of North-West region held discussions with most of the parties described in this chapter. The listed parties were involved in the process of arriving at this roadmap for the Human Capital Agenda Green PowerNL (HCA-GVNL) region Northwest. The description of the current ecosystem has been divided into six clusters within region Northwest. These clusters were chosen based on local partnerships. For the most part, the clusters focus on one or more links of the hydrogen chain. However, there is also overlap and start-up cooperation between clusters. Within each cluster, the triple helix involved includes: 1. knowledge and educational institutions, 2. governments and 3. industry. In addition, relevant local collaborations and learning communities are described for each cluster. These collaborations and (learning) communities are an important link in the process to achieve the implementation of the regional roadmap.

Central players in the North-West region are the Province of North Holland, Province of Flevoland, Province of Utrecht, the North Sea Canal Area Program Office and the North Holland North Development Company. Underlying the development of this roadmap for HCA-GVNL are the following initiatives by these parties:

- The Manifesto Working and Developing 2030 and North Holland InZicht.
- Attack Plan Labor Market Shortages Engineering, Construction and Energy.
- Green and Digital Jobs Action Plan.
- The award of European Hydrogen Valley status North Holland.
- Memorandum of understanding platform "Flevoland Hydrogen Valley".
- Hydrogen Covenant Utrecht

1.1.1 Manifesto Working and Developing 2030

In 2020, the provinces of North Holland and Flevoland, the Amsterdam Metropolitan Region and the House of Skills program took the initiative for a joint Human Capital Agenda Climate Challenge. At that time, Flevoland Province, together with the municipalities of Almere, Lelystad and Zeewolde, made an inventory of focus areas on which efforts should be made. Then, in early 2021, in co-creation with more than 160 boosters from business, education and government, the Manifesto Working and Developing 2030 was compiled. This manifesto aims to "work together on a resilient technical and technological labor market for a sustainable and green North Holland" and focuses on the HCA for the climate challenge (energy transition and circular economy) and digitalization.

Work is being done in development coalitions on:

- Improving the [innovative power](#) of business and education.
- engineering promotion and [increasing entry and advancement](#)
- [Lifelong Development](#) and Sustainable Employability.
- Promoting labor mobility "[from work to work](#)".
- [Inclusiveness](#).
- A [working ecosystem and campus formation](#).

The manifesto takes as its starting point the September 2020 SEO study examining the impact of investments in energy transition and sustainability on the labor market in North Holland and Flevoland. A new SEO research has recently taken place. From this the following quote:

"The expected investments in North Holland in the period 2020-2030 amount to up to €3.6 bln per year; in Flevoland up to a maximum of €244 million per year. Investment amounts are compiled based on projections for contributions from provinces to current plans (Energy Agreement) and intended policies (RES and implementation of Climate Agreement).

It concerns the total amount of public and private investments in offshore wind, on shore wind, solar PV, heat networks, energy conservation, CCS and electric transport. For North Holland, approximately 80 percent of the investments are attributable to offshore wind. In Flevoland, about 50 percent of the investment amount is related to investments in Wind on land."

Hydrogen also had a place in both provinces' draft RESs in 2020. However, SEO concludes in this study that because "*concrete investment decisions have not yet been made, the implementation of the hydrogen agenda is unlikely to take place before 2030*" the human capital needed for the hydrogen transition is not considered.

The conclusion in 2020 is that an additional 16,000 FTEs for North Holland and 1,800 FTEs for Flevoland are needed annually to meet the energy transition and sustainability challenge. By 2022, this number for North Holland in this [recent study](#), is revised downward to 12,000 full time additional workers per year. The potential additional labor supply is 18,000 workers, according to the researchers. This labor force is distributed among manufacturing, construction and business services, among others. In this second study, limited investment for hydrogen was included in the calculations.

1.1.2 Amsterdam Economic Board and network steering

At the request of the Amsterdam Economic Board, board member Jacqueline Cramer has developed [an approach](#) to complex transition tasks. Fundamental transitions such as the energy and hydrogen transition require changes at the institutional, organizational, economic, legal and technical level, but also at the behavioral level. Cooperation in the triple or quadruple helix is crucial. Network steering, with the deployment of an independent transition broker, can accelerate the transition. The essence of network steering is that different parties with a shared sense of urgency work together to create and realize an innovative initiative that contributes to major social changes.

Every major transition is a compilation of numerous initiatives, each consisting of four phases:

- The preparation of an initiative.
- Building and realizing a joint initiative.
- If the first initiative is successful: scale up.
- Mainstreaming the initiative.

Every transition initiative requires change at various levels, involves many different interests and allows for various possible solutions. The building blocks in the illustration touch on all those components of this change process and can serve as a guide for the two transitions to which we want to contribute with this roadmap: the energy/hydrogen transition and the transition to a flexible, skills-oriented education and labor market.

DE TRANSITIE AANWAKKEREN

1. Een transitie-initiatief begint met een gedeeld gevoel van urgentie.
2. De uitvoering van elk transitie-initiatief verloopt in vier opeenvolgende, maar cyclische fasen.
3. De uit te voeren taken per transitie-initiatief zijn ongeveer hetzelfde, maar de focus verschilt.
4. Een transitie-initiatief is een reis met een duidelijk doel, maar heeft geen vooraf bepaalde route.

CONTEXT IS CRUCIAAL

5. Focus op de meest veelbelovende en baanbrekende innovaties.
6. Breng de belangrijkste drijvende krachten en voorwaarden voor een succesvol transitie-initiatief in kaart.
7. Identificeer de relevante partijen en beoordeel hun bereidheid tot samenwerking.

EEN SUCCESVOLLE UITVOERING

8. De kosten en baten van een transitie-initiatief moeten evenwichtig verdeeld worden onder de netwerkpartners.
9. Transitie makelaars kunnen transitie-initiatieven versnellen.
10. Een transparante taakverdeling tussen netwerkpartners is cruciaal.

Figure 1.1: From: *The Power of Network Stewardship - ten building blocks for a smart, green and healthy MRA.*

1.1.3 North Holland InSight

The labor market dashboard of the Manifesto Working and Developing 2030 North Holland provides insight into the development of the North Holland labor market and education in sectors and occupations relevant to the energy transition. In addition, the dashboard provides insight into the progress of the ambitions and objectives formulated within the manifesto. The dashboard functions as a source of information for administrators, entrepreneurs and policymakers concerned with the development of North Holland's climate and energy policy. In order to realize the grand ambitions regarding the energy and hydrogen transition, more than 12,000 additional FTEs will be needed each year in the North West region between now and 2030.

[Energietransitie Noord-Holland dashboard landing page - Energietransitie Noord-Holland dashboard home \(nhinzicht.nl\)](https://www.nhinzicht.nl)

1.1.4 Hydrogen Valley North Holland

In May 2023, North Holland received Hydrogen Valley status. The Hydrogen Valley status is an award from the European Commission for regions that make a distinctive effort to develop an energy system based on sustainable hydrogen. It concerns the cooperation between program office Noordzeekanaalgebied and development company Noord- Holland Noord. The hydrogen projects of Hydrogen Valley Noord-Holland have been mapped on behalf of the Province of Noord-Holland and can be found on this [interactive map](#). Province of North Holland, together with program office NZKG and development company North Holland North, provides updates to this map.

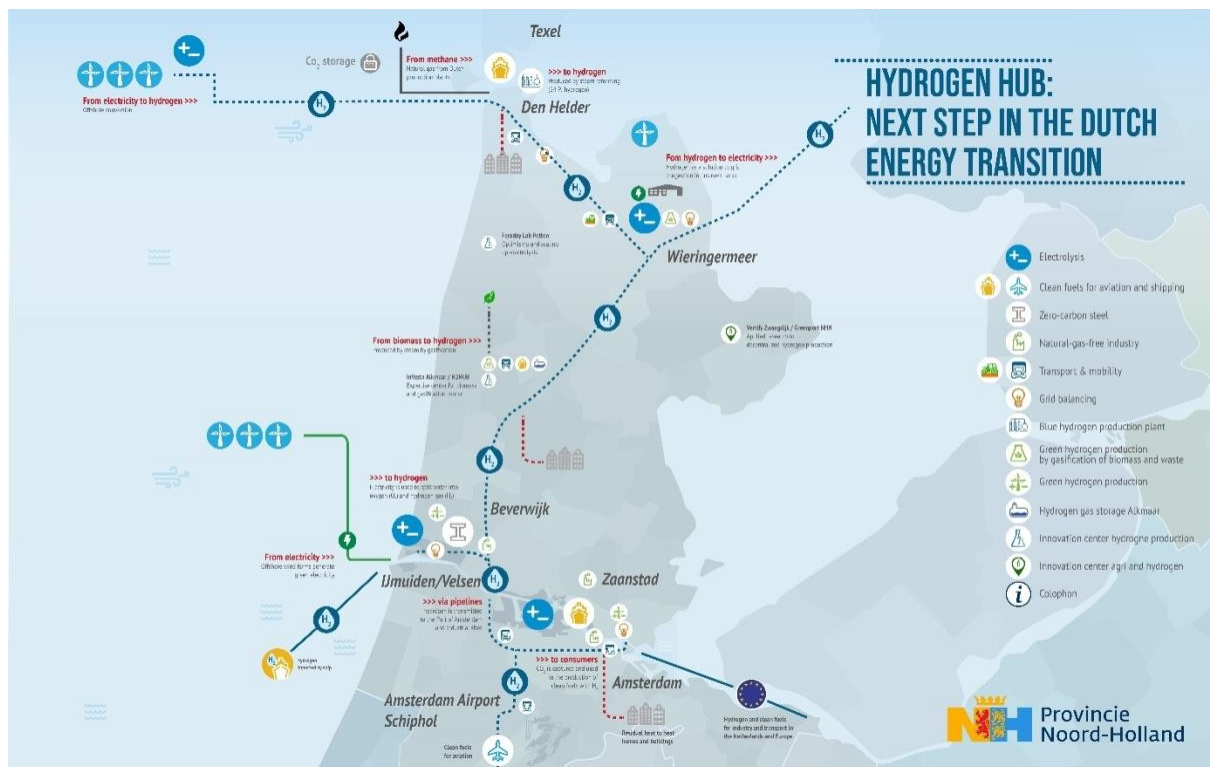


Figure 1.2: Interactive map of Hydrogen Valley showing activities and projects.

The Cluster Energy Strategy 2022 1.0 and other documents such as the NZKG 2020 regional plan can be found via this link: [Publications | North Sea Canal Area](#)

1.1.5 FLHY

The [Flevoland Hydrogen Valley platform](#) was established in the first quarter of 2023. The ambition of Flevoland Province is to contribute to the Dutch hydrogen transition. Prior to that, in September 2022, more than 20 Flevoland parties signed a declaration of intent to work together to develop the hydrogen economy. Parties that are part of the platform include Engie, Energie Expertisecentrum Flevoland, Wageningen University and Research and GigaStorage.

Hydrogen is seen as promising for agricultural vehicles and transport: transport by land and water and by air from Lelystad Airport. The Maxima power plant in Lelystad is already being converted to run on hydrogen. In addition, there is a lot of generation capacity through wind and solar power where hydrogen can be used as a buffer.

1.1.6 Hydrogen Utrecht

In early 2023, the province of Utrecht, KWR Water Research Institute and the Energie Collectief Utrechtse Bedrijven (ECUB) took the initiative for the "Hydrogen Utrecht" covenant. Hogeschool Utrecht, as a knowledge institution, has also joined this via the "Building Future Cities" lectureship and the "Water Program." This covenant focuses specifically on hydrogen for mobility: [Ambition | Hydrogen Utrecht](#).

1.2 Six regional clusters with substantive focus and PPP structure

The entire hydrogen chain is being worked on in the North-West region. To do justice to the multitude of parties working together regionally and with a substantive focus, we describe the North-West region using six regional clusters within which the triple helix collaborates on aspects of the hydrogen chain. Several parties working together within these clusters have expressed the desire and ambition to further develop cooperation and synergy between the clusters for the human capital agenda hydrogen transition.

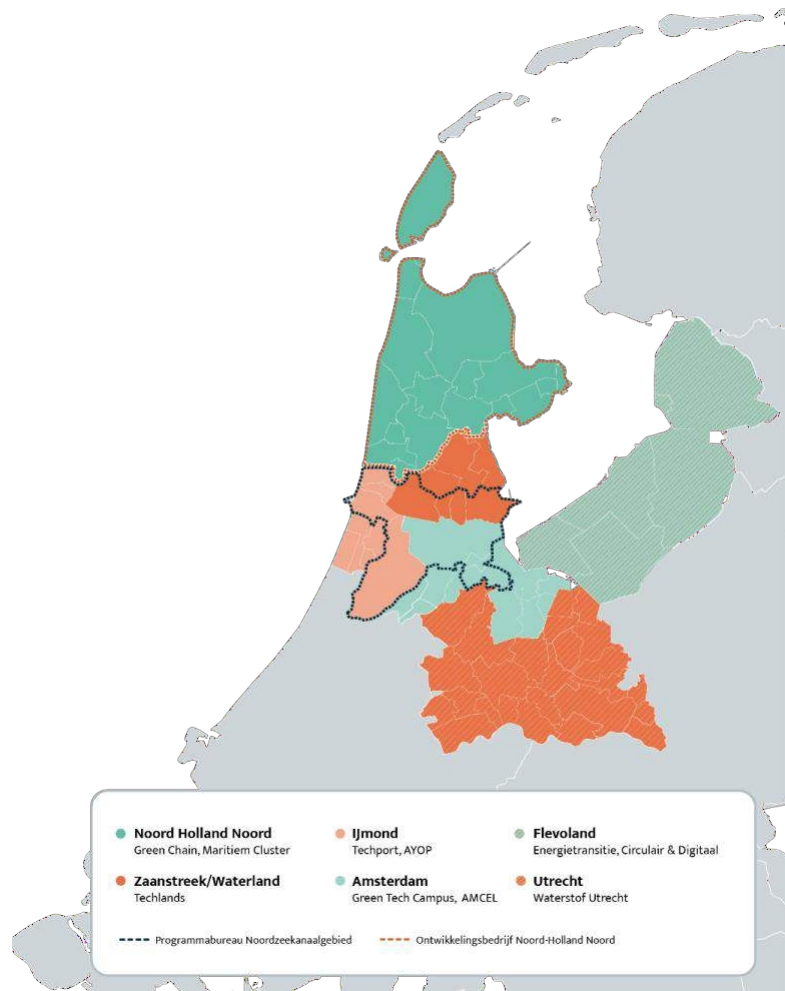


Figure 1.3: Six regional clusters in North-West region, Development Company NHN and Program Office NZKG

PPPs perform an important function in getting relevant parties from the triple helix to cooperate in solving labor market issues. For the IST situation, the regional infrastructure centers around the following clusters of PPPs, each with its own substantive focus on the hydrogen chain.

Besides these six PPS and High Impact PPS-based regional clusters, the Noordzeekanaalgebied program office and the Noord-Holland Noord development company play an important pulling and connecting role. For the provinces of Utrecht and Flevoland, such a leading role for the hydrogen transition is fulfilled by FLHY and the "H₂ Utrecht" covenant.

1.2.1 IJmond | Techport and AYOP

JTF and Transition Plan IJmond

The IJmond municipalities (Beverwijk, Castricum, Heemskerk, Uitgeest and Velsen) and the province of North Holland have, in consultation with stakeholders (about 30 companies, knowledge and educational institutions, collaborations), drawn up a regional transition plan in order to be able to appeal for money reserved within the Just Transition Fund (JTF) for the IJmond region. The IJmond Transition Plan describes the intended use of the JTF funds in the region. The total amount involved is 58.5 million euros. With the JTF, the IJmond region is stimulating the equitable transition to a sustainable industry and economy, along four parallel "transition paths.

The four transition paths along with their outline commitment are:

1. Transition to a sustainable steel industry in IJmond including hydrogen support.
2. Exploit opportunities to make NZKG more sustainable for the benefit of a diverse, future-proof economy in IJmond, including a focus on offshore wind farms and the hydrogen economy.
3. Making other industrial activity IJmond sustainable.
4. Transition to a future-proof labor market.

Techport

Techport is a network of more than 70 schools, companies and governments. Techport advocates for the future of the manufacturing and maintenance industry and works to ensure a healthy labor market, an up-to-date and challenging educational offer and sufficient talent in IJmond.

With the under construction Techport Innovation Centre (TPIC, ready in 2024), Techport aims to support innovations that contribute to the digitalization of the manufacturing and maintenance industry and thus reduce energy consumption. In addition, Techport is currently working out the plans for setting up field labs/trials and a digital workshop where SME companies can use data to gain insight into energy consumption and thus pursue 'smart' energy savings.

Recently, the Just Transition Fund honored Techport's application "TPIC Green Incubator." Through this incubation process, Techport enables the accelerated growth of startups into successful companies by offering an integrated package of services, such as workspace, services, culture, coaching, network, (access to) capital, etc.

In addition, work is underway to establish a number of Fieldlabs, which will be housed in the TPIC: Smart Energy, Green Industry, Smart Sensorlab Tiny Machine Learning, Circular Scrap. The Hydrogen Learning Community will be a new part of the Techport Innovation Agenda.

Learning Community Hydrogen

Techport is currently starting a Learning Community Hydrogen together with ROC Nova College. In Holland, the Hogeschool van Amsterdam and 50 companies are also partners in this. The Learning Community Hydrogen (LCW) focuses on "The Safe and Skilled Design, Operation and Maintenance of Hydrogen Related Industrial Plants in the IJmond Region." Practical techniques such as coatings, valves, maintenance procedures, safety procedures, etc. are covered. The LCW can use the TPIC during meetings and research.

Tata steel

Tata steel together with Techport has initiated a major transition program that invests 4 billion until 2030 to convert factories to renewable electricity. TATA steel cooperates with parties worldwide to have right knowledge and fill in anything risky with answers. For innovative knowledge, it does not look directly to the region. Tata steel wants to work with region to develop knowledge in the areas of: safe handling of hydrogen, what materials do you need for hydrogen, and how to maintain plants. TATA likes to work with regional parties to accomplish the transition.

AYOP

AYOP is the regional trade association for the offshore industry and has more than 120 members. The entire offshore chain is represented. Focus is on offshore wind installation, maintenance and cable logistics, drilling projects for gas exploration, logistics for the oil and gas sector, modifications and maintenance of working vessels and platforms and dismantling of offshore structures and vessels. Local municipalities, training institutes, logistics providers, HR companies and facility service providers are also affiliated.

Learning Community Offshore Energy

AYOP, in collaboration with Katapult, TKI Offshore Energy and program office NZKG, is currently investigating the possibility of establishing a Learning Community Offshore Energy. The aim is to respond more actively to the challenges surrounding human capital and to make the IJmond/North Sea Canal area/North Holland region attractive for employees, innovation and enterprise in the field of Offshore Energy and related (technical) training.

Main goals of this learning community are: innovate in the region and fill out HCA with education, training and people.

If the community stands regionally, the goal is to build intensive relationships with other national regions. There is contact about this with Zeeland, South Holland, Groningen and Arnhem. The ambition is also to share knowledge internationally through the North Sea Energy Coalition. Hydrogen production at sea and bringing hydrogen ashore are part of the LC Offshore Energy. There is also a focus on circular transition for decommissioning and refurbishment of wind farms. The lifetime of a turbine is 25 years on average and current permits are also 25 years. Research is underway to license new tenders for the 40-year period. Circularity is high on the agenda of OEMs such as e.g. Siemens Gamesa and Vattenfall. Building a new value stream together and keeping valuable raw materials within Europe is becoming more essential. Other innovations that will receive attention are system integration such as the generation of electricity through solar and wave energy and the stabilization of power supply through hydrogen and battery storage (at sea and on land), ecology in cooperation with Wageningen and "community of practice North Sea" with fisheries and maritime sector. We are also looking to the further future such as Smart Maintenance, Robotics (Drones above and under water), Digitalization and the potential creation of energy islands at sea.

1.2.2 North Holland North | Green Chain NH

High Impact PPP Green Chain

[Green Chain NH](#) is committed to bundling and strengthening the innovation power of the agrifood sector in North Holland (which is currently fragmented). This is to meet the requirements of climate and energy transition and achieve sustainable agriculture throughout the agrifood chain. In addition to required energy sources for heat, especially in greenhouse horticulture, electricity is also needed for storage, cooling and lighting. A reliable and affordable CO₂ supply (in a climate-neutral greenhouse horticulture without natural gas, the CO₂ needed for cultivation must come from other sources) is also very important for the transition in greenhouse horticulture.

Furthermore, in addition to strengthening the innovation power, the goal is to improve the green education and training offer. Among other things, they are doing this by realizing practorates, strengthening lectureships and developing an associate degree.

Fieldlab Hydrogen in Agri

The Agrifood network Greenport Noord-Holland Noord is working on the fieldlab hydrogen agri: <https://www.greenportnhn.nl/projecten/fieldlab-waterstof-agri>. Three locations are currently working on hydrogen application in the agricultural sector: hydrogen-powered agricultural equipment, hydrogen as part of a self-sufficient agricultural business with expansion problems due to grid congestion and hydrogen production, application and delivery to the hydrogen grid.

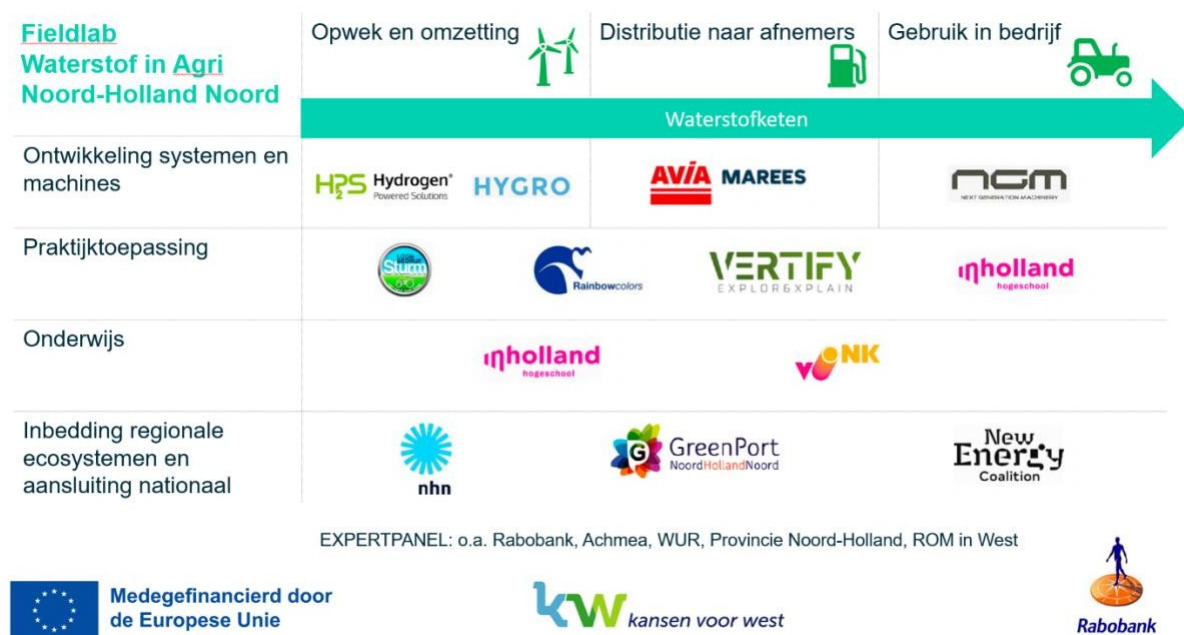


Figure 1.4: Partners Fieldlab H₂ in Agri ©2023 Development Company NHN.

Project ZepHYros

The ZepHYros project promotes the development of a green hydrogen infrastructure in the Wadden Sea ports and the use of hydrogen in the maritime sector. To achieve a hydrogen infrastructure, a solar park, electrolyser, pipeline for transport and a public hydrogen refueling facility will be realized. Two hydrogen vessels will bunker hydrogen at the refueling facility.

Region Deal "Maritime Cluster Kop van Noord-Holland"

In mid-2023, the [Region Deal "Maritime Cluster Kop van Noord-Holland"](#) awarded HYGRO a subsidy to set up a hydrogen chain: from renewable energy production with solar or wind via hydrogen transport to a filling station. A pipeline will be constructed through Wieringermeer-Zuid to the filling station AVIA Marees.

Tech@Connect

Tech@Connect connects partners in engineering in the Noordkop. The goal is to use targeted initiatives to promote and strengthen the technology sector and thus ensure more recruitment of technically trained personnel. From the manifesto "[Building the region of the future together with technology](#)" initiatives are developed and implemented. TekPark, the Maritime Drone Initiative and Thuisduinen2025 are some examples of Tech@Connect initiatives to inspire students to get started with technology.

1.2.3 Zaanstreek-Waterland | Techlands

Zaanstad Make City

By 2020, the 15 largest industrial companies in the Zaan region that make products from natural raw materials have united in the association "Zaanstad Maakstad". These 15 companies use 30% of the total energy demand in the NZKG if Tata steel is excluded. Energy demand will grow to 2000GWh by 2050, with hydrogen playing an important role as a storage medium.

Techlands

Techlands is a major partnership (PPP) based in Zaandam, within which the Regio College, Hogeschool van Amsterdam, OvO Zaanstad, Tetrix Techniek, Bouwmensen and IW Nederland work together with business, the municipality of Zaandam and the province of North Holland.

1.2.4 Flevoland | Energy Transition, Digital and Circular

The platform "FLHY" ("Flevoland Hydrogen Valley"), in the [report FLHY by Impact Hydrogen](#), describes five clusters within the hydrogen chain, which the platform consists of:

1. Balancing the system around the Maxima Power Plant.
2. Self-sufficient agriculture: convert surplus self-generated energy into H2 and use it to power farm vehicles or dry/cool crops.
3. Mobility and Distribution: deployment of H2 in the logistics sector and transport around distribution centers but also for vehicles of public customers like municipalities and province. Also, making Lelystad Airport more sustainable of both air traffic and groundwork for a low-emission airport.
4. Maritime sector: distribution and off-take of H2 at Flevoland ports.

5. The built environment: using waste heat released from hydrogen production and deploying fuel cells, where there is grid congestion and businesses cannot connect to the electricity grid.

In the short term, Flevoland chooses to invest in the user side of the hydrogen chain; the mobility of the future, i.e. hydrogen-powered vehicles, boats, planes and construction equipment. These new forms of mobility can only grow if hydrogen is also available nearby. Connection to the national hydrogen network, the backbone, is key.

The following projects are under development:

- Dutch company H2Trac is supplying urban farm in Almere with an electric tractor that draws its power from four hydrogen tanks, allowing it to operate for four to five hours.
- At Lelystad Airport, work is underway on an H2 business aircraft: an electrification conversion system that equips existing small civil aircraft with new lightweight electric motors with hydrogen energy storage.
- Greenpoint Fuels is working on a hydrogen fueling station at the Trekkersveld business park in Zeewolde. It is intended initially for buses and later for passenger cars.

Region Deal New Land

In October 2023, the Province of Flevoland, municipalities of Almere and Lelystad, signed the "[Regio Deal Nieuw Land](#)" with the central government. ROC of Flevoland, Windesheim and the companies Yanmar and Alfen signed statements of support for this region deal. At Aeres Farms in Dronten, students are trained for the agricultural sector. Trainings are focused, among other things, on making agriculture more sustainable. Application of hydrogen in agricultural partnerships so that a collective of farms work together on local production, manufacturing and storage are being explored.

High Impact PPP Circular and Digital in thinking, learning and doing

The HIP Circular and Digital in Thinking, Learning & Doing is committed to reducing the skills gaps in SMEs in the field of circular economy and digitalization in the Amsterdam Metropolitan Area. The following parties are affiliated with this HIP.



Figure 1.5: Partners HIP Circular and Digital in thinking, learning and doing ©2023 HIP C&D.

1.2.5 Amsterdam | Green Tech Campus

Within the Amsterdam cluster, several public-private partnerships and consortia are active that are relevant to the hydrogen transition. The focus is on application areas of hydrogen in the built environment and mobility, the integration of hydrogen in the energy system (system integration) and electrochemical conversion.

High Impact PPP Green Tech Campus

The ROC of Amsterdam and the Faculty of Technology of the Hogeschool van Amsterdam are working with ten public-private partnerships on five program lines: Ecosystem, Orientation, Learning, Working and Innovation.

Collectively, these program lines provide:

- More influx into engineering (including new target groups).
- Reduced student dropout rates in education.
- More (future) professionals with the knowledge and skills to make the transitions happen.
- Reduced outflow of professionals in the industry.
- Working smarter with fewer people.
- Increasing SME productivity.
- Better and more efficient cooperation and coordination between educational institutions, businesses and regional governments in the MRA region.

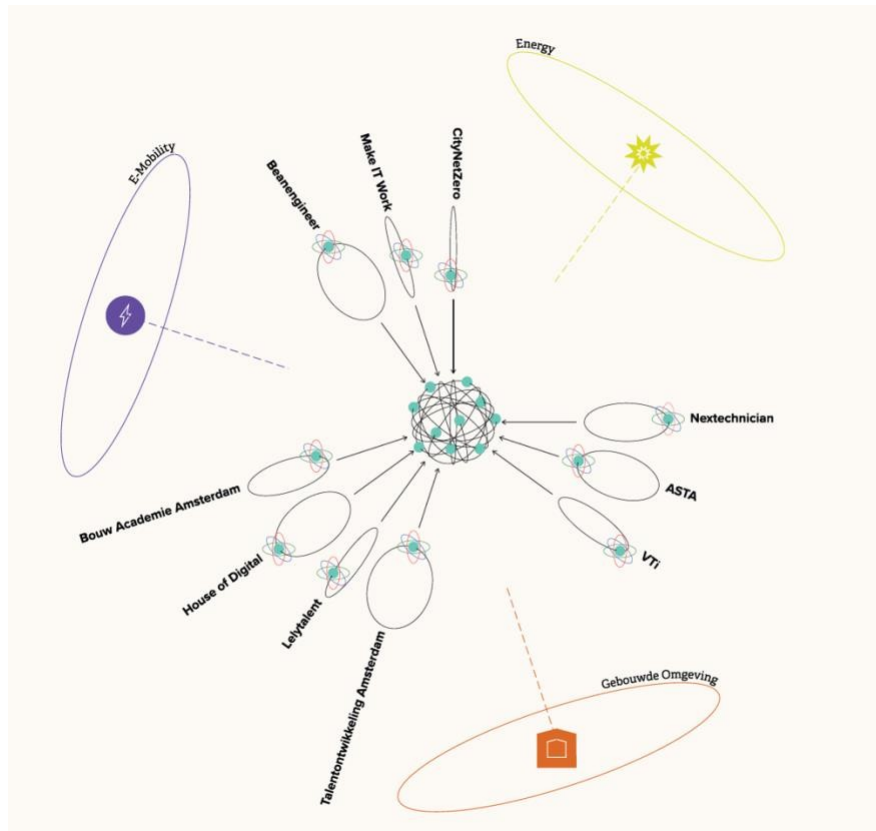


Figure 1.6: Schematic representation of HIP Green Tech Campus ©2023 HIP GTC

AMCEL

The transition in the chemical industry from current petrochemical-based processes to electrochemical processes requires the development of many new "redox chemistry-based" transformations. In addition, electrochemistry forms the basis for storage of renewable energy as, for example, in batteries or hydrogen. As the North Sea Canal area is an important landing point for green electricity, a knowledge center in the field of electrochemistry is relevant for all parties in the region in the green electron sector. AMCEL has the ambition to set up a learning and innovation center in the field of electrochemistry to develop human capital and strengthen regional innovation power.

1.2.6 Hydrogen Covenant Utrecht

The Platform Waterstof with the province of Utrecht, KWR Research Institute and the Energie Collectief Utrechtse Bedrijven focuses specifically on hydrogen for mobility: [Ambitie | Waterstof Utrecht](#).

Utrecht University of Applied Sciences

The Institute for Life Sciences & Chemistry (ILC) and the expertise area Samen Duurzaam of the Hogeschool Utrecht are training and researching the following topics relevant to this roadmap: Circular and Healthy Drinking Water, Biobased & Green Chemistry. Utrecht University of Applied Sciences is the largest higher education provider in the North-West region with regard to chemistry, chemical technology and life science. Every year about 120 students graduate in chemical technology and chemistry. Hogeschool Utrecht has a close cooperation with TATA steel: students who graduate from the TATA steel academy have the opportunity to go on to university of applied sciences. After a math course and exam, operators can choose to follow the hbo part-time chemistry or chemical engineering at HU. Every year the HU trains 4 to 5 people for TATA steel in this way. From the "Green Chemistry" minor, there is great interest in joining GroenvermogenNL to train people for the hydrogen transition.

In addition to the chemistry courses, work on the logistics of hydrogen refueling stations is being done within the "Building Future Cities" lectorate, and the HU's "Water" program is working closely with KWR on water as a hydrogen feedstock. Connections can also be sought with engineering courses in electrical engineering, mechanical engineering, technical business administration and part-time integral safety.

ROC of Central Netherlands

ROC van Midden-Nederland has a Tech Campus in Nieuwegein. The "Vakcentrum Duurzame Energie" is the vocational center for knowledge and skills related to the latest techniques in energy transition, it innovates courses by embedding the latest developments in education. It also innovates by experimenting with multidisciplinary projects at the Tech Campus Nieuwegein. The Trade Center also provides for bringing and maintaining the knowledge and skills of teachers in the field of energy transition within the built environment. The ambition is to investigate which hydrogen-related topics should become part of the curriculum there as well.

CoVE Seed project

In the [CoVE Seed](#) project, ROC Midden Nederland and Hogeschool Utrecht work together with 4 other EU regions that want to innovate & develop vocational education in the field of sustainable energy. Goals are: courses that better match the labor market, a larger supply of well-trained professionals and the development of new technologies.

1.2.7 North Sea Canal Area (NZKG) program office.

The Amsterdam metropolitan region has the ambition to realize the greenest industrial zone in the world in the North Sea Canal area. The program bureau of the NZKG foundation supports regional cooperation in the North Sea Canal area. The bureau initiates and implements programs in the areas of space, energy and aviation sustainability. The region consists of subareas, each with its own character. In the IJmond region, the (offshore) industry and fisheries dominate. In the Zaanstreek, the food industry is important. The Port of Amsterdam is big in import, storage and transport of (fossil) fuels and aviation. In this description of the IST situation, we choose to separate the activities around industry and educational institutions in Zaanstreek/Waterland and the activities and parties around IJmond.

describe. The issue around energy transition and hydrogen for the food industry is of a different order and content compared to the offshore and onshore transition in the ports and the sustainability of the steel industry.

Hydrogen Acceleration Table

Part of the NZKG program office is the hydrogen acceleration table. The hydrogen acceleration table consists of parties with different roles in the hydrogen chain. Both producers and users and providers of hydrogen, infrastructure managers and investing parties: the Port of Amsterdam, Tata Steel, Gasunie, Vattenfall, Schiphol, municipality of Amsterdam, province of North Holland, Alliander, Argent Energy, HyCC, etc. With this hydrogen acceleration table, the entire hydrogen chain in the NZKG will be developed, scaled up and, if possible, accelerated. By simultaneously scaling up demand, supply, transport and storage, a hydrogen cluster in the NZKG can be accelerated to reduce CO2 emissions.

The ambition of parties in the NZKG is to also work with the other industry clusters in the Netherlands to further accelerate the hydrogen and energy transition. The expected demand for hydrogen in 2030 is 230kton. This is concentrated around the three industry clusters Beverwijk, Zaanstad-Westpoort and Schiphol. Plans now include 500 MW of electrolysis capacity. The port of Amsterdam focuses on import and transit of hydrogen carriers, cryogenics, ammonia, methanol, LOHCs.

Innovation region NZKG

Page 11 of the Amsterdam Economic Board's [inspiration document](#) states the following about the hydrogen transition:

"Thanks to leading knowledge institutions in the field of hydrogen, technology hubs, large-scale industry, innovative SMEs and an attractive innovation and startup climate, the Metropolitan region can become the innovation region for hydrogen, renewable fuels and the industrial energy transition."

Program office NZKG is currently focusing on further elaborating and strengthening such an innovation region and the human capital agenda. According to program office NZKG and other parties involved, an attractive innovation and startup climate for the hydrogen transition is currently lacking.

The following activities and ambitions are on the NZKG agenda:

- Realization of HC projects Techlands and scaling up test facilities Techlands.
- Scale-up test facilities AMCEL for electrochemical conversions.
- Development of Learning Community Offshore Energy led by AYOP.
- Develop "transition community Industry" led by HvA Faculty of Engineering.
- Collaboration with Techport and Techport Innovation Center.
- Appoint project developers in the region to support learning, knowledge & innovation projects. This will involve cooperation with The New Energy Coalition in collaboration with the province and development company North Holland North.

Within these activities, connections are made and sought with regional companies, SMEs, governments and knowledge institutions. The aim is to benefit from mutual synergy and improve the quality and supply of training. Examples include intensive knowledge transfer, industry experts in front of the class, jointly mapping out the profiles of the future, compiling training modules, creating apprenticeships, etc.. The most important thing is to create an attractive, innovative learning & living environment, where people like to live and work.

1.2.8 North Holland North development company

The NHN region has established a Hydrogen Platform for everyone concerned with hydrogen in North Holland North. The development company brings together companies, organizations, knowledge institutions and governments. By exchanging knowledge and making connections between the right parties, together we will ensure a faster transition to a hydrogen economy.

Work is underway in North Holland North on:

- H2 in Agri.
- Infrastructure and storage.
- Transmission.
- Built environment.

All H2 projects in North Holland North can be found at [Projects - Hydrogen North Holland North \(waterstofnhn.nl\)](https://waterstofnhn.nl)

1.3 Educational institutions, Engineering campuses and Fieldlabs

For this roadmap, an inventory was made of the educational institutions operating and established in the North-West region and associated programs at the wo-, hbo and mbo levels with a focus on engineering and science. These educational institutions align with the regional clusters described above. The locations are plotted on the map of the region (Figure 1.8). Test and lab facilities relevant to the hydrogen and energy transition can be found for each location in Appendix A. Sixteen locations are known to already be working on the development of education relevant to the hydrogen transition, mostly still individually and in some cases linked to the GVNL teacher professionalization track developed by Region North and West.

Province of North Holland is working on a dashboard for the "Talent Infrastructure Climate Challenge" for engineering and technology at the time of writing this roadmap. This dashboard will provide insight into what is happening in the areas of choosing, learning, working and innovation in North Holland. In the image below a "sneak preview" of this dashboard that will be published via the website of the province of North Holland. The GVNL North-West liaison team is connected to this development and will provide input on the talent infrastructure for the hydrogen transition.



Figure 1.7: "Sneak Preview" Dashboard Talent Infrastructure Climate Challenge Province of North Holland ©2024.

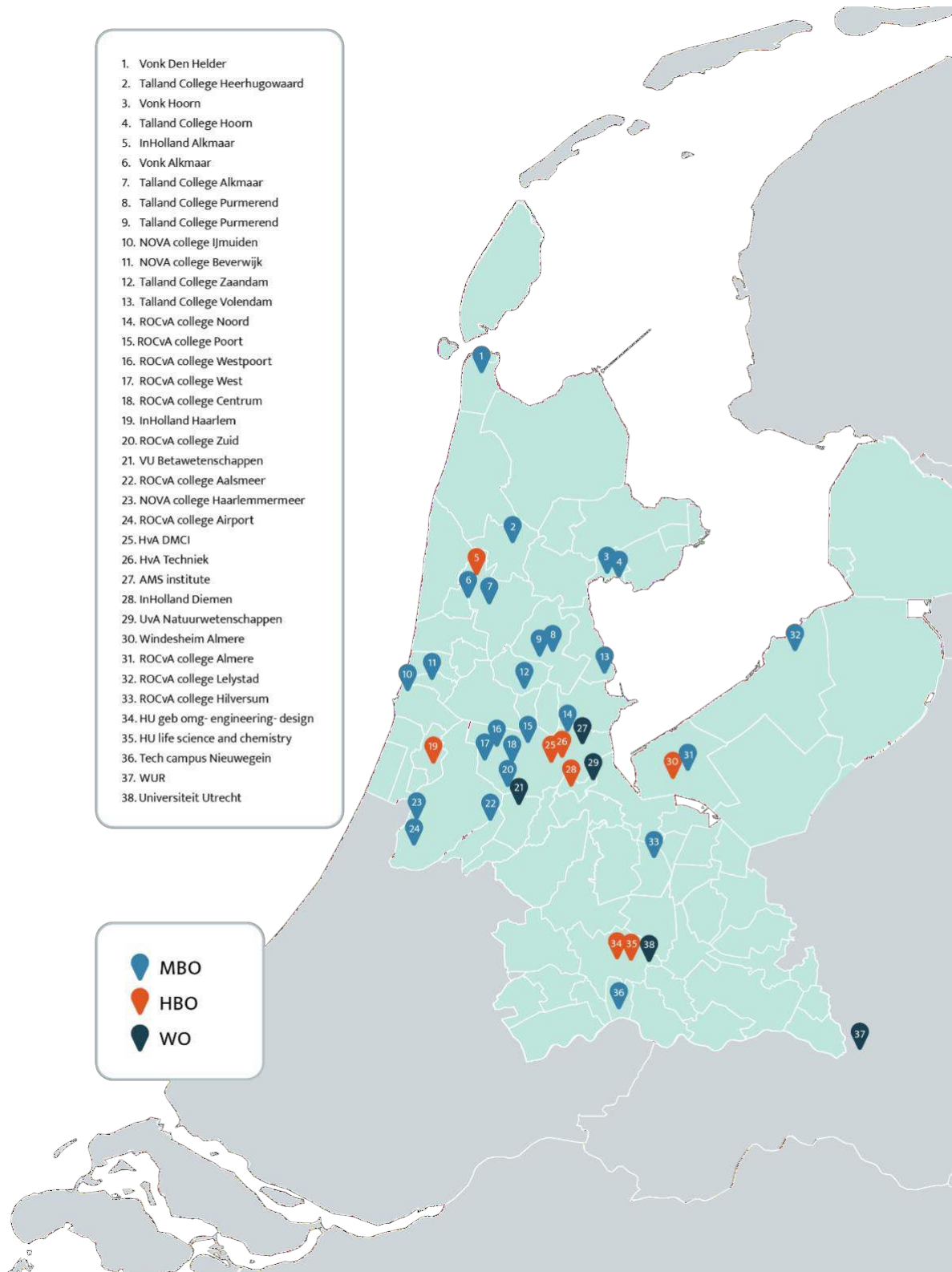


Figure 1.8: Educational locations and campuses relevant to engineering and the hydrogen transition mbo hbo wo.

1.4 Service Points Engineering

The Engineering Service Points (SPTs) in North Holland contribute to a better functioning labor market for employees and employers in the engineering sector. The SPTs support technology companies in filling vacancies in a technical profession and mobility questions in general. In particular, an SPT focuses on retaining workers for the engineering and construction sector and filling hard-to-fill vacancies and placing unemployed technicians.

An SPT is located in every labor market region in North Holland:

1. Greater Amsterdam, ASTA;
2. Zaanstreek/Waterland, Techlands;
3. South-Kennemerland and IJmond, Techport;
4. North Holland North, SPT NHN;
5. Gooi- en Vechtstreek, SPT Midden (together with Utrecht and Amersfoort).
6. Flevoland
7. Central Utrecht
8. Amersfoort

An SPT is an important, if not the most important, activity of the identified clusters. All partners from the public-private partnerships are connected, contributing greatly to the realization of the goals of the SPTs. Within the context of HCA GroenvermogenNL, they provide implementation power for the responsive infrastructure. This means that employees and employers can go there for training and development issues, among other things. In Flevoland, a similar service is offered by the Technology Switching Team.

1.5 Conclusions exploration HCA region Northwest

1.5.1 Six clusters of PPPs as starting points for the hydrogen HCA

In the North-West region, we distinguish six clusters of PPPs and consortia in which relevant parties from industry, educational and research institutions, and government authorities work together on the energy and hydrogen transition and the flexibilization and modularization of the educational offering in combination with learning-working environments and lab facilities on campuses. The initiatives developed within these clusters are in most cases at the beginning of their development. Partly for this reason, initiatives often operate "solo," with their own - mainly regional - network from the triple helix and in implementation separate from other similar initiatives in the region. To solve the labor market and training issues in coherence, exchange and linking of these initiatives is an important accelerator.

1.5.2 North West region working across the board on hydrogen transition

Full-scale hydrogen value chain work is underway in Northwest region. Image

1.9 visualizes which elements of the value chain the six clusters focus on. Programmabureau NZKG operates across the full breadth of the value chain. Four of the six clusters focus on production and availability of green and blue hydrogen in the region. Each cluster works on hydrogen application and market. Within this link of the value chain, the focus is on Industry: H_2 as a feedstock and H_2 as a fuel. On a smaller scale, six clusters are working on H_2 for mobility, transport and agri. Built Environment is addressed within the

Amsterdam High Impact PPP "Green Tech Campus," Flevoland cluster and North Holland North cluster touched upon. Within each PPP cluster, there are multiple transition initiatives.

Because work is being done in the North-West region on all links of the hydrogen value chain, it is important to have a living up-to-date map of and about all hydrogen projects, human capital initiatives, training opportunities, partnerships, fieldlabs, etc. for the hydrogen transition. The interactive map of the hydrogen hub North Holland fulfills that function in terms of all hydrogen-related activities in the region and is periodically supplemented, expanded and further detailed. The Dashboard "Talent Infrastructure Climate Challenge - Engineering and Technology" as described in section 1.3 fulfills this function for an up-to-date overview of educational locations, PPPs and HIPs, lab facilities, labor market regions and SPTs etc..

1.5.3 Required HC for energy transition and sustainability - quantitative

The labor market studies for the North-West region show that between now and 2030 approximately 12,000 FTE of additional manpower will be needed annually to realize the investments in energy transition and making our society more sustainable. The share specifically for the hydrogen transition cannot be distilled from this and has not been calculated in part because the investments in the hydrogen transition are only partially included in the calculations. At the moment, that shortfall is still limited, but it is clear that the large scale-up in the hydrogen sector will have to take place in the coming years.

The expected required level of education most often mentioned is MBO 3 to 4+ and college. Recruitment from regular education will not be sufficient. Retraining and upskilling are an important part of reducing the shortages.

1.5.4 Required HC for energy transition and sustainability - qualitative

The regional analysis and the SEO study "Investing in sustainability and energy transition North Holland" from 2022 show that there is a mismatch between the available and required competencies. For example, people must be able to deal with new safety aspects, have digital skills in addition to technical skills, preferably be educated to a higher or higher professional level and have a practical attitude. Retraining and upskilling are important to retain people for the DET sectors.

"We are looking for college graduates who want to drive around in a van to drive the implementation of projects." David Molenaar, CEO Netherlands Siemens Gamesa 2023.

1.5.5 Professional profiles for the hydrogen transition

Parties foresee increasing demand, but it is currently (very) unclear when how many people will be needed. The profiles involved are also not yet sufficiently clear to most companies and initiatives.

1.5.6 Need for flexible, skills-based and modular training

Companies indicate that they anticipate that long-term training specifically focused on hydrogen topics will not be necessary for appropriately trained personnel. Modular offerings will be sufficient in many cases to complete the HCA.

Basic training for technical personnel should be supplemented with modularly designed topics relevant to working in the hydrogen economy. This preferably in the form of relatively short hybrid courses, practice combined with theory.

The need for educational innovation in which skills-based learning and flexibility for the learner are central is endorsed by employers. This also requires that companies align their HR policies and L&D programs more closely with the changing labor market in which skills-based learning becomes the necessary norm. Less emphasis on diplomas, more on skills and competencies (Transition HR and L&D).

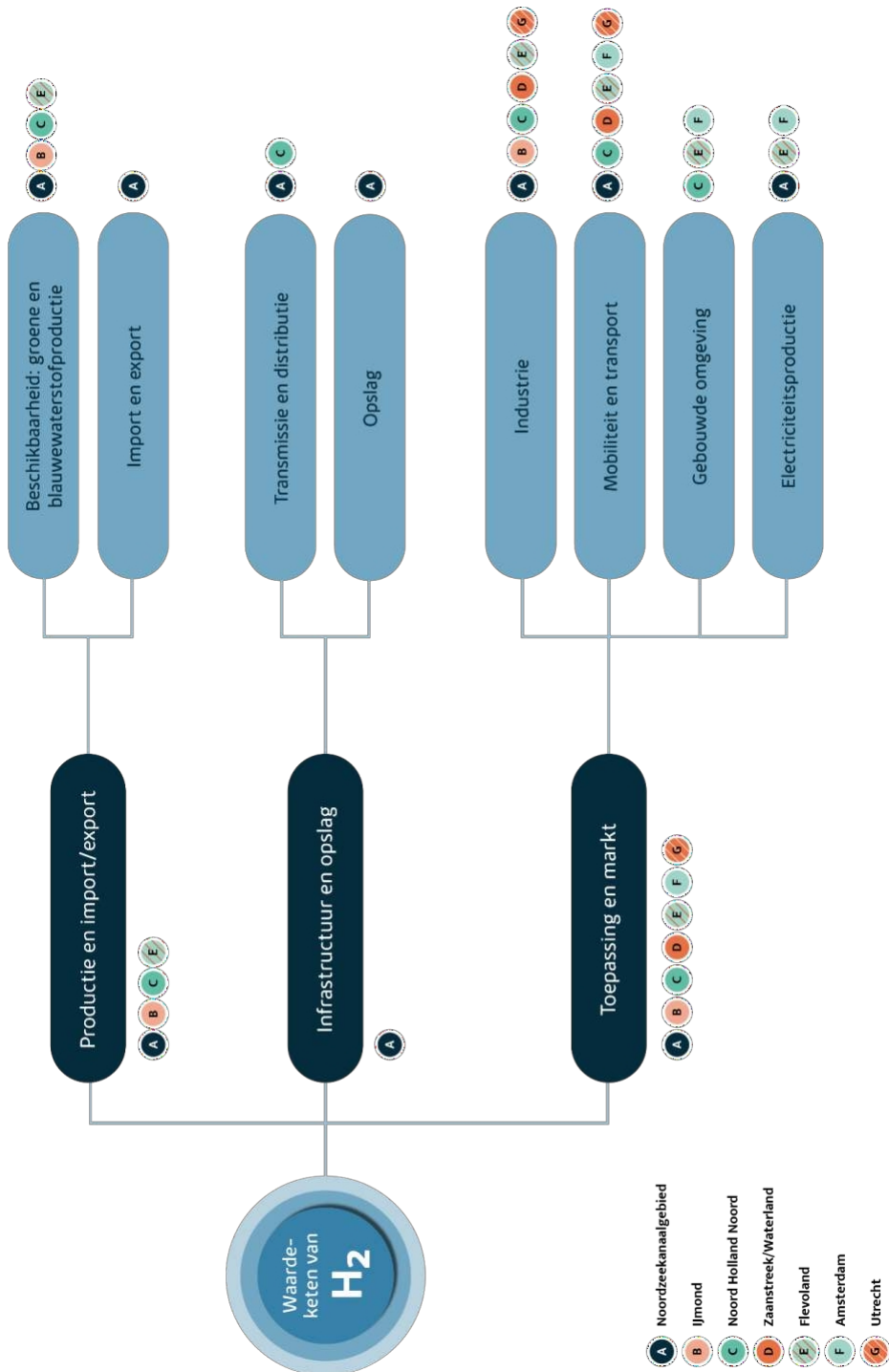


Figure 1.9: Value chain of H₂ and the 6 regional clusters, the NZKG program office and development company NHN?

2. Impact of HCA Green PowerNL in Northwest region.

2.1 Introduction

The roadmap for the HCA energy and hydrogen transition actually combines two major societal transitions: the energy/hydrogen transition and the transition to a resilient, skills-oriented education and labor market. Two societal transitions that are taking place in parallel and in which the energy and hydrogen transition needs the transition to a skills-oriented labor market and flexible training to accelerate.

The [NWP roadmap](#) outlines the intended timeline for the hydrogen transition in the Netherlands. Region Northwest aligns with this as described in the [Cluster Energy Strategy](#) for the North Sea Canal Area and the [Regional Energy Strategies for region North Holland North, North Holland South, Flevoland, and Utrecht](#).

The transition to a resilient and skills-oriented labor market is central to the North West region in the Manifesto Working and Developing North Holland 2030. This is being worked on in development coalitions. The progress of the development coalitions can be viewed via [this link](#). At the time of writing this roadmap, the reassessment of the manifesto is in full swing. Manifesto 2.0 will be launched in March 2024. In updating Manifesto 1.0 to Manifesto 2.0, the results, lessons learned from the period 2021-2023, recent developments in the field of work and development and the recommendations from a study conducted by SEO are included in the new action agenda and in an adjustment of the cooperation model. The essence is to focus on a number of important development coalitions, such as Technology for the climate challenge in research and education, Inclusivity and Education-Labor Market Chain. Three learning communities will also be established that will contribute to the exchange of knowledge and expertise between the various clusters, including the SPTs. The named learning communities are Turn on the Green World, Lifelong Development and Shaping Ecosystems. HCA Green PowerNL liaisons will join the relevant learning communities and development coalitions.

2.2 First intended effect HCA GVNL: a responsive infrastructure

The conclusions from the discussions with relevant parties in the region point to the need for a flexible infrastructure for training, further training and retraining and ensuring more influx and retention of people. An infrastructure that can grow with the expected increasing demand for well-trained personnel. While there are many hydrogen initiatives, they are still in the early stages of development, making it challenging to shape appropriate educational curricula until now. This calls for working with parties in the region, educational institutions, businesses and government, to establish an infrastructure that can provide a rapid response to new, growing and changing labor market demands. In other words, a responsive infrastructure that supports the fulfillment of the hydrogen transition HCA and reduces or optimizes the "time to job" for people who want to work on the hydrogen transition.

This responsive infrastructure is created by identifying and keeping track of business needs and ensuring that it is in line with societal and labor market trends.

An effective and efficient responsive infrastructure for the hydrogen and energy transition provides:

- Efficient development of the necessary knowledge and skills to be effectively and flexibly employable in the hydrogen and energy transition for all who want to work in the hydrogen and energy transition.

The deployment of funds from the HCA Green PowerNL program facilitates the development of this responsive infrastructure for working, innovating and learning and the creation and testing of content for training, retraining and upskilling into hydrogen transition-relevant occupational profiles and continuous learning lines in North West region.

This responsive infrastructure:

- Works from PPP clusters to strengthen regional campuses with fieldlabs for the hydrogen transition where MBO, HBO and WO students and trainees can come together and become proficient in continuous learning.
- Encourages the development of hydrogen learning communities associated with engineering campuses and field labs.
- Test in practice the effectiveness of various existing programs and newly developed pilots for LLO offerings.
- Connects with the national elements of the GroenvermogenNL program: Make Hydrogen Work, Teacher Professionalization and the Knowledge Platform.

2.3 Second intended effect HCA GVNL: Securing coherent approach

A cohesive approach should ensure that resources made available for both transitions are aligned and mutually reinforcing. An approach that brings together the development of the HCA and the substantive/technical developments for the hydrogen transition.

The cohesive approach for North-West region is coordinated by the regional liaison team GroenvermogenNL. The approach has a number of interlocking elements from the various national programs, such as GroenvermogenNL, LLO catalyst, Scaling up PPPs, AINed and regional programs such as JTF.

2.3.1 Pillars under cohesive approach

The first pillar under the cohesive approach is the Manifesto Working and Developing 2030 prepared by the province of North Holland. In three rounds in 2020, under the guidance of the work ambassador and discussion leaders, participants from the triple helix considered what 9 strategic themes would look like in 2030, what goals must be formulated to make these images a reality and what actions are needed to actually realize these goals. This process provided broad support for the issues, focus and development direction identified therein, which are now being worked on in development coalitions.

The second pillar of the cohesive approach in North West Region are regional PPPs. From the manifesto p. 8-9:

"During the period October 2020 - February 2021, a Katapult expert team analyzed a total of 25 public-private partnerships (PPPs) in the provinces of North Holland (20) and Flevoland (5). These are the PPPs that were started in previous years under the Regional MBO Investment Fund. The analysis shows that PPPs have played an important role in innovating vocational education in recent years. Great strides have been made in making the various MBO programs more flexible and modular. Networks with companies and governments have also expanded considerably. Students are increasingly working on practical assignments thanks to the PPPs."

However, the conclusion of this study was that the PPPs still play a limited role in strengthening the innovative power of companies, lifelong development and missing the connection with universities of applied sciences. The aim is for PPPs to further develop their networks into fully-fledged ecosystems around social issues. This requires a multi-level (MBO-HBO), multidisciplinary and multi-sectoral approach. See Figure 2.1.



Figure 2.1: A multi-level, multi-disciplinary, multi-sectoral approach to ecosystem development © Manifesto 1.0 Working and Developing 2030.

A third pillar under the cohesive approach is the joint positioning - a position paper in the making from the directors of Engineering programs in higher vocational education and secondary vocational education - including concrete approach of the secondary vocational education and the on the external and internal developments outlined above, the objectives from the HCA agenda and the objectives from the growth funds. This lays the foundation for well-connected continuous learning lines, realized and organized with each other, and

appropriate to the necessary movement toward flexible demand-based education, which is being designed in cooperation with all relevant actors in the region.

2.3.2 Coherence among growth funds

GroenvermogenNL's regional liaison team is positioned as an independent party to support and strengthen the coherence between the various national programs and the vision and focus of the province and stakeholders involved.

A regional cohesive approach connects the acceleration ambitions and goals of the individual funds to work toward a the regional responsive infrastructure for the human capital agenda hydrogen and broader - the energy transition:

GroenvermogenNL answers the question of **what is needed?** The roadmap outlines the regional ecosystem and identifies the needs and commitment of parties in the region. Together with the parties in the region, the HCA agenda for the hydrogen transition will take on increasingly concrete form in the coming years. The regional liaisons are independent connectors: an important condition to accelerate the transition and achieve a coherent approach.

Scaling up PPPs aims to realize and **perpetuate the infrastructure** for what is needed. This is achieved by organizing the running capability within ecosystems and permanently connecting education and business. This has resulted in 3 honored scale-up PPP project applications in North West region.

The LLO catalyst aims to **continuously connect** organizations and **professionals to a rapidly changing society and labor market**. The regional application for North Holland has been designed in conjunction with Opschaling PPS, where running capacity is organized from the regional ecosystems and PPS clusters and the LLO catalyst application should lead to LLO solutions for those same clusters.

Just Transition Fund IJmond Track 3 focuses on an **agile, resilient workforce** through lifelong development, sustainable and inclusive employability, job coaching for job seekers and attracting and retaining talent.

European Hydrogen Valley Call 2024 will be opened in early 2024. The North Sea Canal Area Program Office will submit a proposal together with Development Company North Holland North and their partners. Regional liaisons are reading along to ensure consistency with the other programs and the human capital agenda.

2.4 The Green PowerNL Liaison Team in Northwest Region.

To establish the responsive infrastructure for working, innovating and learning for the energy and hydrogen transition and to secure the regional cohesive approach, the perpetuation of a liaison team is important. The initial liaison function will be continued in the form of a team that maintains an overview at the heart of the needed transition (GroenvermogenNL is a transition program), ensures interconnection of initiatives, coordination and monitoring of the regional cohesive approach and connection to the national program HCA GroenvermogenNL. In the process terminology of "focus, set up and perform," perpetuating and strengthening the liaison function has added value in *focusing* and *setting up* the responsive infrastructure and the regional cohesive approach. *Performance*, implementation, takes place within the regional PPPs, Campuses, Fieldlabs and Learning Communities.



Figure 2.2: Process terminology: Directing, Furnishing, Performing.

Pointing

The PPPs, program office NZKG and development company NHN act as nodes in the widespread and finely meshed ecosystem characteristic of the North-West region. The liaison team is in close contact with each PPP, NZKG and NHN. Thus, the liaison team has insight into the development and contribution of the regional initiatives to the regional ambitions for labor market and hydrogen transition and the national ambitions of HCA GroenvermogenNL and the top sector Energy. The liaison team connects the HCA GroenvermogenNL ambitions nationwide with the ambitions of the PPPs.

Furnish

The liaisons support PPPs, Learning Communities, private parties and educational institutions in setting up -elements of- the responsive infrastructure. This can be by helping to develop project applications on content, networking, connecting resources etc.. The liaisons also connect national initiatives from the HCA GroenvermogenNL with the regional initiatives for the purpose of setting up the responsive infrastructure. The connection and collaboration with initiatives in the North-West region and initiatives in other GroenvermogenNL regions is also facilitated.

3. Activities and Operationalization.

From: "[The power of network steering](#), Ten building blocks for a smart, green and healthy Metropolis Amsterdam" by Jacqueline Cramer i.o. of the Amsterdam Economic Board 2022 - p.19:

Every major transition is a compilation of numerous initiatives, each consisting of four phases:

1. The preparation of an initiative
2. Building and realizing a joint initiative
3. If the first initiative is successful: scale up
4. Mainstreaming the initiative

This four-stage process should not be seen as linear, but as a continuous, cyclical improvement process. Each transition initiative is not realized all at once, but needs several rounds of further improvements. The summation of a large number of transition initiatives may ultimately collectively lead to the realization of one major transition."

The two transitions this roadmap focuses on: the hydrogen and energy transition and the transition to a resilient, skills-oriented education and labor market also consist of a bundling of transition initiatives. Within PPPs and High Impact PPPs (the regional clusters), transition initiatives are being developed in the North West region that contribute to these two transitions. However, the ambition to achieve a responsive infrastructure for working, innovating and learning specifically for the hydrogen transition requires further cooperation and a regional cohesive approach on this topic.

Based on the Manifesto Working and Developing 2030, network steering is deployed in the North-West region on the themes [i] from work to work, [ii] lifelong development and sustainable employability, [iii] inclusiveness, [iv] innovation, [v] inflow and throughput/technology promotion and [vi] a working ecosystem & campus formation. The following cooperation model was developed for this purpose in the province of North Holland: [How do we want to cooperate?](#) In parts, the provinces of Flevoland and Utrecht are also joining this model.

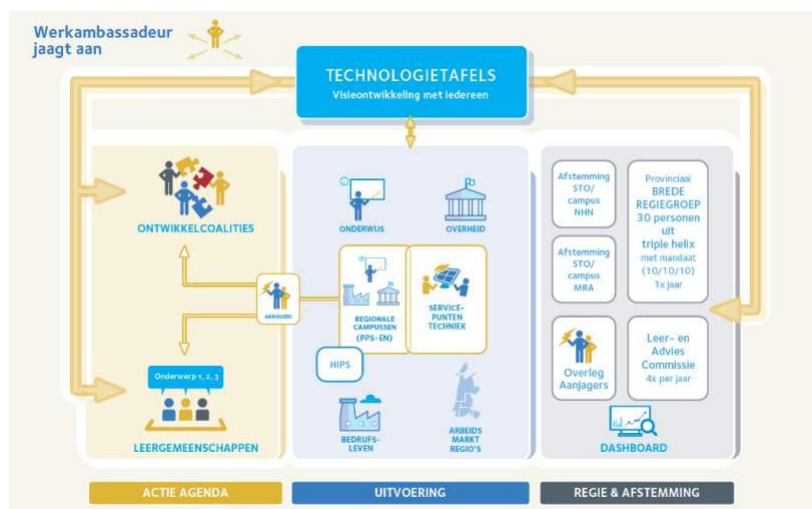


Figure 3.1: Collaboration model associated with Manifesto Working and Developing 2030.

The Green CapabilityNL Region Northwest liaison team is in close contact and aligns at various levels with the collaborative structures in this collaborative model. Building a responsive infrastructure in which work, innovation and learning come together to realize the human capital agenda for the hydrogen transition consists of a large number of transition initiatives, each laying out part of the puzzle. Figure 3.2 outlines the various elements that interact to give substance to the responsive infrastructure. Central to this figure is "deepening collaboration." Deepening collaboration to fulfill the human capital agenda within the "WIL triangle" of work, innovation and learning. Through further or retraining (to promote lateral entry and retain people for engineering), research and implementation (to make the latest knowledge quickly available to those in the field), learning in initial education MBO/HBO/ WO in close collaboration with professional practice and innovation pathways.

Employers and training institutes work closely together so that training modules fit the needs of the employer, but also lead to a diploma with civic value. Within this outline of a responsive infrastructure, learning communities, field labs, technology campuses and learning workplaces are key elements to achieving the human capital needed.

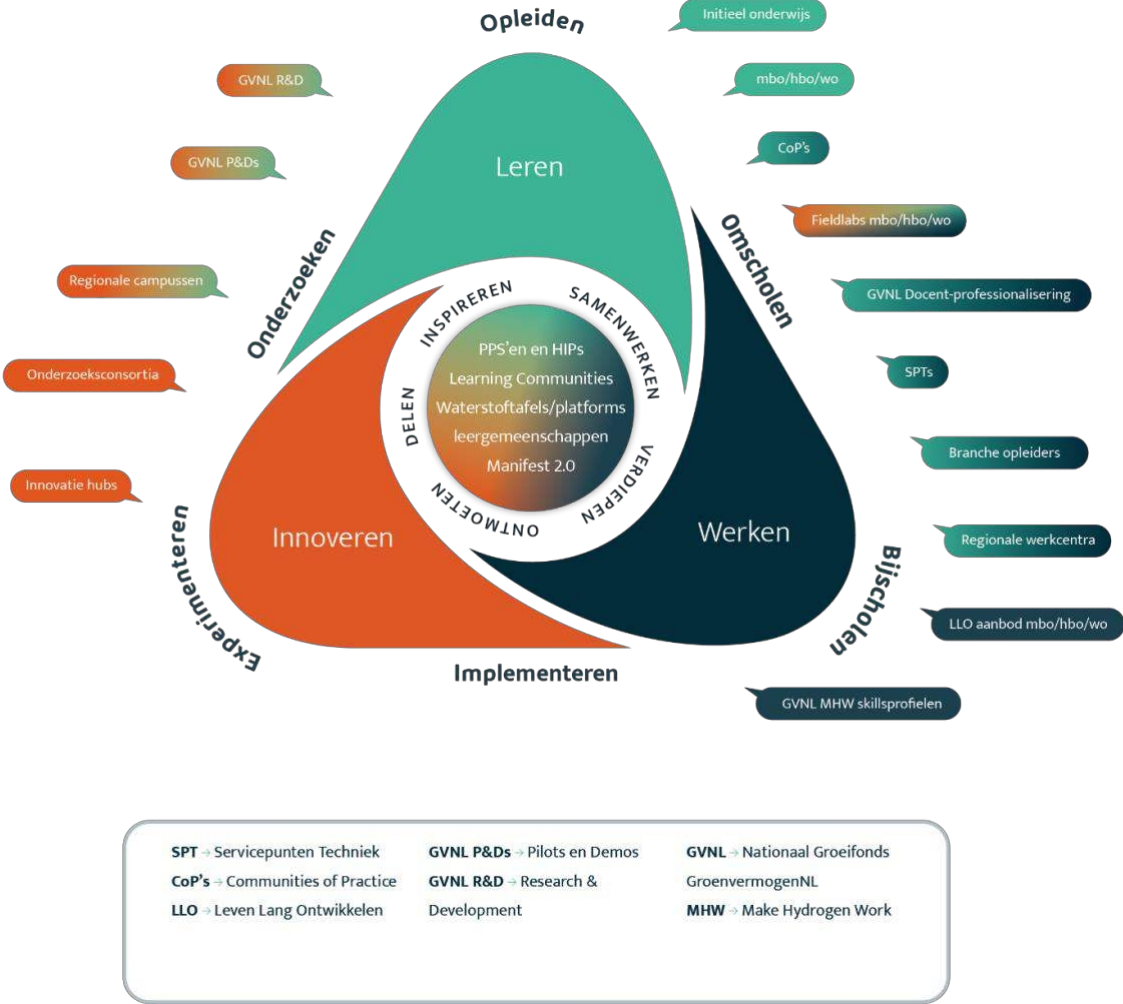


Figure 3.2: Elements that combine to give substance to a responsive infrastructure.

The liaison team ensures that the cohesive approach, the development of a responsive infrastructure and the connection with other regions and at the national level is secured.

The following sections elaborate on the main themes of "deepening cooperation" and "work-innovate-learning" and the activities of the liaison team and HCA-GVNL.

3.1 Collaboration Deepening

3.1.1 Transition initiatives in the region in view

Many transition initiatives in the region are in the preparatory/idea phase (phase 1 according to the phases transition initiatives go through: action plans are written, relevant parties hooked up and funding sources sought) or are under construction (phase 2: funds have -partly- been allocated and tools, methodologies and procedures are being worked on (within High Impact PPPs). There are also initiatives that are already operational (phase 3) and could be scaled up to start filling in part of the regional responsive infrastructure. The urgency of the energy transition broad HCA is felt in the region and is being driven by development coalitions of the Manifesto Working and Developing 2030. Regional engineering and technology campuses are working together to choose, learn, work and innovate. Despite the fact that much is still unclear regarding the numbers and skills profiles required for the hydrogen transition, educational institutions are taking the first steps to integrate knowledge about hydrogen into courses and initiatives are emerging to train professionals for the hydrogen transition. Initiatives are mostly still separate from each other - there are mutual contacts and consultations take place, but the focus is local and on the own PPP or HIP. The inventory of the current state of affairs revealed a large number of transition initiatives: from learning communities under development, test and lab facilities for innovation and training and the development of new education specifically for the hydrogen transition. Appendix A summarizes these.

Following the delivery of this roadmap, the liaison team, in consultation with the regional clusters, will invite the most promising transition initiatives that contribute to a responsive infrastructure for working, innovating and learning for the hydrogen and energy transition to collaborate in the next phase of the Green PowerNL program. Through hands-on design research for educational concepts and other pilot elements of the envisioned responsive infrastructure, a number of transition initiatives will be further developed and the effectiveness of these pilots and their contribution to the responsive infrastructure investigated.

The liaison team is supervising research on the effectiveness of various transition initiatives.

3.1.2 Connecting transition initiatives on the hydrogen value chain

The regional clusters in the North-West region each have a specific focus on the hydrogen value chain. However, there is also interconnection and overlap, both within the North-West region and with other regions. Ideally, transition initiatives share experiences and developed content, so that the wheel does not have to be invented in many different places at the same time.

Deepening and intensifying collaboration across their own PPPs and High Impact PPPs is necessary for this.

The liaison team facilitates meeting and connecting regional initiatives within the Northwest region and the national GroenvermogenNL regions. Examples include connecting regional learning communities with learning communities on the same topics in other GroenvermogenNL regions. Promoting collaboration and sharing of testing and lab facilities between institutions within the region and sharing of educational materials is also part of developing a responsive infrastructure for working, innovating and learning.

3.1.3 Promoting a "Cohesive Approach" in the region

In spring 2022, the Cabinet announced the introduction of the Green and Digital Jobs Action Plan, in addition to the generic policy against labor market tightness. In parallel, there is a large amount of investment programs from the National Growth Fund and from the European Union aimed at the energy transition or parts of it: GroenvermogenNL, LLO- Katalysator, scaling up PPPs and Vocational Education Katapult, Just Transition Fund, AINed, European Digital Innovation Hub and funding sources HCA from the top sectors. At the Top Sector Energy, the question arose: how do we manage this together? This gave rise to an exploration of a cohesive approach: [Final Advice - Cohesive Approach](#) to Human Capital for Energy Transition. Since all of these programs will be investing in training, innovation, lifelong development, upscaling, and labor market projects in the region in the coming years, they want to work together on this as well as possible.

The liaison team operates at the heart of the required transition, has an overview of what is happening in the region and provides the mutual connection and coordination to achieve a coherent approach between the various investment programs in the region. The liaisons join regional consultation structures such as the hydrogen table and the knowledge and innovation table of the NZKG program office, but also the High Impact PPPs. Liaisons assist in the development of transition initiatives. In doing so, they fulfill the role of independent transition broker.

The liaison team is working on a position paper commissioned by the directors of Engineering higher vocational and intermediate vocational education in the region. This position paper will outline how to achieve a multi-level (mbo-hbo), multi-disciplinary and multi-sectoral approach to achieve the objectives from the HCA agenda and the objectives from the growth funds. This will lay the foundation for interconnected continuous learning lines, realized and organized with each other, and matching the necessary movement towards flexible demand-oriented education, which will be shaped in cooperation with all relevant actors in the region.

3.1.4 Connecting region to national initiatives Green PowerNL

Within the GroenvermogenNL program, the following initiatives will be realized with regional commitment in the coming years, with a strong focus on national alignment, coordination and achieving synergy between the regions.

The regional liaison teams and regional transition initiatives provide -part of- the interpretation of the projects set up at the national level within the GroenvermogenNL program. The regions load pilots and ensure, among other things, that material is made available via a national digital infrastructure or platform. The figure below shows the various components of the GroenvermogenNL program.

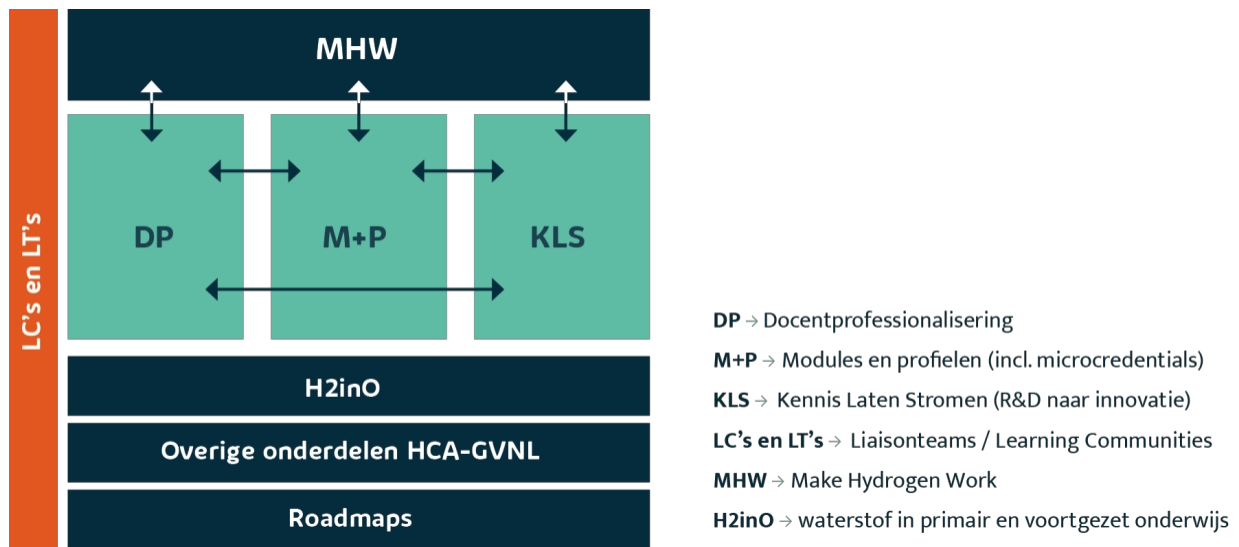


Figure 3.3: National program HCA Green PowerNL

LT = Liaison Teams: 7 liaison teams are active on behalf of GroenvermogenNL in 7 by GroenvermogenNL designated regions: North, Northwest, East, Brainport, West, Southeast and Southwest.

DP = Teacher Professionalization: the collectively organized component teacher professionalization program that educational institutions from all regions can join and make use of.

M+P = Modules and Profiles: jointly, in close coordination between the 7 regions, skill profiles will be developed for the hydrogen transition. In addition, it will be possible to offer modules through a national platform and relate them to the skill profiles. The development of skill profiles for hydrogen transition will make use of the knowledge present in the regions and developments at the European level: [Green Skills for Hydrogen](#).

Unlocking and application in the context of concrete career paths, lateral entry etc. takes place within the Make Hydrogen Work (MHW) component. Within MHW, attention is also paid to other elements, such as knowledge requests from and knowledge exchange with international parties.

KLS = Let Knowledge Flow: in learning communities and the national cooperation between learning communities, with national meetings etc. Central to this is the translation of new knowledge from innovations and research programs (such as the R&D work packages) into concrete application in the Work-Innovation-Learning triangle.

H2inO = national program line carried out by Platform Talent for Technology to interest young people at PO and VO level in the hydrogen transition and an education and profession that fits with it. Developed material is and will be available to the regions.

Roadmaps: the regional roadmaps are the underpinning for the national initiatives of GroenvermogenNL and the development of activities in the regions in the second phase of Green PowerNL.

The Northwest Liaison Team provides the connection, exchange, cross-fertilization and collaboration between regional transition initiatives and the national elements of the Green PowerNL program as described above.

A selection of regional initiatives are prepared to contribute and collaborate on the national initiatives from the GroenvermogenNL program.

3.1.5 Consortium formation for the purpose of GVNL phase 2.

We are putting together a region direction group consisting of a continuation of the current liaison team supplemented by a representative from the identified clusters, learning communities and the three provinces. The people in the region regiegroep function as linking pins between the clusters in region North-West and the national GroenvermogenNL initiatives.

This region direction group, led by the regional liaisons, is working toward an outline of activities and outcomes that lead to a regional responsive infrastructure for working innovating and learning. This outline forms the input for the sandpit process envisioned in the next phase of HCA- GVNL.

3.2 WIL: Working, Innovating and Learning

In the work-innovate-learning triangle, a multitude of transition initiatives are being worked on in the North-West region. In this section, we concretize the activities aimed at the creation of Learning Communities for the hydrogen transition, Test Facilities and Fieldlabs, Training Modules and Skill Profiles, Teacher Professionalization and the connection of the human capital agenda with innovation pathways. In January and February 2024 companies, knowledge institutions and governments identified in three sessions what learning communities, test and lab facilities and training (modules) are already available for the hydrogen transition, under development or in the idea phase.

Online, participants completed a "Mural." The Mural can be viewed through [this link](#). Appendix A tabulates the results for learning communities, testing facilities and field labs and training modules.

3.2.1 Learning Communities

Learning Communities (LCs) are pre-eminently a vehicle to carry out work, innovation and learning in a partnership between educational and knowledge institutions and companies. A number of learning communities are active in the region focused on the hydrogen transition. In addition, learning communities are under development or initiatives are in the idea phase. Within LCs, LC teams collaborate on specific topics, learn together and innovate together. Other LCs in the region primarily focus on sharing and exchanging knowledge and not on concrete collaboration on innovation or training.

Figure 3.4 shows an overview of the Learning Communities in Northwest region in relation to the hydrogen chain. A larger version of this overview is in Appendix A.

	H ₂ waardeketen & Energietransitie	H ₂ Productie	Infra & Opslag	Industrie	Mobiliteit, Transport, Agri	Gebouwde Omgeving	Elektriciteitsproductie & Systeemintegratie
1	H ₂ community NHH						
2		LC Offshore Energie (AYOP)					
3				LC Waterstof (Techport)			
4					LC H ₂ in Agri (GreenChain)		
5						de Groene Walvis (NHH)	
6							LC Systeemintegratie (HvA)
7		ZepHYros project (NHH)					
8				CoP Warmtetransitie (HvA)			
9					CoP Clean Mobility (HvA)		
10			Community Transportleidingen (RoCvA)				
11							SES Community (NH)
12							Energy Hubs (NH)
13	AMCEL						
14	Transitie Community			(HvA FT)			

Figure 3.4: Learning Communities in Northwest region: green = operational, orange = under development, d.blue = idea phase.

Based on this overview, the next phase will look at how these learning communities contribute to fulfilling the human capital agenda and how effective the learning community approach is for that purpose.

Based on this overview, connections are being made between learning communities working on the same themes: both within the North West region and beyond. For example, with the learning community Offshore Energy, there are similar initiatives in the other coastal regions. It is interesting to explore the extent to which national cooperation and regional initiatives can reinforce each other.

Within learning communities, work is often done on pilots and demos. The next phase explores the extent to which the knowledge gained can be generalized and translated into education.

3.2.2 Test Facilities and FieldLabs

In Appendix A an overview of all fieldlabs and test facilities in Northwest region as retrieved in the aforementioned sessions with relevant parties in the region. Within PPPs and High Impact PPPs, regional campuses and test facilities/fieldlabs for the hydrogen transition are being strengthened. Here, MBO, HBO and WO students, trainees and professionals already working in the sector are gaining practical and research skills.

Have relevant lab infrastructure connected to training modules for both full-time education and LLO offerings. This includes looking at the possibility of sharing facilities and setting up an optimal lab infrastructure for hydrogen education in the region. This will involve close cooperation with the Province of North Holland and Flevoland to keep the overview of facilities in the region as up-to-date as possible and to encourage cooperation between facilities.

3.2.3 Educational Modules and Skill Profiles.

Regional educational institutions MBO, HBO, WO, commercial training providers whether or not commissioned by industry associations, business academies such as the Tata Steel Academy, the Alliander training center and Royal Haskoning DHV, are all working on education and training offerings for the hydrogen transition. One of the ambitions of GroenvermogenNL is to make these offerings visible and findable along a recognizable and unambiguous route. The main goal here is for someone who wants to play a role in the energy or specifically hydrogen transition to gain insight into his or her already present skills and knowledge level and which education or modules can lead him or her to a particular position.

The North-West Region contributes to the above-mentioned main goal by working with the partners involved in the region to further elaborate skills and occupational profiles for the hydrogen chain and to test them in the nationally developed digital environment. One of the exercises associated with the elaboration of skill profiles is the determination of the required occupational profiles and associated skills. Figure 3.5 shows an initial attempt to identify which occupational profiles are needed at what point in the hydrogen transition.

The liaison team has insight into the educational offerings relevant to the hydrogen and energy transition and coordinates where possible to encourage exchange and cooperation between regional clusters. It also enables gaps in supply to be spotted so that adjustments can be made quickly and effectively: an important element in the responsive infrastructure.

Already existing or under development educational modules and training offerings from partners in the Northwest region form the basis for conducting pilots.

In the second tranche of the incidental grant, through mid-2025, pilot modules for LLO offerings will be developed and tested that will determine the impact on time-to-job.

This is connected to the Green Skills for Hydrogen taxonomy established within an EU context. The ambition is to collaborate with other regional liaisons and regions to develop and test educational resources for these required professional profiles. The cooperation should ensure alignment on content, prevention of duplication in development of educational offerings and accessibility of educational offerings for everyone who wants to be trained to fulfill a role in the hydrogen transition.

Routekaart H₂ beroepsprofielen

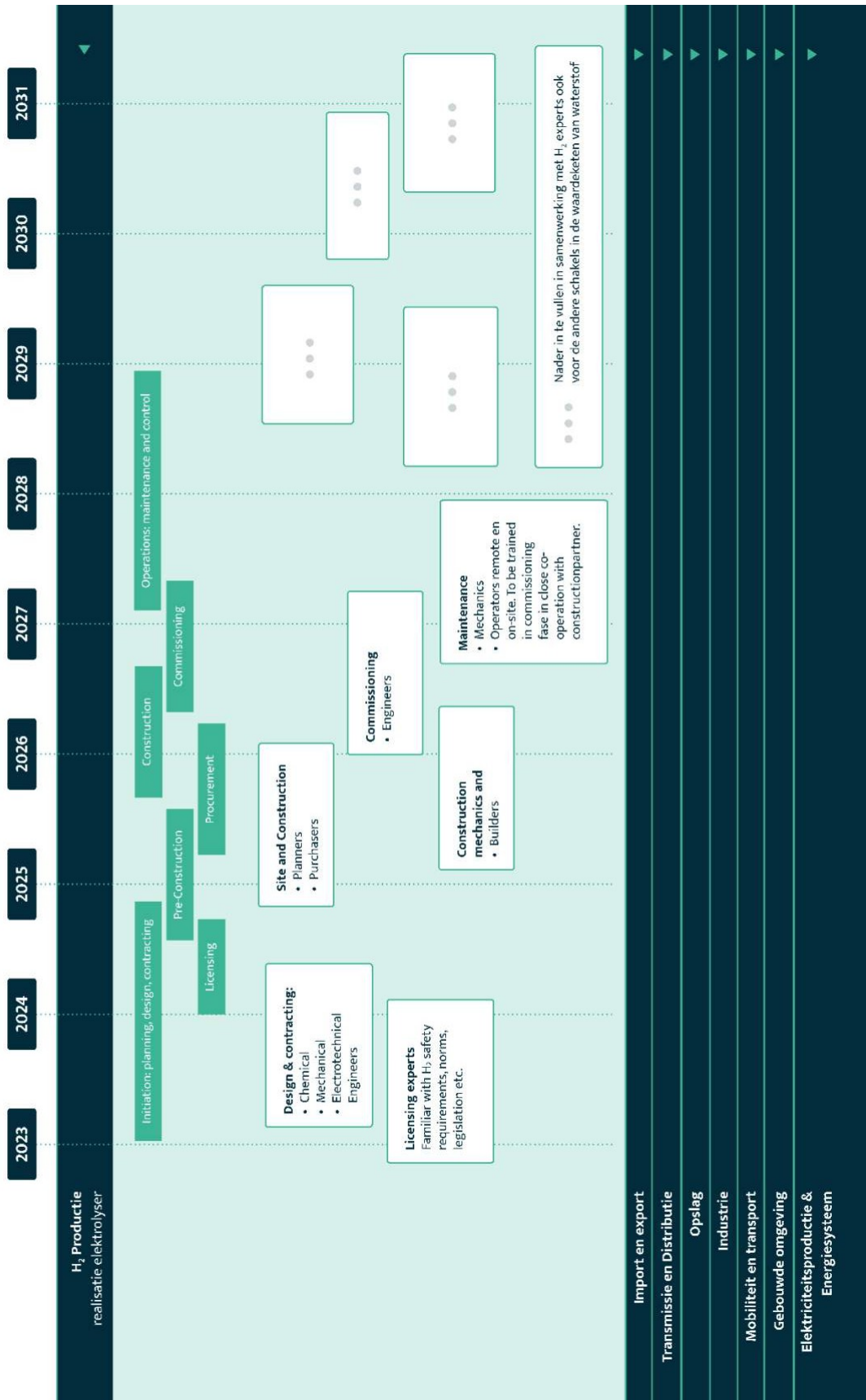


Figure 3.5: Hydrogen transition: sketch of required occupational profiles over time.

3.2.4 Teacher professionalization

At the end of March 2024, the start-up phase of the teacher professionalization track will be completed within the project "Start-up activities Learning Communities" of HCA GroenvermogenNL. ROC Noorderpoort and STC Brielle developed this trajectory together and piloted it in some regions during the past year. Within this trajectory, a basic course on "hydrogen education" and "safety in the hydrogen lab" have been developed. In addition, materials are ready for the development of educational modules on hydrogen and safety (safety certificate college and mbo), hydrogen in mobility and hydrogen in industry. Teacher professionalization is a course that a group of MBO and/or HBO teachers goes through to develop their own hydrogen education modules. The track provides support by hydrogen experts and experienced teachers and providing content. In the next phase of HCA GroenvermogenNL, teachers or teacher teams can start a teacher professionalization track on their own initiative. From HCA GroenvermogenNL, this will be facilitated by making the knowledge base available and connecting experts to teacher teams or groups. A national coordinating team will be put together that includes a representative/booster from each GroenvermogenNL region. This person collects and shares materials developed in the region and organizes regional teacher professionalization programs.

The liaison team region Northwest provides a region representative to the national coordinating team teacher professionalism. He/she has visibility into the development of hydrogen-related education in the North-West region and shares materials with the national team and hydrogen knowledge platform where possible. This person also organizes regional teacher professionalization tracks.

3.2.5 Innovate

Innovation for the hydrogen transition takes place within the R&D and Pilots&Demos work streams of GroenvermogenNL. The ambition of work stream HCA GroenvermogenNL is to embed new knowledge and innovations in education as quickly as possible and to develop them to a higher TRL level (7-9) within the partnerships and learning communities. The aim is to involve not only research groups and professorships, but also students and teachers in the development of innovations to higher TRL levels. In addition, the aim is for new knowledge to be integrated as quickly as possible into the education on offer. Connection with R&D packages is necessary to gain and maintain insight into the demand for professionals, what knowledge and skills they need and how much demand there is for that professional.

The regional liaison team is committed to valorizing knowledge from Learning Communities and the GVNl R&D packages toward LLO and initial supply in the region. Along the knowledge and innovation table and the hydrogen table of the North Sea Canal Area and the hydrogen platforms of Utrecht and Flevoland, connection is sought to R&D packages and Learning Communities.

The regional liaison team supports and facilitates activities aimed at knowledge sharing and providing inspiration with e.g. thematic meetings based on the hydrogen chain or thematic regional safaris.

What can we learn from successful HCA projects and how do we apply this within the hydrogen transition and vice versa: what is already available for the HCA hydrogen transition and can we embed this in existing HCA projects?

4. KPIs and Key results

There is a national monitoring system for the HCA-GVNL that provides insight into the progress, results and course of the HCA as a whole as well as the individual components such as the roadmap of the North-West region during the entire term (2021-2028).

The national monitoring design uses "hard numbers" on the one hand, and reflection on the question: are we doing the right things and are we doing things right? For the regional roadmaps, this reflection is secured through dialogue and discussion with critical friends appointed at the national level.

Quantitative monitoring is important, but not all-important. HCA-GVNL recognizes that the "final situation" cannot be hard and clearly defined at this time. Rather, there are scenarios with variations in time, size, sector and degree of innovation and technology development. The KPIs and key-results used by the HCA-GVNL board have been defined by the GroenvermogenNL board. Here, at the highest impact level, "shortening the time to job" is central.

4.1 Shortening the time-to-job

Shortening time-to-job as the "highest impact" sets the course for the activities and operationalization described in chapter three. Activities aimed at deepening collaboration and developing a responsive infrastructure for working, innovating and learning.

Above that, shortening time-to-job depends on a candidate's pre-existing competencies and skills, flexibility in training offerings and the employer's needs.

These 3 components can be influenced by:

1. Good view of the gap between present competencies and needed competencies, with a broad view; not only acquired education results but also preferences, motivations and practical experience.
2. Flexibility of educational offerings (modular) with civil effect (microcredentials) and opportunity for continuous learning.
3. Validated competency and skills-based recruitment profiles based on Green Skills for Hydrogen, among others.

Re 1

A skills passport and thorough skills assessment methodology are valuable for both the candidate, the trainer and the (future) employer to quickly land a candidate at an appropriate training offer and subsequently make the step to a (learning) workplace. Result: Assessment methodology and skill passport applied to potentials for the hydrogen transition: brought from pilot to mainstream in 3 years time.

Re 2

In North-West region, one of the core activities is the development of professional profiles for hydrogen transition: together with roc, hbo, wo and industry.

Result: from 2 to 4 to 6 occupational profiles for hydrogen transition in the next 3 years.

Re 3

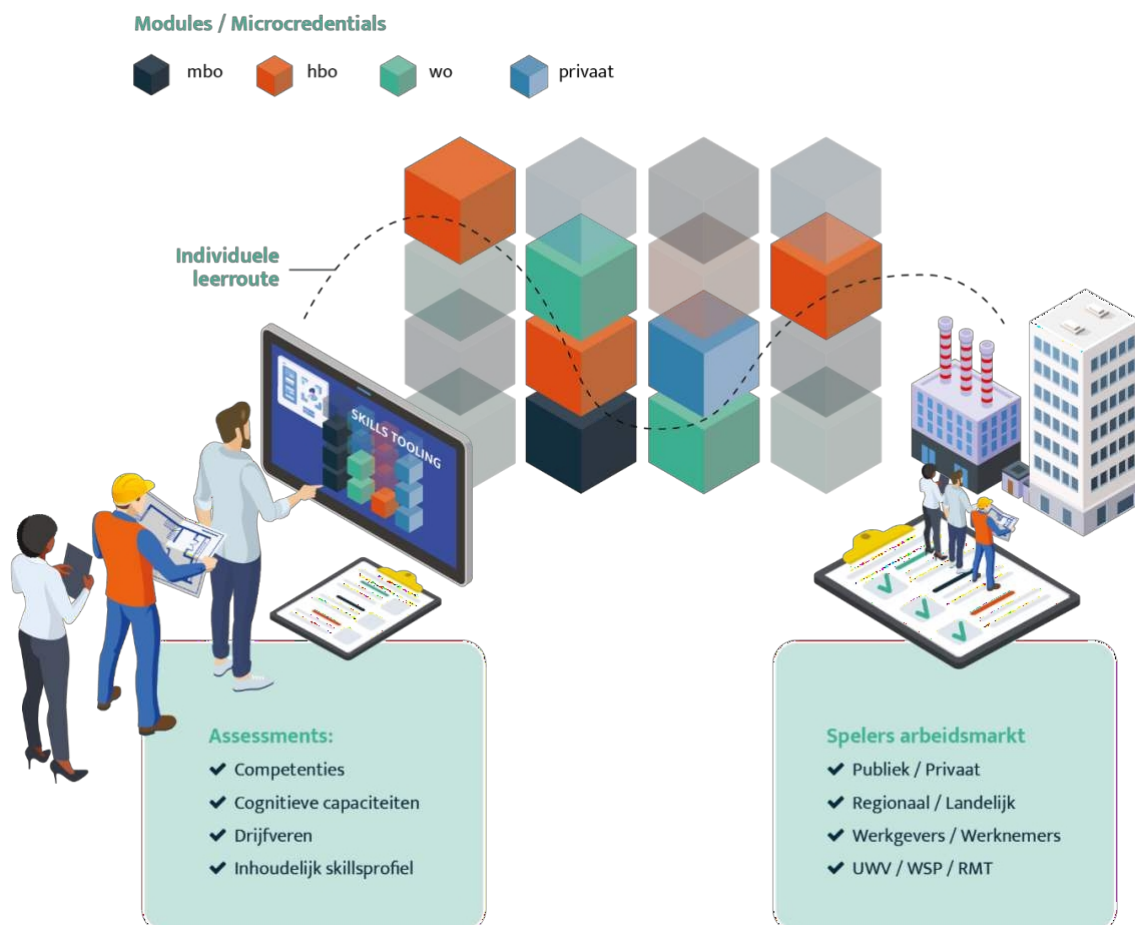
Along with the introduction of a skills passport and a centrally directed skills assessment methodology, business will have to work toward competency-based work.

Result: recruitment, selection and valuation of an employee are increasingly based on competencies rather than diplomas - perhaps quantifiable through analysis of job ads, supply of apprenticeships in the work field, etc.

The activities from chapter three and the development of skills- and competency-oriented training and recruiting outlined above lead to an increase in:

- Offering training and education modules for the hydrogen transition
- Number of participants in training and education offerings: from students in initial education to professionals and lateral entrants.
- Number of companies participating in learning communities, PPPs and High Impact PPPs.

The visualization below shows how the three components work together to reduce time to job.



Appendix A "Responsive Infrastructure."

We distinguish the following elements in North-West region that, in conjunction with each other, provide a responsive infrastructure for working, innovating and learning:

- PPPs, High Impact PPPs and H2 platforms (Who?).
- Labor market regions and their Engineering Service Points (Who and Where?).
- (Field) Labs, Test Facilities and Campuses (Where?).
- Learning Communities (How?).
- Educational offerings Initial and LLO mbo, hbo, wo (What?).

PPPs, High Impact PPPs and H2 platforms North West region

1. NHN regional cluster
 - Green Chain NHN
 - Maritime Cluster NHN
2. IJmond/South-Kennemerland regional cluster.
 - Techport
3. Zaanstreek/Waterland regional cluster.
 - Techlands
4. Amsterdam regional cluster
 - Green Tech Campus MRA
5. Flevoland regional cluster
 - MRA Circular and Digital in Thinking, Learning & Doing
6. Utrecht regional cluster
 - Vakcentrum Duurzame Energie Midden Nederland

In addition to the PPPs and High Impact PPPs, the [Noordzeekanaalgebied program office](#) and the [Noord-Holland Noord development company](#) play an important connecting and initiating role in the province of North Holland. In Utrecht province, parties from the triple helix are similarly connected in the [covenant Waterstof Utrecht](#). In Flevoland province, the ["FLHY" platform](#) fulfills this role of initiator and connector for the hydrogen transition.

Labor market regions and Service Points Engineering.

Green PowerNL North-West region includes the following labor market regions (source: [My Maps - Region Atlas](#) maps regional cooperation, accessed 4-2-2024):

1. North Holland North | SPT NHN
2. Zaanstreek Waterland | SPT Zaanstreek Waterland/Techlands
3. South-Kennemerland and IJmond | SPT Techport
4. Greater Amsterdam | ASTA
5. Gooi and Vecht region | SPT Midden
6. Flevoland
7. Mid-Utrecht
8. Amersfoort

There is 1 central coordinator for the 5 Service Points Engineering in the first five labor market regions. More information can be found at: [NHinzicht.nl](#).

Learning Communities

	H ₂ waardeketen & Energietransitie	H ₂ Productie	Infra & Opslag	Industrie	Mobiliteit, Transport, Agri	Gebouwde Omgeving	Elektriciteitsproductie & Systeemintegratie
1	H ₂ community NHN						
2		LC Offshore Energie (AVOP)					
3				LC Waterstof (Techport)			
4					LC H ₂ in Agri (GreenChain)		
5						de Groene Walvis (NHN)	
6							LC Systeemintegratie (HVA)
7		ZepHYros project (NHN)					
8				CoP Warmtetransitie (HVA)			
9					CoP Clean Mobility (HVA)		
10			Community Transportleidingen (RoCVA)				
11							SES Community (NH)
12							Energy Hubs (NH)
13	AIMCEL						
14	Transitie Community			(HVA FT)			

green = operational, orange = under development, dark blue = idea phase

Field Labs and Test Facilities to H₂ value chain

green = operational, orange = under development, dark blue = idea phase

Insert table

Training offer

green = operational, orange = under development, dark blue = idea phase

Insert table

Appendix B Transition Initiatives Northwest*

* not exhaustively described - work in progress

Activity	PPP Trade Center Sustainable Energy
Tractor + Partners	ROC Midden Nederland. 4Some technical management, Bloemendal Bouw, Hogeschool Utrecht, Radiair Totaalinstallatie, Studio OxL, Van Schoonhoven Infra, AbelTalent, Bouwend Nederland, Homij, Siemens, Wij Techniek, Sellox, Ballast Nedam, Municipality of Nieuwegein, Level 5, Strukton Infratechnieken, Sustainability Certification, OOI Opleiding, Mammoet, MW Holodeck and Development in Insulation.
Start date	January 1, 2021
Website	https://tech.rocmn.nl/alles-over-het-tech-college/vakcentrum-duurzame-energie
Duration	4 years?
WHY: train students for tomorrow's energy-efficient building and living.	
IST:	
AMBITION 2024 and beyond:	
SOLL:	

Activity	CoVE SEED project
Tractor + Partners	Hogeschool Utrecht, ROC Midden Nederland, ...
Start date	?
Website	https://tech.rocmn.nl/alles-over-het-tech-college/vakcentrum-duurzame-energie
Duration	?
WHY: Cooperation between 5 EU regions seeking to innovate vocational education in renewable energy & develop. Goals: training that better matches the labor market, an increased supply of well-trained professionals and the development of new technologies.	
IST:	
AMBITION 2024 and beyond:	
SOLL:	

Activity	Program Be an Engineer - side entry students
Tractor + Partners	HvA, HAN, WIJ Techniek, Homij, Heijmans, Bouwend Nederland,
Start date	2018?
Duration	Go-live 2024, possibly with funding from LLO catalyst.
WHY: A potential source of labor potential for the hydrogen economy is lateral entrants. Developing pathways in which lateral entrants study part-time or modularly and work at a company at the same time is interesting because it reduces the time to hire and time to pay value shortened.	
IST: Be an Engineer is a collaborative initiative of colleges and companies to recruit more technical talent. The program offers an opportunity for a part-time education as a lateral entry student, while also working directly with an employer. The employer pays the salary and training costs. Be an Engineer is broadly technical and currently lacks a track specifically focused on the hydrogen economy.	
AMBITION 2024 and beyond: Be an Engineer's ambition in the Northwest region is	
SOLL: Be an engineer has successfully expanded to include a hydrogen transition-focused track within the engineering part-time bachelor's degree, has a large pool of hydrogen-related business partners and also offers short upskilling or continuing education courses focused on the hydrogen transition. To increase they intake numbers, recruitment of hisinstromers is an integral part	

of the Be an Engineer program.

Activity	Make IT Work program: they enter IT
Website	Make IT Work - Retraining to an IT job at college level (it-omscholing.co.uk)
Tractor + Partners	HvA, Amsterdam Economic Board, HAN, Fontys University of Applied Sciences, Municipality of Hilversum, IT Academy Noord-NL (Hanze), Katapult, MediaPark Hilversum, Media Perspectives, MRA, Ministry SZW, MyBit, NLdigital, SAP NL, CA-ICT, TechMeUP.
Start date	2015
Duration	Continuous
WHY: Digitalization plays an important role in the hydrogen and energy transition. A possible source of labor potential for the hydrogen transition is lateral entrants into IT. The Make IT Work program, in which lateral entrants are prepared for a job in IT in 5 months with a job guarantee, is interesting because it shortens the time to hire and time to wage value. Lessons learned from Make IT Work are interesting to include in the new compact to be developed. training programs.	
IST:	
AMBITION 2024 and beyond:	
SOLL: Applied IT for hydrogen and/or connecting companies involved in the hydrogen transition.	

Activity	Learning Community Hydrogen
Website	
Tractor + Partners	Techport Technology Campus Foundation, ROC NOVA College.
Start date	September 1, 2023
Duration	
WHY: The arrival of hydrogen-related plants has major implications for asset owners, engineering firms and (SME) maintenance companies that design, operate and maintain the plants. They must prepare themselves, both in terms of knowledge and innovation, and the resilience and agility of their employees.	
IST: The ecosystem (companies, knowledge and educational institutions, labor market parties, governments, partnerships and umbrella organizations) is not ready for the arrival of hydrogen; neither technically nor organizationally. Knowledge is fragmented and individual parties do not know how to find each other.	
AMBITION 2024 and beyond: The safe and competent Design, Operation and Maintenance of hydrogen-related industrial plants.	
SOLL:	

Activity	Transition Community NZKG
Website	N/A.
Tractor + Partners	Program Office NZKG i.c.w. HvA Faculty of Technology training Engineering Stork, Siemens Gamesa, HyCC, The New Energy Coalition, AMCEL/UvA, ETCA, AYOP, ROCvAF.
Start date	Fall 2023 - start project formulation and dialogue
Duration	?
WHY: The energy transition in the North Sea Canal Area (NZKG) is a complex challenge with diverse stakeholders. This initiative focuses on creating a collaborative ecosystem for talent, innovation and transition, and emphasizes the involvement of MBO, HBO and WO, as well as four expertise labs. Moreover, we introduce the directing role of the NZKG Program Office, in collaboration with New Energy Coalition, to support SMEs in their innovation and labor market issues in the North Sea Canal area.	
IST: The ecosystem is not ready for the arrival of hydrogen. Late 2023 5 students HvA Engineering with integral project started i.o. HyCC.	
AMBITION 2024 and beyond: The Transition Collective NZKG connects existing initiatives in the labor market and in learning systems, in collaboration with four expertise labs: <ol style="list-style-type: none"> 1. Heat transition at the Energy Lab of the Hogeschool van Amsterdam 2. Hydrogen system integration in the ETCA 3. Electrochemistry at AMCEL/UvA 4. Offshore wind in collaboration with AYOP/ROCvA We promote cooperation and innovation, increase the value of the labor market and develop into a powerful regional learning network and knowledge partner for the energy transition.	

SOLL: an effective collaborative system that enables companies, educators and governments to jointly develop the challenges of industrial energy transition in the NZKG, with the support of four expertise labs and the directing role of the NZKG Program Office in collaboration with The New Energy Coalition.

Activity	Project Zephyros
Website	https://zephyros-nhn.nl/
Tractor + Partners	Port of Den Helder , Green Shipping Waddenzee, New Energy Coalition, Inholland, TU Delft, Engie, Total Energies, Damen.
Start date	2022
Duration	?
WHY: Zephyros promotes the development of a green hydrogen infrastructure in the Wadden Sea ports and its use in the maritime sector through renewable energy generation with solar park, electrolysis, a hydrogen refueling station and the construction of hydrogen service vessels.	
IST: Pilots have been developed and are currently being tested (hydrogen refueling station, electrolyser, H2 service boats)	
AMBITION 2024 and beyond:	

Activity	Sustainable Energy Systems Community province of North Holland
Website	
Tractor + Partners	Province of North Holland
Start date	2022
Duration	?
WHY:	
IST: The province of North Holland has established an Energy Infrastructure Task Force. Within this task force, the province, grid operators and involved municipalities are tackling the main bottlenecks in the electricity grid. At the same time, it is designing future-proof new energy networks and looking for smart grid solutions that make efficient or limited use of the electricity grid. In addition, the task force has created a regional Sustainable Energy Systems community. On a monthly basis, parties from the region who have something with the energy transition need or want to get together online to exchange knowledge and design/research together.	
AMBITION 2024 and beyond:	

Activity	Learning Community Offshore Energy
Website	
Tractor + Partners	AYOP + partners, supported by TKI Wind at Sea and RVO
Start date	2024
Duration	?
WHY:	
IST:	
AMBITION 2024 and beyond:	

Activity	Community of Practice Clean Mobility
Website	
Tractor + Partners	HvA Faculty of Engineering + partners
Start date	2023
Duration	?
WHY:	
IST:	
AMBITION 2024 and beyond:	
Activity	Fieldlab H2inAgri
Website	

Tractor + Partners	
Start date	
Duration	
WHY:	
IST:	
AMBITION 2024 and beyond:	

Activity	Enexel Kitchenlab UvA Lab facilities electrochemical conversions
Website	
Tractor + Partners	
Start date	
Duration	
WHY:	
IST:	
AMBITION 2024 and beyond:	



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