

Green powerNL HCA Roadmap Region East

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Feb. 28, 2024

Table of contents

1	Introduction	3
1.1	Establishment of liaison team	5
1.2	Methodology	6
2	Region Exploration	8
2.1	Arnhem-Nijmegen center region	8
2.2	Brainport center region	14
2.3	Content interpretation	19
2.4	Teaching and research network	23
2.5	Conclusion	26
3	Activity Plan	28
3.1	Activities	28
3.2	Monitoring	34
3.3	Organization and implementation	35
	Appendix 1: Descriptions of activities.	36

1 Introduction

The Netherlands, along with the rest of the world, faces an immense climate challenge. The fossil-based society and industry must be transformed. The Netherlands is doing this with green hydrogen, the green power, as the pull for that transition.

GroenvermogenNL is the program for this green capital that allows the Netherlands to build a new industry and an attractive business climate that goes hand in hand with contributing to a climate-neutral world.

With an integrated approach, GroenvermogenNL is creating 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 commitment is to make better use of the knowledge and skills with 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 to achieve common goals within four specific pillars.

To strengthen the ecosystem and bring the Netherlands into the European lead, the following pillars have been defined:

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

Pillar 4, the Human Capital Agenda (HCA) is, as expressed in the core document¹ 'Bridge to the Future', *'the "enabler" for the ambitious activities regarding the production and transport, storage & transshipment of hydrogen and its (large-scale) application in industry and other application areas such as mobility & transport and the built environment.'* Thereby, the condition for success of these ambitious activities is described: *'the sufficient availability of professionals with knowledge and skills of hydrogen and its application. For this, it is necessary that new and necessary knowledge becomes quickly available in both mainstream education and for the education and training of professionals already working. Education and training will also need to pay more attention to learning to innovate and renew as a basic competency. Given the task, these programs will have to be able to operate with scale. And they will have to be agile in content and design because of the rapid developments in the field of hydrogen.'* The HCA GroenvermogenNL consists of several work streams that together must lead to the realization of the above condition. This is clearly shown in the overview below.

¹ See [https://np-groenvermogen-production.s3-eu-west-1.amazonaws.com/Bijlage-2b_HCA-
implementatieplan-GroenvermogenNL-dec2021.pdf](https://np-groenvermogen-production.s3-eu-west-1.amazonaws.com/Bijlage-2b_HCA-implementatieplan-GroenvermogenNL-dec2021.pdf)



Specifically, HCA GroenvermogenNL identifies five related work streams:

- Workflow 1: Mapping knowledge areas;
- Workstream 2: Realize and scale up Learning Communities and mobilize region;
- Workstream 3: National Knowledge Platform knowledge exchange and training opportunities;
- Workstream 4: National Package of Educational Programs Hydrogen;
- Workstream 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 three core activities were carried out, namely:

Workstream 2: Realize and scale up Learning Communities and mobilize region

- 2.1: Appointment of regional liaisons and development of regional roadmaps.
- 2.2: 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 result of Work Stream 2.1, the HCA roadmap for **Arnhem-Nijmegen/Brainport region**, often called **region East**.

1.1 Establishment of liaison team

For the implementation of Work Stream 2.1, six universities of applied sciences in as many regions were asked to appoint a regional liaison team to develop the regional roadmap. This working method contributes to a solid start as the liaison teams have strong networks in the sector and region. Within the Arnhem-Nijmegen/Brainport region, the liaison (core) team was initially formed from the **Sustainable Electrical Energy Centre of Expertise**² (SEECE) and consists of experienced people within research and education with good networks covering the quadruple helix.

In addition, the team includes an experienced member focused on communications. A primus inter pares has been appointed within the liaison team. In addition to his regional role, he is a structural participant in the national HCA GroenvermogenNL core team consultation in which the national coordination between the HCA regions is realized (other team members also regularly participate in this consultation). The primus inter pares is also part of the structural GroenvermogenNL consultation across all the pillars, one of the aims of which is to optimally link the HCA to the R&D, Demonstration and Pilot pillars. For specific cooperation between the HCA and R&D pillars, the primus inter pares of Region East is a member of the NWO Advisory Board that advises the consortia on content and cooperation during the workshops of the R&D work packages.

During the start-up year, it once again became clear that the evolving labor market within the hydrogen sector is particularly challenging at the MBO level. For this reason, the liaison team was strengthened from the **Tech in Motion**³ (TiM, a national practical training center) and the network was immediately reinforced with typical partners from MBO institutions. Brainport Development represents the ecosystem in and around Eindhoven and Helmond consisting of companies, municipalities, knowledge institutions and other organizations and is part of the HCA Green PowerNL region East. Cooperation with **Brainport Development**⁴ has been initiated and shaped and Brainport Development has also become part of the liaison team. Members of the liaison team are part of the **Decentralized Hydrogen SPRONG**⁵ program so that the **Stedendriehoek** and **Overijssel** are also part of the development of the GroenvermogenNL roadmap.

In addition to the reinforcement as shown above, explicit cooperation has been established within the East Region with Kiemt and more specifically with the **Kiemt Hydrogen Cluster**⁶, often referred to as H2Cluster, consisting of (supra-regional) SMEs and start-ups and scale ups in the hydrogen sector. This cooperation is important for the platform it gives the liaison team and thus GroenvermogenNL. Conversely, the added value for the H2Cluster is equally important. At the time of this writing, direct cooperation has started with the industry association **Dutch Hydrogen & Fuel Cell Association**⁷ (NWBA). The NWBA aims to promote the application of hydrogen and fuel cell technology in the Netherlands in the broadest sense to make society more sustainable. The strong overlap with the objective of GroenvermogenNL makes cooperation with the industry association promising and important. The added value can be found in the strengthened (business) network with national coverage and the contribution the NWBA offers where it concerns

² <https://www.han.nl/onderzoek/centres-of-expertise/seece>

³ <https://technimotion.nl>

⁴ <https://brainporteindhoven.com/nl/ontdek/brainport-development>

⁵ <https://www.nwo.nl/projecten/spralg01004>

⁶ <https://www.kiemt.nl/programmas/waterstofcluster>

⁷ <https://www.nwba.nl/>

joining forces, sharing knowledge and representing the hydrogen sector within national and international initiatives.

1.2 Methodology

The methodology used corresponds with the trajectory proposal REGIONAL LIAISONS AND REGIONAL ROADMAPS REGION EAST_ submitted under Regieorgaan SIA regeling *Regionale liaisons en learning communities 2022*. The track proposal describes an approach to arrive at a supported roadmap for which ownership is taken. The approach is based on Bruce Tuckman's team development model in which the phases Forming, Storming, Norming, Performing and Adjourning are defined.

The first period, the forming phase, of the development of the present roadmap has consisted of introductions, during one-on-one meetings and (quadruple helix) meetings, in the context of GroenvermogenNL. The meetings have mostly used existing structures. For example, a SEECE H2 Learning Community meeting, the HAN/SEECE/BES/Kiemt H2 Event,



Kiemt H2Cluster and a specially created Kiemt HR H2Cluster meetings, a NWBA ALV and dedicated Brainport Development GvNL meetings deployed to introduce the GroenvermogenNL program, discuss developments in the market and among specific key players, explore challenges and share ambitions and initiatives where overlap and mutually reinforcing elements were identified. There is enthusiasm and endorsement of the objectives of GroenvermogenNL. The input gathered has formed the basis for follow-up steps such as the

formation of the Kiemt HR H2Cluster, the GvNL core team and the Brainport Development GroenvermogenNL team. Activities were also initiated from the liaison team, which was expanded in response to the input, regarding relevant follow-up explorations with specific (groups of) partners.

In the follow-up to the forming phase, the storming phase, the choice was made for a joint model-based approach and a number of tracks were set up in parallel on groups of motivated and well-equipped like-minded people and explicitly in quadruple helix context and across the various professional and educational columns. The latter because this is the starting point of the HCA GroenvermogenNL. The liaison team carried out follow-up explorations within the Arnhem-Nijmegen region and within the Brainport region with specific partners from which activities with (proven) potential and added value were identified and added in coherence to the HCA building blocks for the region. In a second track, the follow-up exploration and the elaboration of the input within the Kiemt HR H2Cluster were continued. The third track focused on administrative traction.

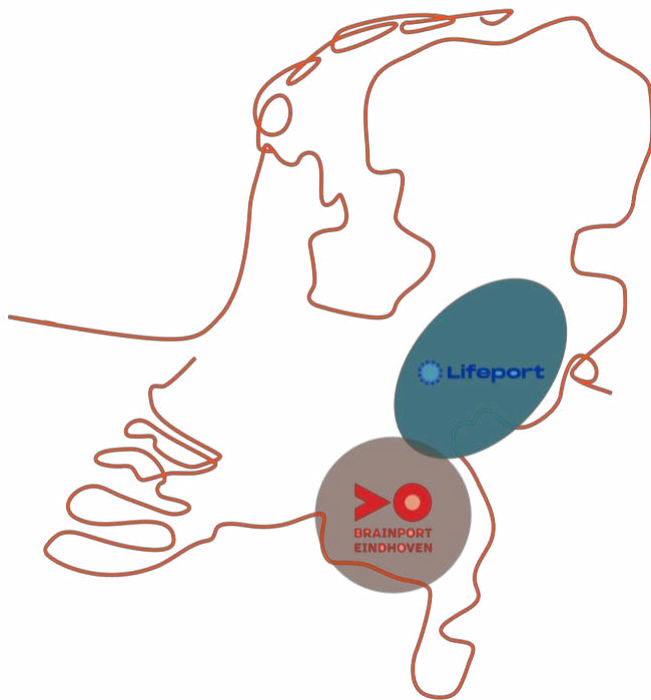
With this, a bottom-up-top-down approach is envisioned that contributes to a prosperous and decisive elaboration and follow-up of the present roadmap.

Administrative traction has been secured in the Lifeport region, as described below, through the Human Capital Agreement Arnhem-Nijmegen Region⁸. Administrative traction is underway in the Brainport region. The municipalities of Eindhoven and Helmond have been selected as duo cities for the EU Mission Climate Neutral and Smart Cities in 2022. The link to a Human Capital Agenda is an important requirement to start realizing the goals. An assignment to arrive at a quantitative and qualitative overview from the needs of companies in the labor market has been given.

In the final phase, the liaison team, in consultation with the (supra)regional partners, drew up the set of coherent activities included in this roadmap. This set will contribute to the ambitions of the region as well as those of GroenvermogenNL. For the activities, initial consortia have been formed in dakpak construction and priority activities have been defined.

⁸ <https://theeconomicboard.com/ons-werk/human-capital/>

2 Region Exploration



Arnhem-Nijmegen/Brainport Region is one of the six regions identified within the human capital agenda "Bridge to the Future" of the National Growth Fund Program Green PowerNL. The region has great innovative strength and plays an important role in realizing and accelerating the energy transition and within it the hydrogen transition. As the region designation suggests, there are two center regions, Arnhem-Nijmegen and Brainport. From these center regions, supra-regional, national and international connections are established and maintained within the framework of GroenvermogenNL.

2.1 Arnhem-Nijmegen center region



As a region within the province of Gelderland, HCA GroenvermogenNL center region Arnhem-Nijmegen falls under the environmental vision **Gaaf Gelderland**⁹ with the mission: Going for a healthy, safe, clean and prosperous Gelderland. In carrying out provincial tasks, the focus is therefore on a sustainable, connected and economically powerful Gelderland. This is given direction through seven ambitions in the areas of **energy transition**, climate adaptation, circular economy, biodiversity, accessibility, economic **climate for business establishment** and the living and working environment. In particular, the goals and activities in the areas of energy transition and the business climate create important preconditions that fit the ambitions of GroenvermogenNL.

- Encourage development and application of new technologies
- Creating experimentation and innovation space
- Encourage (small-scale) entrepreneurship and innovation
- Encouraging the connection between Gelderland education and the labor market
- Increase attractiveness of Gelderland regions

⁹ <https://www.gelderland.nl/themas/omgeving/omgevingsvisie>

Within the Arnhem-Nijmegen region, the **Green Metropolitan Region¹⁰ Arnhem-Nijmegen** is active which includes 18 municipalities that are working together on the direction of the region based on widely supported ambitions.

- We position ourselves as the green metropolitan region of the Netherlands
- We profile ourselves as the (inter)national circular top region 2050
- We are working together to create the relaxed growth region in balance

The Green Metropolitan Region will realize its ambitions by fulfilling five tasks:

- Connected region (mobility and accessibility)
- Productive region¹¹ (economy and labor market)
- Circular region (circularity, sustainability, climate and energy)
- Relaxed region (livability, nature & landscape, culture and heritage)
- Green growth region (housing and habitat)

The Arnhem-Nijmegen region has a lot of innovative power and the location quality of the work locations scores above the national average. At the same time there is a need to raise the profile of the qualities of the region and to make better use of its economic potential. Within the task **Productive Region**, the aim is to strengthen the innovative power of the region in the themes of Energy, Health & Hightech and the cross-over with Food. This lays the foundation for a strong (inter)national position and for productivity of leading companies. The strong economic profile ensures that the Arnhem Nijmegen region becomes even more attractive for talent. The ambition is to facilitate growth and drive substantial job growth. **Human Capital** is a spearhead within the task and of importance for HCA GroenvermogenNL.



Energy, Health & Hightech and the cross-over with Food, these are the themes in which the Arnhem-Nijmegen region excels and has broadly expressed the ambition to develop them into regional top sectors. They are the spearheads for the region and therefore also for **The Economic Board Arnhem-Nijmegen¹²**. The Economic Board works to strengthen connections in the Arnhem-Nijmegen region on the basis of its economic strength with an emphasis on collaboration in the triple/quadruple helix. Together with the business community, educational and knowledge institutions and the authorities, innovations in the themes and the crossovers between them are being stimulated and work is being done on ambitions for 2025 that are closely aligned with the ambitions of HCA GroenvermogenNL.

¹⁰<https://www.groenemetropoolregio.nl/over-ons/>

¹¹<https://www.groenemetropoolregio.nl/opgaven/productieve-regio/?id=2228>

¹²<https://theeconomicboard.com/>

- International recognition of the ecosystem around regional top sectors
- The move has been made from cluster development to mission-driven innovations
- A strong regional business climate has been developed and the Energy theme is performing as a national hotspot for development on hydrogen and battery technology and on smart grid applications.

To reinforce the above and other ambitions, The Economic Board stands to profile the region as **Lifeport**¹³ with the goal of being awarded formal mainport status by the State within five years.

The main port status is relevant to be recognized and acknowledged by the government as a core economic area of national significance where action agendas are worked on together with ministries. This has a direct impact on the business climate, facilities, research & development and infrastructure and thus supports the international competitive position of the Netherlands.

Samenwerken aan een arbeidsmarkt die werkt!

In the Arnhem-Nijmegen region there is an enormous shortage in the labor market in almost all sectors, but the shortage of employees with the right skills is particularly great in the Energy, Health and High-tech sectors. This poses a risk to the realization of the ambitions and the social tasks involved, such as the climate, housing, energy and circular transitions we are facing. The human capital issues are both quantitative and qualitative in nature.

The Arnhem Nijmegen Region has a multitude of initiatives and projects around education and the labor market. There is a great fragmentation in parties and projects, whereby the focus is often on projects that are mainly small-scale. More impact can be achieved if small-scale initiatives and projects are scaled up to a regional level. The Green Metropolitan Region, The Economic Board and the province of Gelderland have jointly committed to regional cooperation through a widely supported Human Capital Agenda. This agenda is based on a labor market analysis, stakeholder analysis and an inventory of projects with potential for the Arnhem Nijmegen region.

¹³ <https://lifeport.nl/>

The objective is for the agenda to help entrepreneurs, educational institutions and governments with the major human capital issues. The decision-making process was completed in April 2022 resulting in the Human Capital Agreement Arnhem-Nijmegen Region 2023-2026¹⁴, **Working together for a labor market that works!**

Human Capital Akkoord Regio Arnhem–Nijmegen 2023–2026
 Samenwerken aan een arbeidsmarkt die werkt!

Uitdagingen

- **Kwantitatieve mismatch:** veel openstaande vacatures
 14.200 in Q3 2022
- **Kwalitatieve mismatch:** tekort aan benodigde kennis en vaardigheden
- **Onvoldoende profilering als aantrekkelijke regio**
- **Omvangrijk onbenut arbeidspotentieel**
 36.000 mensen in 2021

Basisprincipes

- **Focusectoren**
 Energy Health Hightech
- **Regionaal**
 We richten onze inspanningen op initiatieven die regionale impact hebben
- **Duurzame samenwerking**
 We investeren in duurzame structuren voor samenwerking: verbinden en opschalen van bestaande initiatieven, nieuwe initiatieven aanjagen waar nodig
- **Kennisdeling**
 We stimuleren kennisdeling in de regio en tussen partners en initiatieven
- **Triple helix samenwerking**
 Overheid
 Onderwijs Ondernemer

Speerpunten & doelstellingen

- **Leven Lang Ontwikkelen voor iedereen**
 10.000 medewerkers
 ontwikkeld in o.a. technische en digitale vaardigheden
- **Aantrekken en behouden van talent**
 40.000 jongeren en jongvolwassenen
 in contact gebracht met innovatieve bedrijven in de regio
- **50% van de IT-studenten**
 voert projecten uit in de regio
- **Activeren onbenut arbeidspotentieel**
 1.000 werkzoekenden en werkenden
 meer aan de slag in de focusectoren Energy, Health en Hightech

Uitvoering

6 werktafels

- Onderwijs
- Aantrekken en Behouden van talent
- Activeren onbenut arbeidspotentieel
- LLO Health
- LLO Energy
- LLO Hightech

Kernteam
 TEB GMR Prv

¹⁴ <https://theeconomicboard.com/themas/arbeidsmarkt/human-capital-akkoord/>



Underlying the Human Capital Agreement Arnhem Nijmegen Region 2023-2026 is the Human Capital agenda Arnhem-Nijmegen region¹⁵. The **labor market analysis** has been an important activity during the preparation of the agenda and is the source for understanding the qualitative and quantitative state of the current labor market and the expected developments. The analysis shows that in the third quarter of 2022 there were already more than **14,000** vacancies in all sectors combined. Here, the greatest shortages are visible in technical occupations. In the future, as a result of the energy transition, the number of jobs in the focus sector Energy alone will rise by **15,000** until 2030. From the labor market analysis, conclusions have been drawn that give direction to the measures to be taken to which HCA GroenvermogenNL will also contribute.

- **Quantitative mismatch:** many job openings

The region has more job openings than job seekers. With a growing economy and an aging population, this shortage will not be solved with new inflows alone. In addition to shortages, there are now surpluses of workers in sectors such as hospitality and events.

- **Qualitative mismatch:** shortage of required knowledge and skills

Insufficient talent in the region is trained in needed knowledge and skills in the focus sectors Energy, Health and Hightech now and towards the future. There are opportunities for providing further and retraining in hard and soft skills for workers and job seekers in technical and digital skills. Lifelong development is not given enough priority to reduce the mismatch in the region.

- **Insufficient profiling** as an attractive region

Thanks to education (MBO, HBO and university), the region attracts many (international) students who can serve as a new influx into the labor market. However, many students leave for other regions and employers. The Arnhem Nijmegen region has a strong profile in the growth sectors of energy, health and high-tech. This offers opportunities to profile the region to attract and retain students and knowledge workers.

- **Vast untapped labor potential**

The region has a sizeable unused labor supply of 36,000 people. More than 10,000 part-time workers want to work more hours. Inequality among different groups of young people in job opportunities has increased since 2021.

¹⁵ https://issuu.com/theeconomicboard/docs/human_capital_agenda_regio_arnhem-nijmegen.defjan2

The focus of the Human Capital Agenda Arnhem-Nijmegen Region is on promising regional initiatives for the focus sectors of Energy, Health and Hightech. It is in these sectors that the mismatch in the labor market in quantity and quality is greatest. The Human Capital Akkoord Regio Arnhem-Nijmegen 2023-2026 formulated the spearheads and objectives based on the focal point.

Speerpunten	Doelstellingen, periode 2023-2026
<p>Leven Lang Ontwikkelen voor iedereen</p> 	<p>In 2026 hebben 10.000 medewerkers zich verder ontwikkeld in technische en digitale vaardigheden</p> <p><i>De werkzame beroepsbevolking bedroeg 368.000 in 2021, waarvan 110.000 in de focussectoren Energy (25.000), Health (70.000) en Hightech (15.000) werken.</i></p>
<p>Aantrekken en behouden van talent</p> 	<p>In de periode 2023-2026 zijn 40.000 jongeren en jongvolwassenen in contact gebracht met innovatieve bedrijven in de regio.</p> <p><i>Dit komt neer op zo'n 10.000 mensen per jaar. Dit betreft zowel de jaarlijkse uitstroom van mbo, hbo en wo (ca. 15.000 studenten) als jongeren en jongvolwassenen die niet (af)studerden of die al werken.</i></p>
<p>Activeren onbenut arbeidspotentieel</p> 	<p>In de periode 2023-2026 voert 50% van de IT-studenten projecten uit in de regio om ze te laten ervaren hoe het is om te werken in de regio.</p> <p><i>IT studenten trekken nu te makkelijk weg naar andere locaties buiten regio Arnhem-Nijmegen, waar bedrijven zich beter weten te presenteren richting de studenten.</i></p>
<p>Activeren onbenut arbeidspotentieel</p> 	<p>In 2026 zijn 1.000 werkzoekenden en werkenden meer aan de slag in Energy, Health, en Hightech dan in 2021.</p> <p><i>In 2021 was er een onbenut arbeidsaanbod van 36.000 mensen. Binnen de sectoren Health, Energy en Hightech worden er tienduizenden extra banen verwacht in 2030.</i></p>

The Human Capital Accord defines guiding principles for the approach to work on the objectives of the spearheads, which are basically the same as those of HCA GroenvermogenNL supplemented by the national impact that the program aims to achieve.

- **Triple/Quadruple helix;** Collaboration between business, education and government is critical to achieving impact in the region.
- **Regional;** Efforts are focused on initiatives that have regional impact.
- **Sustainable cooperation;** Investing in sustainable structures for cooperation is the basis. The preference here is to connect and scale up existing initiatives.
- **Knowledge sharing;** Within the Human Capital Agreement, knowledge sharing is a precondition for making impact together. This concerns both the sharing of knowledge within the region, and between the initiatives and between the quadruple helix partners.

It is the *Human Capital Agreement Arnhem-Nijmegen Region 2023-2026* with underlying agenda to which HCA GroenvermogenNL is connected. This gives an emphatic win-win situation where the Green Metropolitan Region, The Economic Board and Province of Gelderland in cooperation with GroenvermogenNL gives concrete substance to the ambitions within the focus sector Energy of the regional agenda. Conversely, for GroenvermogenNL the regional agenda with the associated governance of existing structures, decision-making processes and the working tables through which concrete implementation plans are created is the vehicle through which it can realize the ambitions of the program within the Arnhem-Nijmegen region. The connection to the supra-regional and national level, both in terms of governance and content, is provided by the *HCA GroenvermogenNL liaison team Arnhem-Nijmegen/Brainport* which works according to the principle of national coordination, namely regional implementation.

2.2 Brainport center region

Provincie Noord-Brabant

The Province of North Brabant is committed to innovation clusters. By forging joint coalitions around missions, companies, institutions and governments work together on solutions and thus strengthen Brabant's innovation power. The challenges have been chosen based on the European new innovation and technology policy and the Knowledge and Innovation Agenda of the state. The energy transition is one of the largest societal transitions. The challenges here are smart integrable solar energy solutions, hydrogen as an enabler for industry and society, the battery of - and for the future, green molecules & recycling and nuclear energy for the future. These are therefore the areas in which innovation clusters - in quadruple helix context - will be formed. The coalition "Hydrogen as an enabler for industry and society" is one of the first five coalitions started. They focus on the development of 3rd generation electrolyzers, for which labor market shortages - now and in the future - are an obstacle.



In Southeast Brabant, 21 municipalities are working together in the Eindhoven Metropolitan Region (MRE) within the regional program Energy Transition. Together with the partners - province, water boards and grid operator Enexis, a Regional Energy Strategy (RES) has been drawn up. The vision and long-term strategy have thus been established. By 2050, the region wants to be climate neutral. There are four program lines:

- Built environment/saving
- Heat
- Large-scale generation
- Energy Systems

Grid congestion is an impeding factor when it comes to realizing, among other things, the sustainability task facing the RES Metropolitan Region. By the end of 2023, the cabinet will designate the Brainport region as a priority area in the current approach to grid congestion. The Netherlands could lose valuable technology if high-tech companies in the region have insufficient grid capacity available. Brainport's tasks are broader than industry; it also deals with housing and related facilities including education.



Helmond and Eindhoven are working together as a duo city on the EU mission "100 Climate Neutral and Smart Cities." With the great ambition of being climate neutral already in 2030. The cities are working together on projects and innovative solutions that contribute to the sustainable, green and healthy city. So that Eindhoven and Helmond now and later are nice places to live, work and recreate.



The Brainport region strengthens the Netherlands' international competitive position. Maintaining this position is vital for the position of the Netherlands in Europe and in the rest of the world. For this reason, the national government and the Brainport region have agreed on a joint agenda¹⁶ through 2030. In this way, they are working together to secure and future-proof economic growth for the Netherlands based on high-quality technological productions. Productions that contribute to Europe's strategic autonomy. The ability to protect, and future-proof investments in, important knowledge, (key) technologies, vital chains, systems and networks (such as campuses and other innovative incubators) is an important part of this.

Brainport is a powerful engine of the Dutch economy with big growth and big ambitions. But it also squeaks and creaks in the region. A broad view is needed. The growth figures can only be consolidated if there is enough attractive housing, the region is sufficiently accessible, there is enough space for housing and scaling up new innovative companies, there is enough talent available and everyone is able to participate. The joint ambitions of the national government and Brainport Region on which the policy dialogue is being conducted are:

- The region can make a spatial jump in scale;
- There is sufficient talent available;
- Technological competitiveness is strengthened;
- There are resilient supply chains.

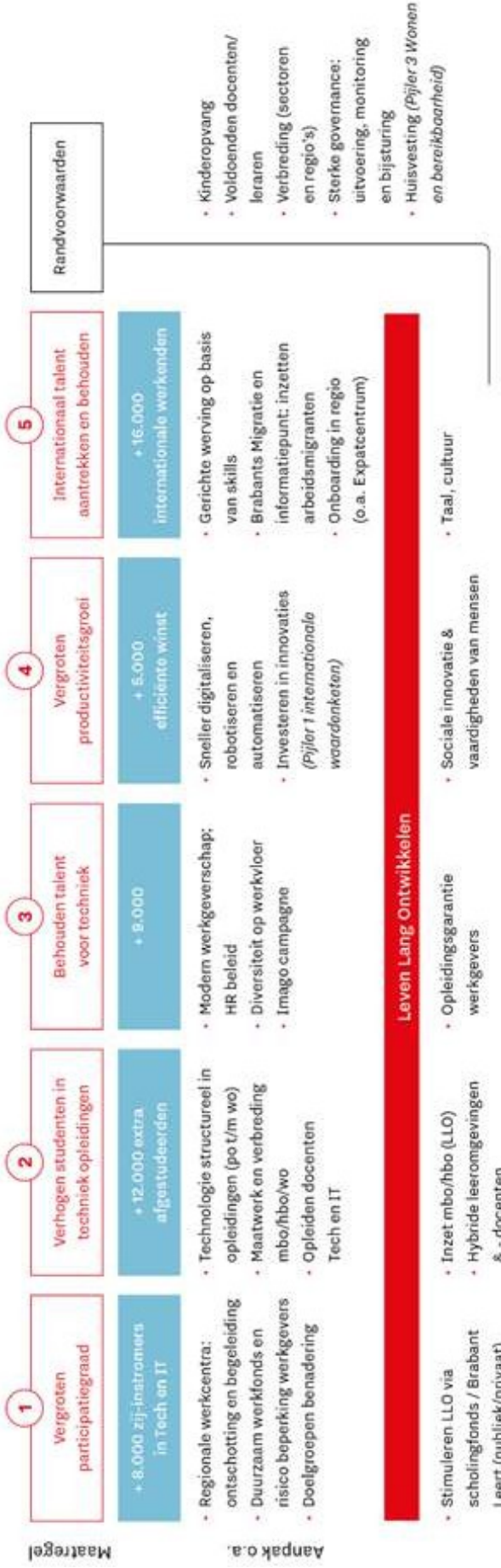
Scaling Talent the measures

In the Brainport region, there are about 10,000 vacancies open in High Technology and IT, about a quarter of the workforce is expected to retire, and due to the rapid growth of the sector, the expansion demand is high. This total growth is estimated at about 52,000 jobs through 2032. The growth also has knock-on effects to other sectors such as healthcare, education, childcare and construction. Sectors, which are already facing shortages as well. The growth does not stop at the

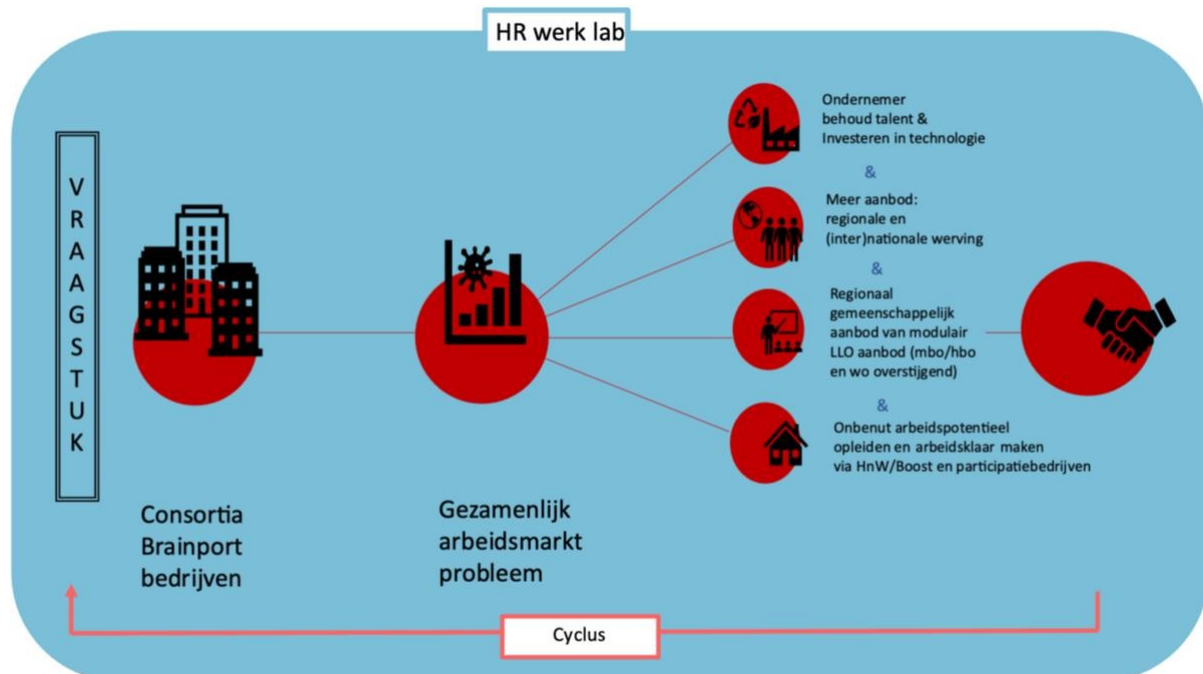
¹⁶ <https://brainporteindhoven.com/nl/ontdek/strategie/strategische-agenda-brainport>

boundaries of the region and has a nationwide knock-on effect. The extent of shortages is compounded by a qualitative mismatch. Technological developments are rapid and social transitions, such as the energy transition, require different knowledge and skills in all professions and sectors. In order to meet the labor market challenges, five interrelated measures are being worked on with the national government in line with the strategic agenda.

- Increase participation rate
- Increase students in engineering programs
- Retained talent for engineering
- Increase productivity growth
- Attract and retain international talent



The role and responsibility of industry in the Brainport region is great. They are part of the solutions for energy transition and will have to make contributions. The labor market shortage affects them daily. Employers need **sufficient graduates** now and in the future. Benefit from **inflow from other sectors**, but will also **have to organize** the work **differently**, because there is a shortage of labor capacity in all sectors. Where needed, influx from other countries is also required. And employers will take care of retaining and retraining current employees.



The Brainport region has two labor market regions within the geographical boundaries of the 21 municipalities. Southeast Brabant with Eindhoven as its center municipality and Helmond De Peel with the municipality of Helmond as its center. Together, they will map out what the energy transition means for jobs in terms of climate adaptation, energy transition and the circular economy (KEC). What current labor market projects already provide for this and what additional projects are needed.

In the Brainport region, we stand for cooperation, including in and with education. In the context of the region's challenges, public-private partnerships are a requirement here. It is precisely in the cooperation between the educational levels, the public and private trainers and on the basis of the demand of the companies that the solutions are found to achieve the necessary innovation in the field of Lifelong Learning (LLO). The regional educational institutions are taking their role and responsibility here.



2.3 Content interpretation

Achieving an impactful design of the regional human capital agenda requires a thorough understanding of the (supra)regional ecosystem. An overview of the current relevant parties, developments, ambitions, challenges, ongoing initiatives and existing structures is important in this. In the context of the HCA GroenvermogenNL's contribution to the region, the focus of the study is the hydrogen ecosystem in the context of energy transition.

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Arnhem is home to the network organization Kiemt. Kiemt's ambition is to address the greatest challenge of our time: to *accelerate the climate and energy transition and the realization of circular economy*. This ambition is partly realized through the Kiemt Hydrogen Cluster¹⁷. The cluster consists of supra-regional SMEs, knowledge institutions, start-ups and scale ups, and aims to drive innovations for the further development of Gelderland/Eastern Netherlands as a hydrogen technology region, thereby strengthening the regional economy. To this end, Kiemt carries out activities that seamlessly match needs within the implementation of HCA GroenvermogenNL:

- Organizing and programming the cluster
- Launching and accelerating initiatives
- Strengthen planning and realization
- Matchmaking of parties to value chain(s).
- Exchange of knowledge and information



In 2023, the Kiemt Hydrogen Cluster and its affiliates have been the main stage for retrieving and interpreting the state of affairs, developments, ambitions and challenges in the water sector. It also explored which initiatives are relevant to the region in relation to the (human capital) challenges and to what extent there is support and opportunities for

¹⁷ <https://www.kiemt.nl/programmas/waterstofcluster/>

scaling up and/or expansion. In the process, much information was gathered and important observations were made that have implications for content and form of the regional HCA Green PowerNL.

- The hydrogen sector in the region is broadly on the eve of a **scale-up step**, with activities that to date have mainly focused on R&D and small-scale production advancing to large-scale production and management. Companies within the region have raised subsidies in the order of €100 million to support the realization of plants and facilities in the region. Here, the explicit commitment is to come up with solutions that require a minimum of labor. This requires innovation and cooperation in the quadruple helix has been set up for this purpose.
- Many companies, mainly belonging to or partners in **the sixth cluster**¹⁸, are searching for solutions to grid capacity constraints, including **grid congestion**, and the role that storage and hydrogen can play for and in their business. **Lack of application-oriented knowledge** is the main challenge.
- There is great diversity of challenges and needs regarding the human capital issue. Whereas small(er) companies struggle to **attract new staff**, larger companies struggle more with the issue of how to **retain staff**. What development opportunities can be used to prevent the departure of current staff?
- The sense of urgency varies widely. In general, the companies that are more rigorously and visibly focused on hydrogen technology and the energy transition have a greater pull so they tend to get any human capital challenges solved and can afford **short-term thinking**. Companies on the margins of hydrogen technology and the energy transition have a considerably harder time in this area, there are **problems in the now** and there is an action mode regarding **human capital initiatives** for the **short and long term**. This action mode is variably linked to individual and/or collective initiatives.
- Large(er) and more powerful companies are establishing business schools on a significant scale. This way of working is chosen to solve the **mismatch** between the required and present competencies of (prospective) employees, in the field of hydrogen technology but emphatically much broader than this. It is necessary to do this themselves because suitable training and education programs are lacking from mainstream institutions.
- Having your own company school contributes to the possibility of attracting people from a **broader target group** and then training them yourself to suitable and, increasingly, created jobs. Having internal employee development opportunities lowers the barrier to development and contributes to better bonding with the company, making it seen as a powerful tool for **employee retention**.
- There is strongly increasing **competition for human capital**. Especially companies that have invested in their own initiatives see limited added value in contributing to collective initiatives and are only marginally open to scaling up their own initiatives.

Region East is home to major players in the electricity supply industry and to many players belonging to the sixth cluster. In the center region of Brainport Eindhoven, the world's most complex and advanced machines, products and innovations are conceived and made. These players are very important for the content interpretation of the region and are therefore included in the region exploration. The substantive interpretation is relevant because it makes visible which developments where

¹⁸ klimaataakkoord.nl/documents/publications/2020/10/22/headlining-program-the-sixth-cluster

hydrogen can play a role in can be expected and what challenges this brings, both in terms of human capital and content.

Content narrative

The energy transition is most visible in the electric domain. The installation of wind turbines on land and sea is booming, the installation of solar panels is accelerating and the number of battery-electric vehicles is growing faster and faster. There are limits to this growth and they have already been reached locally and regionally, resulting, for example, in **grid congestion**. Available storage to match supply and demand of electric energy is too limited. The performance of battery technology in terms of range and charging time is limited, which hinders the electrification of heavier transport in particular. The limited transmission and distribution capacity of our electricity grid is increasingly causing serious grid congestion and calls for decentralized solutions. It is increasingly recognized that hydrogen can play a role in shifting or removing these limitations. It is the only energy carrier with proven technology (with a TRL of 7 or higher) and a modest carbon footprint that can store large amounts of energy over months. However, it is not enough to establish centralized (nationwide) seasonal energy storage. This approach ignores the ongoing electrification over a power grid with limited capacity. This makes storage on a decentralized scale relevant.

The focus of the Arnhem-Nijmegen/Brainport/Stedendriehoek-Overijssel region is **decentralized applications** of sustainable (hydrogen) technology, with attention to the **broad context** (governance, business and social acceptance) of energy transition and grid congestion. As the living lab for integrated energy systems for decentralized generation, storage, conversion and use of renewable energy, the region has everything it needs to help the Netherlands and Europe with the energy transition. Located in the heart of the Dutch electricity infrastructure, and with the **center of gravity of an innovative (energy) (manufacturing) industry**, Arnhem-Nijmegen/Brainport region is actively contributing to the energy transition. **Developing, integrating, testing and applying (components of) energy systems** is in the DNA of the region. All parts of the value chain for decentralized energy systems are present. The region has **technology developers for energy storage** in batteries, flywheels or electrochemical energy carriers such as hydrogen. Necessary material knowledge, components, integration knowledge and test facilities are also present in companies and educational and knowledge institutions.

The Netherlands' six industrial clusters have mapped out plans to reduce greenhouse gas emissions toward 2030 and with a look ahead to 2050 in six Leader Programs to achieve the ambitious goals of the climate agreement. The regions of Arnhem, Overijssel and Brabant East are also firmly represented in the **sixth cluster** (non-regionally bound industry with CO2 taxpaying companies) with the presence of the Ceramic Industry (KNB), Food Industry (FNLI), Chemical Industry (VNCI), Metallurgical Industry (FNLI), Paper and cardboard industry (VNP), Waste and recycling sector (VA) and the ICT sector (NL-digital). In the **longer** term, these industries are looking at electrification of heat above 200°C, hydrogen, broad deployment of heat supply, CCUS2 and the development and application of innovative technologies. Many companies are still completely **dependent on natural gas** for their processes, but this will have to be replaced **in the future** by CO2-neutral energy carriers including **hydrogen**, renewable electricity, geothermal and renewable gas. In many cases, natural gas affects **the design and configuration of process plants** and, in specific cases, the **quality and properties of products**. As a result, current natural gas cannot be replaced overnight with another energy carrier.

The region's content interpretation complements the regional exploration within the Kiemt Hydrogen Cluster observations. Again, important observations have been made that have implications for content and form of the regional HCA Green PowerNL.

- The business community within that is currently actually active in the hydrogen sector does not have a clear collective focus on specific themes from the **National Hydrogen Program (NWP)**¹⁹. These are mostly developers and suppliers of components and/or subsystems. The greatest upscaling challenge is seen in the development of chains for the (decentralized) production, transport and application of (hydrogen) technology (particularly within the sixth cluster). The region is strongly at the service of other regions, nationally and internationally. **Decentralized application** forms the core of the activities.
A limited number of companies do have a strong focus on an NWP theme. This is particularly the case for the **Mobility** theme and within that, particularly in the area where battery-electric propulsion is not a good solution; **heavy duty equipment**.
- With the energy transition in full swing, companies belonging to the sixth cluster are going to increasingly need **knowledge**. Knowledge that is not readily available and requires **(practical) research**. Developing **demo/pilot projects** and later **scaling them up** is a logical next step. In the short to medium term, the developments will lead to human capital issues in the field of training and filling jobs. Within the region, development is expected to take place most strongly in the NWP theme of **Industry**. Here again, the decentralized application of (hydrogen) technology is the core.
- Given the established contractors and installer companies and the ambition of provinces and municipalities to accelerate the energy transition, it is to be expected that significant developments within the **Built Environment** theme will take place within the region. This will be particularly the case at the level of **energy hubs**. This will involve the continuation and scaling up of activities already taking place in and from the region. In this area, there is particular interest within the region in **demo/pilot projects** as the necessary component/system knowledge is available in the region. The challenge that is currently the biggest threat in this is the availability of people with the **right knowledge and experience**. Again, decentralized applications are the core of the activity.

¹⁹ nationalhydrogenprogram.co.uk/themas/default.aspx

2.4 Teaching and research network

The regional designation described describes the most relevant regional ambitions, business parties and substantive developments. What is still missing is an interpretation of the education and innovation landscape. The public-private partnership Sustainable Electrical Energy Centre of Expertise (SEECE) plays a central role in this for the region.



SEECE focuses on the transition to a sustainable and reliable energy system within the context of transitions in technology, learning & development and societal cooperation necessary for this.

SEECE, as a Center of Expertise, adds value to the energy transition by initiating, organizing and/or implementing programs and projects within three related clusters:

- System integration and flexibility
- Human capital
- (Continued) development of ecosystems

As a public-private partnership, SEECE works together in an extensive and strong network of parties from education, research, business and government (quadruple helix) on both small-scale projects and large programs. This makes SEECE the place where human capital and innovation-oriented initiatives come together. In regional and/or national programs, SEECE promotes reciprocity in cooperation between involved parties, for example, in the Growth Fund programs GroenvermogenNL, LLO Katalysator, the Growth Fund program Charging Energy Hubs (in cooperation with the Automotive Centre of Expertise ACE) and the NWO-SIA SPRONG program Decentralized Hydrogen. From various roles, SEECE translates operational approaches to local issues into working principles for tactical and strategic cooperation at regional and national levels and vice versa.

SEECE stands for reciprocity in cooperation between companies, education, research and governments (quadruple helix). Reciprocity in cooperation means that parties recognize each other's interdependence (skin in the game), are willing to invest in the cooperation (shareholders) and work on the transition to a sustainable and reliable energy system from a healthy balance between their own and the common interest.

For SEECE, the University of Arnhem and Nijmegen (HAN) is an important partner in education and research. *Education and research are close and equal at the HAN.*

Research is evident in the learning environment of students. This gives (beginning) professionals a critical, inquisitive and innovative attitude. Quadruple helix collaboration is the starting point. The HAN focuses on themes in line with the focus sectors from the Human Capital Agreement 2023-2026, Working together for a labor market that works!

The partner map shows the (supra)regional education and research network of Brainport, SEECE and the HAN. This network consists of MBO, HBO and university partners, quadruple helix (i.e. shared facilities, hybrid learning environments) partners and commercial training providers, and as a network is part of the much larger ecosystem that also includes companies, governments and other parties. Each partner obviously has, to a greater or lesser extent, its own (quadruple helix) networks within which cooperation is organized and takes place.



Within the education and research network, there are various structures and partnerships relevant to the implementation of HCA GroenvermogenNL, with partners affiliated in roof-top structures. In addition to the many local and small regional collaborations, a number of larger supra-regional collaborations exist.

- Platform RxH, a supra-regional partnership linking HBO and MBO with objectives that contribute to the realization at HCA GroenvermogenNL. 1) *Promote flexible transfer from MBO level 4 to HBO by improving the quality of the connection.* 2) *Stimulate innovation around learning, research and training.* 3) *Develop regional networks per sector to stimulate sustainable and fruitful cooperation.* 4) *Professionalize cooperation between parties.*
- Decentralized Hydrogen SPRONG (DWS), a program to fulfill the joint ambition of Hogeschool van Arnhem en Nijmegen and Hogeschool Saxion to *realize a powerful research group in the field of decentralized hydrogen applications.* The ambition is closely aligned with the content orientation of the region. The DWS network includes partners from across the quadruple helix. Emphatic activity of DWS is to strengthen the

research group through collaboration with Avans University of Applied Sciences, Fontys University of Applied Sciences and Utrecht University and Eindhoven University of Technology.

- LEVE Network, a lecturer platform in which lecturers from different colleges pursue a shared vision of energy transition and conduct joint research. LEVE advocates *a system vision in the run-up to energy supply in 2030, where the balance between energy supply and demand is maintained, within any time interval and in any place*. To maintain that balance, there is a role for hydrogen.

The education and research networks with the existing collaborations and (consultation) structures around them have been the primary domain in 2023 for retrieving and interpreting the developments, ambitions and challenges related to training, education and practical research in the field of energy transition and hydrogen. The collaboration on the development of the regional roadmap has resulted in the colleges in the region being well informed about the GroenvermogenNL ambitions. Increasingly, these colleges have participated in the workshops of the R&D pillar of GroenvermogenNL. In the HyTROS Consortium the HAN is represented, The HyUSE and Hy-SUCCES consortium has representation from the HAN, Saxion and Avans. In the HyPro consortium both the HAN, Saxion, Avans and Fontys participate. The East region thus has a strong connection between the HCA and R&D pillar of GroenvermogenNL so that the education and research network is firmly deployed and further strengthened.

During the regional reconnaissance, we examined what initiatives exist that are relevant to the region and the country in relation to the challenges and to what extent there is support and potential for scaling up and/or expansion. Information was gathered and observations were made that have implications for the content and form of the regional HCA GroenvermogenNL.

- Educational institutions and training centers across the board (MBO, HBO, WO, commercial) have missions, ambitions and vision for their own contribution to energy transition and increasingly more specifically to **grid congestion**. In general, the ambitions have a **broad scope** in the technical field; socio-economic aspects are taken into account to a very limited extent or not at all. The latter is indeed explicitly addressed within non-technical branches of education, but the technical content is lacking. The broader scope of the ambitions is appropriate in the context of **system integration**. The role of hydrogen technology within that context is **hardly included, if at all**, but the scope offers **fertile ground**. At all levels of training, there are frontrunners between whom the cooperation in 2023 as a result of HCA GroenvermogenNL and R&D GroenvermogenNL has grown emphatically, a **strong ingredient for further development** of the region in the field of energy transition and hydrogen technology.
- Education focused on hydrogen technology is in its first phase of life and is developing, people are generally searching. The existing **MBO optional subjects** are known to a limited extent and are implemented very little. At the institutions where the optional subjects are known, there is reluctance because of the **practical component**, which is insufficiently feasible due to a lack of suitable setups and because of the narrow focus, while the region is focusing more on solutions for grid congestion. Small-scale hydrogen projects and challenges such as TiM's **Hydrogen Challenge** are being worked on in the MBO. Within HBO, there is a **Hydrogen Technology theme route** in the region that places the student's main course in the context of hydrogen, there is an **H2 learning community** in which students work on issues, and **internships** and **graduation trajectories** take place within companies and research groups, often **lectorates**, in the hydrogen sector. An important observation is that students in particular operate in **quadruple helix** contexts within **hybrid learning environments** and **hubs**. It is widely recognized that **Work-Learning-Innovation** can and must go hand in hand

to realize societal challenges and provide an inspiring and motivating professionalization venue.

- Within institutions conducting research activities, hydrogen technology is a topic of interest. There are **robust track records within professorships** and with the increasing value of hydrogen technology within the energy transition, efforts are increasing. Existing hydrogen facilities such as the **H2Lab@Connectr** and **H2 Hub Twente** continue to develop both in terms of technology and the connecting role they have within the hydrogen sector. New initiatives in the field of hydrogen facilities are taken within the technohubs of the Stedendriehoek region including the **NewTechPark Apeldoorn** and the **Techniekmfabriek Zutphen**. All these facilities have their own position and role within the ecosystem and are embraced and deployed by business and education. Increasingly, the facilities are connecting with each other to share knowledge and coordinate activities. This connection is the result of smaller and larger (supra)regional programs such as Decentralized Hydrogen SPRONG and Energietalent.
- As part of the upscaling step that the region is facing, explicit cooperation in the **quadruple helix** is being set up with companies, governments, and lectorates and praxis. The aim here is to arrive at **labor-saving measures** for existing (production/testing) facilities. For newly to be developed facilities and factories, research will be conducted into solutions that will reduce the need for labor.
- Commercial trainers/trainers are either searching for their role in the hydrogen sector or are strongly focused on it. In the first case, **they wait** for market demand before developing a course. If it concerns parties that are specifically focused on the hydrogen sector, they are increasingly being **overcharged**.
- There is little to **no cooperation** on the development of appropriate educational pathways for the energy transition and, within that, hydrogen technology. Not between educational institutions nor with companies. Companies are reluctant to make knowledge and case studies available and contributing to the design of education and training courses is **not a priority**.

2.5 Conclusion

The exploration of the region in the regional focus sector Energy with the deepening in the field of hydrogen technology gives a clear picture of the state of affairs and offers a glimpse into the future. It is clear that the region is facing challenges that will increase in size and complexity without action, which will have an inhibiting effect on achieving its ambitions.

- The labor market analysis shows that there is an existing labor shortage in the Energy focus sector. This shortage will increase. It is expected that around 2030 the number of open vacancies in Gelderland will have increased by 15,000. In the Brainport region, that number 52,000 (for the high-tech and IT sectors combined). The share for the hydrogen sector specifically cannot be predicted due to the variation between different scenarios. Currently, the shortage is limited. However, the regional survey shows that it is likely that this will change in the relatively short term. The immediate reason is the rapidly increasing grid congestion and energy transition that is accelerating within industry and heavy duty mobility and the scale-up step of the hydrogen sector in the region.
- The labor shortage shown by the labor market analysis has a qualitative cause as well as a quantitative one. There is a mismatch between the competencies present and those needed. The regional reconnaissance shows that this is also the case within the hydrogen sector. This mismatch will increase with the progress of the energy transition and scaling up of the

hydrogen sector in the region as hydrogen technology will be applied more and more widely. An important observation is that with the progress of the energy transition, the qualitative mismatch is also strongly visible outside of hydrogen technology as for example in battery technology and power electronics. In addition, the increasing grid congestion is causing the region to focus strongly on mitigating measures for it. Since there is no single solution to the problem, explicit attention to various technologies and system integration is needed.

- The hydrogen sector in the region is on the eve of a scale-up step, with activities that to date have focused mainly on R&D and small-scale production moving on to large-scale production and management. Furthermore, many companies, mainly belonging to the sixth cluster are searching for the role that hydrogen can play for and in their business. This is equally strong for other technologies that can help solve the sustainability challenge.
- For new applications expected by the energy transition in industry, there is often insufficient knowledge available. This knowledge must be developed/collected and shared in order to accelerate.
- Human capital challenges are addressed within the region mostly individually or on a small scale. There is competition in the labor market, cooperation is sought only to a very limited extent. The labor market analysis describes the outflow of labor potential and the strength of visibility and profiling in this. The solution is sought in cooperation. Within the hydrogen sector this is recognized, however, the opportunities and priority are limited. Outside the hydrogen sector, such as within heavy duty charging, an emphatic focus on cooperation within the region (and beyond) is present.
- The education and training offer is very limited and insufficiently connected to the energy transition sector. The labor market analysis also shows that in the short term, professionals in particular should be the target group for training programs. The unused labor potential is also significant and can contribute to solving and preventing shortages.
- The region has a wealth of agreements, plans and initiatives with corresponding structures and decision-making procedures. Cooperation among these is developing in a positive direction and is accelerating. The importance of working in the quadruple helix is widely seen and supported. Operational elaboration and implementation is limited.

3 Activity Plan

Regional explorations were carried out from the central regions of Arnhem-Nijmegen and Brainport. As a result, a clear picture emerged of the challenges in the field of human capital in relation to the energy transition and the hydrogen transition. On the basis of this picture, a coherent plan of activities has been developed within and between the center regions that will help to eliminate the quantitative and qualitative mismatch on the labor market.

3.1 Activities

Region East aims to achieve *an inviting, cooperative and agile regional ecosystem that contributes to accelerating and realizing the green (hydrogen) economy in the Netherlands and more specifically Region East.*

The region will achieve this through a series of related activities within four pillars:

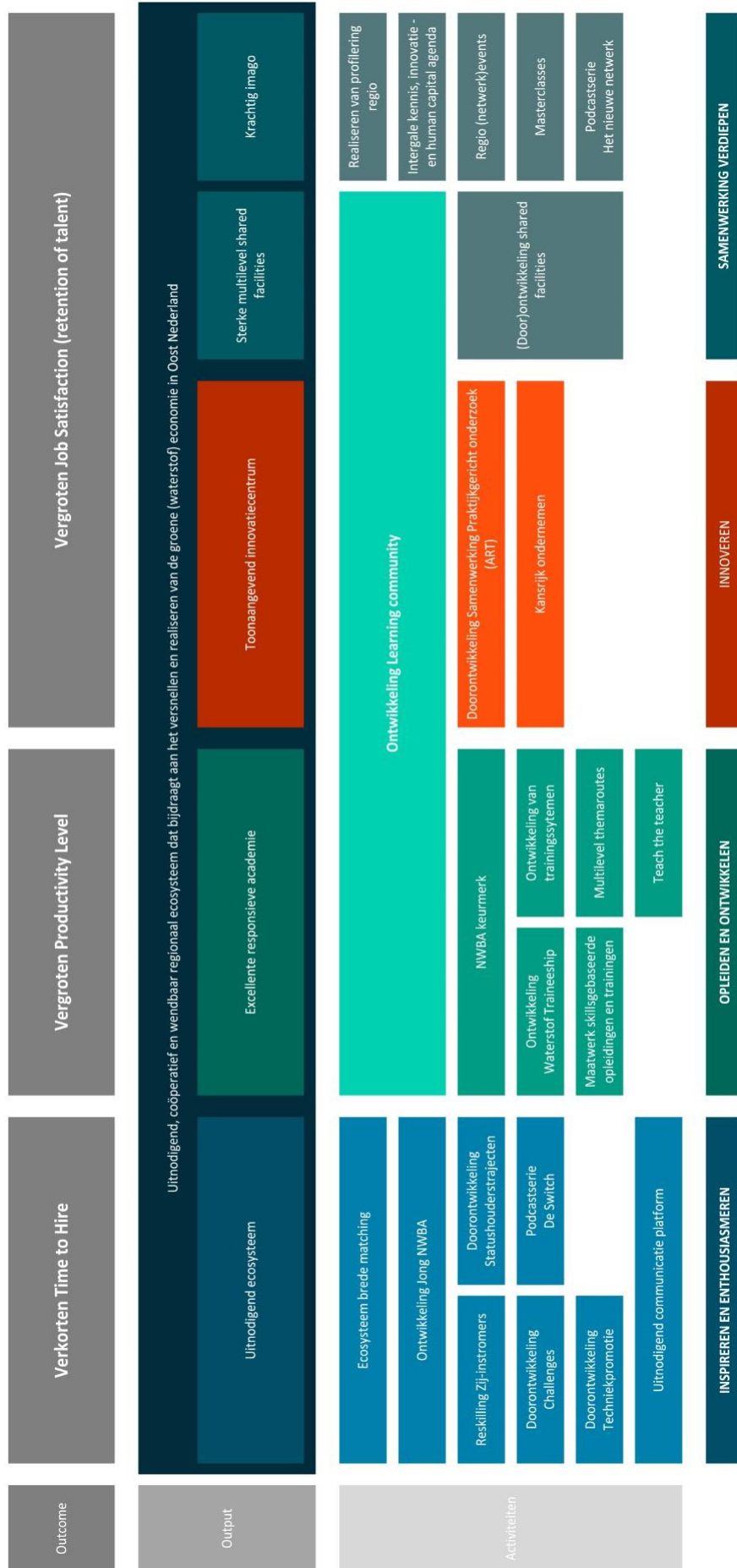
- Inspire and enthuse
- Training and development
- Innovate
- Deepening collaboration

The overview of the pillars with associated activities is shown on the next page. This overview shows how it contributes to the inviting, cooperative and agile regional ecosystem and what primary outcomes this should lead to, namely:

- Shorten Time to Hire (quantitative mismatch)
- Increase Productivity Level (qualitative mismatch)
- Increase Job Satisfaction (quantitative and qualitative mismatch)

In many cases, the intended activities build on already existing activities within the East Region or beyond. They therefore already have owners and networks that can take care of the embedding and implementation of the (further) development. The content of many activities is provided by other activities within this roadmap, so the activities do not stand alone but reinforce each other in cohesion.

The intersecting vehicle for and between the pillars is the learning community. Within the learning community we work on innovation issues to accelerate the realization and scaling up of the energy transition and within that the hydrogen transition. Within the East Region there are several learning communities linked to the shared facilities. These learning communities are in an early stage of life. The innovation ambitions of the learning communities will be supported in Region East by pairing them with experienced program developers and grant experts. Emphasis will initially be placed on connection with the R&D and pilot pillar of GroenvermogenNL. This connection is emphatically under development through the region's active participation in the HyTROS, HyUSE, Hy-SUCCES and HyPRO R&D consortia.



Inspire and Enthuse

One of the causes of the shortage of human capital is a **widespread decline** in people's interest in training and work in the technical field, while the necessary energy transition, among other things, is actually increasing the amount of work. The *Inspiration and Enthusiasm* pillar uses targeted activities to increase interest in technology, energy transition and the hydrogen transition by creating an **inviting ecosystem**. The added value that is explicitly pursued is the shortening of the **Time to Hire**.

This endeavor affects the development of appropriate activities. An increase in young people choosing technical education is important for the medium and long term. HCA GroenvermogenNL contributes to this on a national level through *Action Plan H2 in O* where the goal is to integrate hydrogen as a transition topic in engineering education and engineering promotion within primary and secondary education. In addition, the *"Further Development of Technology Promotion"* activity from the roadmap is specifically aimed at encouraging students to choose a technical education. It is also important to enthuse students who have already chosen a technical education and (young) professionals about the specific challenges in the various transitions. The activities *"Developing Young NWBA"* and *"Developing Challenges"* from the roadmap are aimed at this.

The urgency calls for short-term action which is why this pillar is primarily focused on the already working professional and untapped workforce. This is a broad target group. Through the activities *"Podcast series The Switch"* and *"Inviting communication platform"*, lateral entrants and those moving on are enthused about the opportunities offered by the energy transition and the hydrogen transition. Through the activities *"Reskilling Side-instrumenters"* and *"Developing Status Holder Program"*, these people will be trained according to their desire and ability. The activity *"Ecosystem wide matching"* will ensure optimal matching between people and work and retention of people who want to take up a role within the ecosystem. Retaining the enthusiasm of professionals already working in the ecosystem is just as important, for them too the ecosystem wide matching adds value.

Training and Development

Another cause of the human capital shortage has to do with the fact that the available human capital has a **mismatch** between the competencies present and those needed. This mismatch is the focus area of the *Training and Development* pillar in which the development of new knowledge and skills is central. The added value of the activities in this pillar lie mainly in increasing the **Productivity Level**.

The **excellent responsive Academy** is the framework under which the learning and development activities in the region will take place. The academy also serves as an unlocker of the programs developed in *PL4 HCA GroenvermogenNL: National Package of Education and Training Programs* and as a connector to the *GroenvermogenNL knowledge platform*. The academy also serves as a connector to the *R&D, Pilot and Scale-up activities* in GroenvermogenNL, ensuring that the desired competencies to be developed are tested and regularly updated. This is because at this stage of the transition it is not yet possible to know in full breadth and depth what competencies will be needed in the longer term.

The mismatch between available and required competencies is partly caused by the fact that trainers now develop (hydrogen) training and education themselves based on their own insight. Securing and providing insight into the quality of training and education through the *"NWBA Hallmark"* activity increases the quality of the training and education palette available. The quality of training and education can also be better guaranteed if there are enough expert teachers and trainers available. The *"Teach the teacher"* activity contributes to this. An important component in the competencies needed is practical experience. Due to the investment it requires, many training institutions lack suitable and sufficient hardware for students to develop appropriate practical competencies. The activity *"Developing Training Systems"* provides for this.

The mismatch between present and required competencies can also be reduced by offering the right education and training. To offer the right competencies in existing courses in a low-threshold way, the activity *"Multilevel Theme Routes"* has been defined. For the target group of students (in the broadest sense of the word), a new form of training is being offered with the activity *"Customized Skills-Based Education and Training"* with the goal of drastically reducing the current high dropout rate of technical students while increasing functional employability. For the working professional, the activity *"Developing Hydrogen Traineeship"* provides for the acquisition of appropriate competencies.

Innovate

One reason for the human capital shortage is the **flow through to other sectors and areas**. This flow can be reduced if employees take pride in being part of the ecosystem. The goal of the *innovation pillar* is to create an appealing and agile ecosystem that employees can be proud to be part of and where there are many development opportunities for individuals. The pillar thus focuses on **increasing Job Satisfaction** and thus talent retention.

The capstone within which innovation takes place in the ecosystem is the **Leading Innovation Center**. In addition to innovation in individual companies, innovation that takes place in the quadruple helix provides additional value through the link with training and development and inspiring and enthusing. A strong example of a regional program in this quadruple helix structure is the Decentralized Hydrogen SPRONG. In this, the HAN and Saxion are working together with business partners to establish a practice-oriented knowledge institute in the field of decentralized energy and hydrogen applications. Both colleges have been working together for some time through the national lecturer platforms LEVE and Urban Energy. Researchers in the Decentralized Hydrogen Leap are part of the liaison team HCA GroenvermogenNL and thus make the connection between the HCA pillar and the objectives in the research of practice-oriented knowledge institute. Researchers from Avans, HAN, Saxion and Fontys have participated in the workshops of WP 1, 2, 3 and 7 of GroenvermogenNL R&D and are thus part of the HyTROS, HyUSE, Hy-SUCCES and HyPRO consortia and have the intention to sign up for the upcoming work packages. Participation in GroenvermogenNL's R&D packages strengthens the currently limited cooperation between HBO institutions and universities in the innovation ecosystem.

The objective of the leading innovation center is a closely cooperating and powerful innovation ecosystem with relevant companies, MBO, HBO and university knowledge institutions. In this, practice-oriented research at MBO is a relative newcomer with great potential; After all, a large part of the transition challenge lies at MBO level. The activity *"Doorontwikkeling"*

Collaboration Practice-based Research (ART)" is designed to embed practice-based research as effectively as possible multilevel.

The innovation power of companies in the ecosystem is very high, but for a good number of SMEs, deploying the right innovation power in the green economy is a challenge. The great uncertainty in market developments combined with challenges in the areas of technical know-how, human resources and financeability and insurability require a high and multidisciplinary level of knowledge that these entrepreneurs often do not have in-house. The *Promising Entrepreneurship* activity is aimed at removing stumbling blocks experienced by these entrepreneurs by offering them access to a toolbox of ecosystem enablers. Part of this toolbox development was taken as input to the WP7 sessions of R&D and is now part of the final project proposal of Hy-SUCCES. In it, Saxion, HAN, Avans and Hanze University are collaborating with companies and universities on social, economic and legal issues.

Deepening collaboration

As described in the innovate pillar, one reason for the human capital shortage is that people **move on to other sectors**. This flow can be reduced if employees take pride in being part of the ecosystem. The goal of the Deepen Collaboration pillar is to create a collaborative and engaging ecosystem that employees can be proud to be part of and where there are many development opportunities for individuals. By establishing a **strong image** and **developing strong multilevel shared facilities**, the deepening Collaboration pillar focuses on increasing **Job Satisfaction**.

Multilevel shared facilities are an essential part of the ecosystem. Not only are these natural places for interaction and knowledge sharing between the various participants from the quadruple helix, they also fulfill a facility need in research and education that participants in the ecosystem cannot fill individually and play an important role in inspiring and enthusing. For the East Region, the shared facilities are often in the first phase of life and it is important to further scale up existing shared facilities. This by stimulating knowledge sharing, team development, network expansion & strengthening and sharing best practices and actively involving the shared facility in research consortia and training initiatives. A large number of shared facilities are active in the East region and will be further developed through the "*Further development of shared facilities*" activity.

A powerful image is essential for an attractive ecosystem. With the activity "*Integral knowledge, innovation and human capital agenda*", an integral and broadly supported agenda is created from the many different local agendas under the flags of Brainport, Lifeport and the Stedendriehoek, which is then propagated through the activity "*Realizing profiling region*". A powerful image also requires different communication channels to propagate the image. The activities "*Region (network) events*", "*Master classes*" and "*Podcast series The new network*" all contribute in their own way to communication within and about the ecosystem.

Overview of activities by center region

The overview below indicates which activities are relevant and anticipated in the two center regions. This is the initial intention carried by regional partners.

Activity	Center region Arnhem-Nijmegen/Stedendriehoek	Center region Brainport
Ecosystem wide matching	X	X
Development Young NWBA	X	X
Reskilling/Vocational Gardens side stream	X	X
Further development Challenges	X	X
Continued Engineering Promotion	X	X
Development of Status Holder Process	X	
Podcast series The Switch	X	
Inviting communication platform	X	
NWBA Seal of Approval	X	X
Development of Hydrogen Traineeship	X	
Customized skills-based education and training (customization for school dropouts)	X	X
Development of training systems (training systems in hybrid learning environments)	X	X
Multilevel thematic routes (project education/continuous learning line hydrogen from mbo to master)	X	X
Teach the teacher	X	X
Developing Collaborative Practice-Oriented Research (ART).	X	X
Kansrijk Ondernemen (targeted to help SMEs/employer approach)	X	X
Continued development of shared facilities	X	X
Realizing profiling region	X	
Integrated knowledge, innovation and human capital agenda (at regional level Lifeport and Brainport)	X	X
Region (networking) events	X	X
Master classes (a.o. also Hydrogen in built environment and industry, strengthen network applied energy transition LLO and research)	X	X
Postcast series The New Network	X	

3.2 Monitoring

A national monitoring system is planned for the HCA GroenvermogenNL that will provide insight into the progress, results and course of the HCA as a whole as well as the individual components, such as the East Region roadmap, throughout its duration (2021-2028). This monitoring will provide insight into the region's contribution to the HCA as a whole and its ultimate contribution to the GroenvermogenNL agenda.

The following perspectives are central to the nationwide monitoring effort:

- **Accountability Information:** Are we delivering what we promised?
Looking at progress and outcome range in relation to set goals
- **Steering Information:** Are we doing the right things and doing things right?
Reflection on intended impact and outcome in the context of the program: are we going to achieve it with this?
- **Learning from and with each other:** regions among themselves and HCA Green PowerNL organization as a whole
(e.g., from other growth fund programs with HCA)

These questions will be answered in a monitoring design and layout that does justice to the character of HCA GroenvermogenNL and the essence of a transition approach.

The national monitoring design uses 'hard numbers' on the one hand, while on the other hand it uses reflection on the question: are we doing the right things and are we doing things right? For the regional roadmaps based on the HCA GroenvermogenNL, 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 GroenvermogenNL 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. In the GroenvermogenNL board, the KPIs and key-results used by the HCA GroenvermogenNL have been defined. Here, at the highest level, the focus is on "**Shortening Time to Hire**" for companies. The region exploration of Region East has prompted the addition of the outcomes '**Increase Productivity Level**' and '**Increase Job Satisfaction**'. The concretization of the monitoring is part of the follow-up phase of the HCA GroenvermogenNL. However, for each of the defined activities a proposal for indicators has already been prepared. These indicators are linked to the developed futures of the activities.

3.3 Organization and implementation

The East Region liaison team was initially set up from SEECE and consists of experienced people within research and education from the Arnhem-Nijmegen region with good networks encompassing the quadruple helix. In addition, the team includes an experienced member focused on communication, a member from the Tech in Motion Practorate to secure the role of MBO and a member from Brainport Development to represent the ecosystem in the Brainport region. From the liaison team, close cooperation has been established with local and (supra)regional companies and business clusters such as the Kiemt Hydrogen Cluster and the industry association NWBA.

The liaison team developed the present East Region HCA GroenvermogenNL roadmap with the core partners through consultation in the region. Strong initiatives, parties and partnerships, substantive focus, as well as gaps have been identified and incorporated into a coherent palette of activities for the coming years. Enthusiastic and committed parties contributed to each of the activity definitions. For the continuation of HCA GroenvermogenNL workshop rounds will take place during which the various parties will jointly arrive at a final project plan to implement the present roadmap. Naturally, the parties included in the roadmap will be expressly invited to participate in these workshops. The exact course of the workshops and thus the precise content of the final project plan will depend on the dynamics during the workshops and the priorities given. Nonetheless, it is likely that in the implementation of this project plan, the liaison team will direct the entire range of activities and ensure coordination between the activities and periodic national activities and coordination. E.g., this is being set up at the time of this writing.

With the help of critical friends, the national monitoring system is used to regularly reflect on whether adjustments and adaptations are needed to the total range of activities in order to achieve the overall objectives of the HCA GroenvermogenNL.

For the administrative embedding in the central region of Arnhem-Nijmegen, the Liaison Team GroenvermogenNL links up with the Human Capital Akkoord Arnhem-Nijmegen 2023-2026, which takes place within the already existing structures and decision-making processes of The Economic Board, GMR and Province of Gelderland. For the implementation of the Human Capital Agreement, six working tables will be used with one booster and six to eight substantive working table members, representatives from education, government and entrepreneurs, who will provide insight into the ongoing projects within the agenda and make connections between the projects of the agenda.

The work tables are:

- Lifelong Development Energy
- Lifelong Development Health
- Lifelong Development High-tech
- Attract and retain talent
- Activate unused labor potential
- Education: this involves an integral working table with representatives of all educational institutions in the region

Representatives of the HCA Green PowerNL Region East liaison team are part of Working Table 1. *LLO Energy and Education*. The team monitors developments within the work tables 4. *Attract and retain talent* and 5. *Activate unused labor potential* and uses participation/networking opportunities. Also, the Liaison Team HCA GroenvermogenNL participates in the administrative tables in the Brainport region.

HCA collaboration with R&D

Within the framework of GroenvermogenNL, close cooperation between the R&D pillar and the HCA pillar will take place in the East Region. Last year, regional parties participated in the workshops of the R&D packages to embed this cooperation, application and further development of the Applied Research Team is at the core of this embedding. In addition to this regional effort, further development of the collaboration is part of the agenda of the national GroenvermogenNL core team. The following R&D work packages are being participated in from the East Region:

In the **HyTROS** consortium focused on large-scale transport and storage of hydrogen, the knowledge institutions HAN, UT and TU/e participate in addition to the East Region-based companies Hyet E-trol, Fluidwell and DNV. This provides direct lines of content that will be deployed.

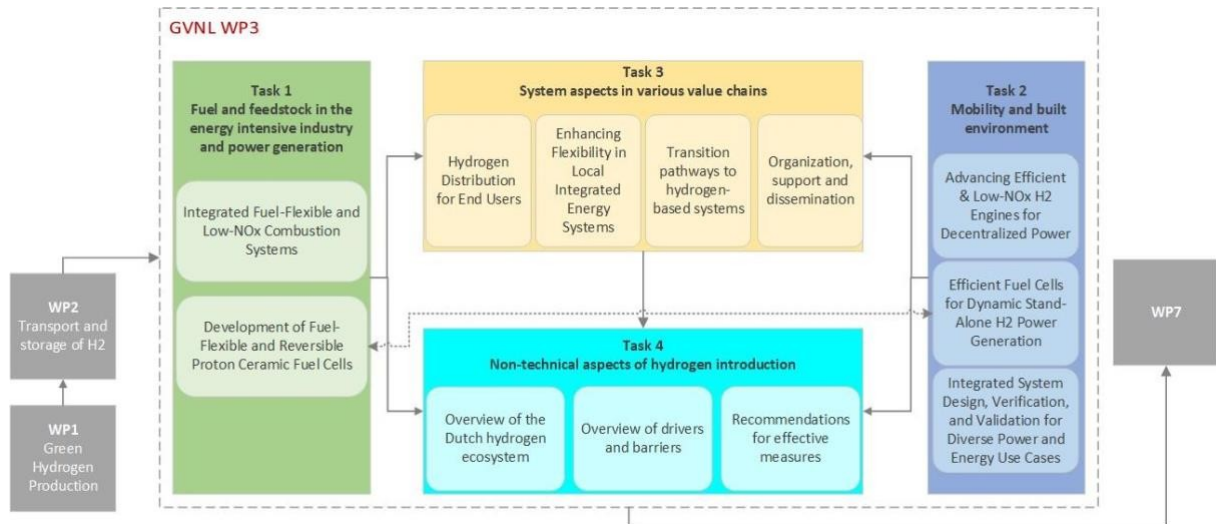


HyTROS objectives:

- Achieve a safe and reliable hydrogen infrastructure
- Assess the potential of offshore pipeline reuse
- Mapping and assessing large-scale hydrogen storage options.

<p>The HyTROS consortium is a well balanced public private collaboration including</p> <ol style="list-style-type: none"> 1. 11 Universities 2. 2 Research organizations (TNO, Deltares) 3. 2 Academia of applied sciences (Hanze, HAN) 4. 18 Industrial partners, of which 3 are co-applicant and 15 are co-funders 5. Coordinated by TNO and TUE 6. Budget 18 Meuro 7. Start Jan/Feb 2024 	<p>• Industry</p>	<p>• Academia</p>
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The **HyUSE** consortium focused on the use of hydrogen has partners such as the knowledge institutions HAN, Avans, Saxion, UT and TU/e, as well as the region-based companies Hyet Nocarbon, Hyster-Yale, Celsian, Thomassen energy, ESCF and DNV. There is already close cooperation between these parties through the HCA GroenvermogenNL. HyUSE adds a direct and strong substantive focus that can strengthen the region and the country.

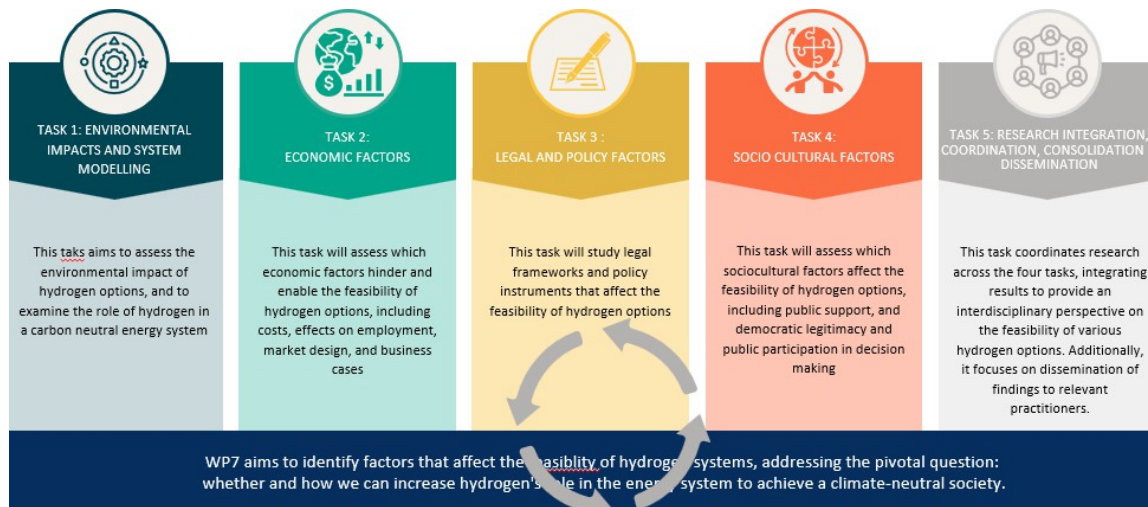


The **HyUSE** consortium is a well balanced public private collaboration including

1. 8 Universities
2. 3 Research organizations
3. 5 Academia of applied sciences
4. 14 Industrial partners
5. Coordinated by TNO and UU
6. Budget 16,6 Meuro
7. Start Jan/Feb 2024



The **Hy-SUCCES** consortium focused on socio-economic aspects of hydrogen has knowledge institutions based in the East region HAN, Avans, Saxion, UT, Radboud and TU/e. None of the region-based companies participate in the consortium. However, the content of Hy-SUCCES is highly relevant to the region. Direct access to this consortium will have an impact on the region.



<p>The consortium is a public private collaboration including</p> <ol style="list-style-type: none"> 10 Universities 3 Research organizations 4 Academia of applied sciences 4 Industrial partners Project leader University of Groningen and technical management Tilburg University Budget 12 Meuro Start Nov/Dec 2024 	<p>• Industry</p>	<p>• Academia</p>
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In the **HyPRO** consortium in the making aimed at hydrogen production, the companies Fluidwell, VDL, AVOXT, Veco, Prodrive Tehnology and Bosch transmission technology established in the East region participate in addition to the knowledge institutions HAN, Avans, Saxion, Fontys, UT and TU/e.

Collaboration outside of GroenvermogenNL

Within Region East, R&D and pilot/scaling projects are taking place across the breadth of the energy transition. Certainly where grid congestion mitigation or resolution is concerned. An important growth fund program in this is Charging Energy Hubs²⁰. In addition to these types of large programs, many smaller projects are being implemented and applications from small to large are in preparation. The East Region, from the liaison team, ensures the connection of the programs and projects and the utilization of the results where this makes sense. The development of this is an ongoing process.

²⁰ <https://www.cpb.nl/sites/default/files/omnidownload/CPB-Analyse-NGF-2023-3e-ronde-5-7-Charging-Energy-Hubs.pdf>



Justification: This track/program was made possible by GroenvermogenNL, a national program of the Ministry of Economic Affairs & Climate, funded by the National Growth Fund and facilitated by Regieorgaan SIA, part of the Netherlands Organization for Scientific Research (NWO)

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