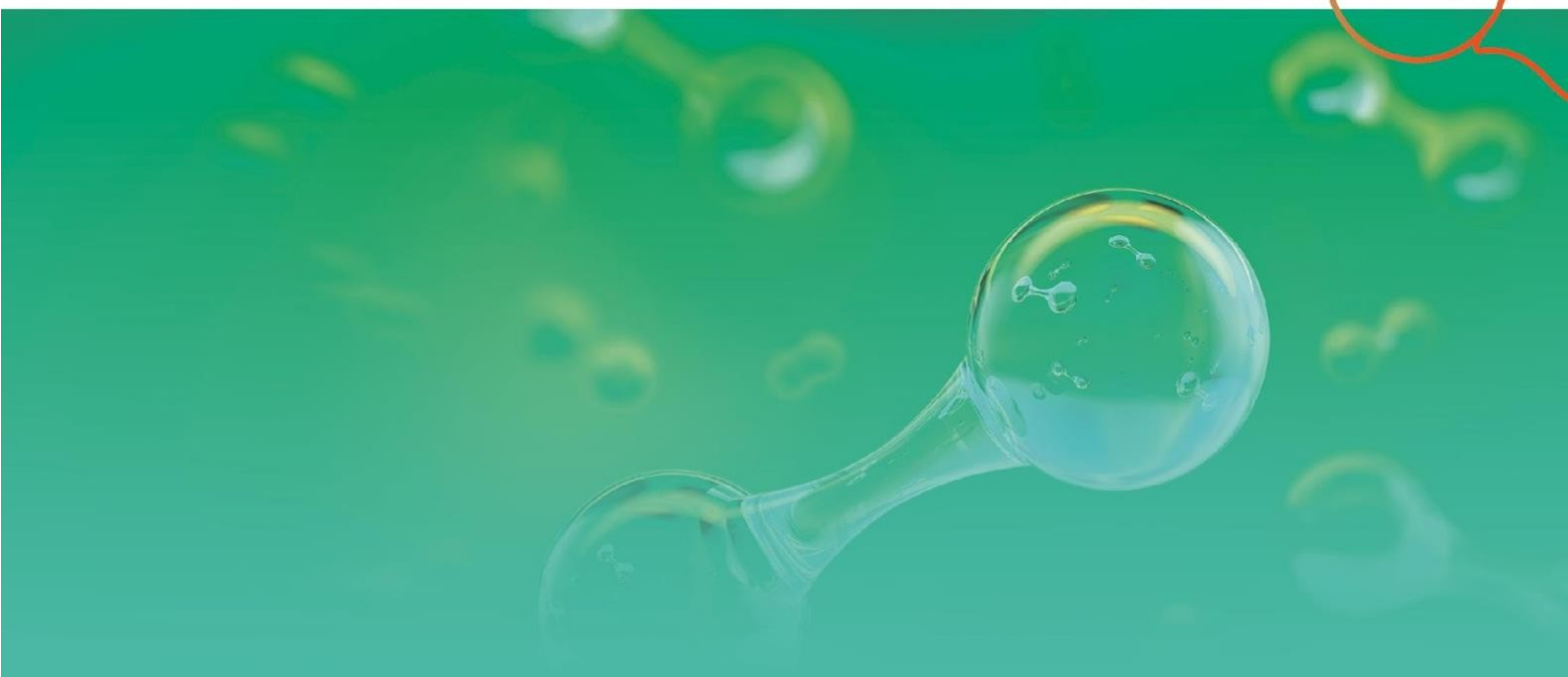
groen vermogen nl | Innovatiemotor van de groenewaterstofeconomie



Green PowerNL HCA Roadmap Region Southwest.

The human aspect of the green industrial revolution in the Dutch region with the largest existing hydrogen demand

Gerben Huiszoon MSc
Feb. 29, 2024

Table of contents

Summary

This roadmap of the South-West Netherlands region is part of the GroenvermogenNL Human Capital Agenda program, which aims to support the green hydrogen transition in the Netherlands by working with knowledge institutions, governments and industry to ensure a sufficient and well-trained workforce. The roadmap describes the current use of gray hydrogen by the Zeeland industry and the opportunities for a transition to green hydrogen.
The Zeeland industry is the largest consumer of gray hydrogen in the Netherlands. The Smart Delta Resources (SDR) partnership includes three of the top 10 CO2 emitters in the Netherlands. Despite being the province with the smallest population, Zeeland emits more CO2 than Groningen and Friesland combined. It is therefore of great importance to support the Zeeland industry in the transition to green hydrogen in order to achieve the Zeeland and Dutch climate objectives.
Fortunately, Zeeland has excellent opportunities for a green hydrogen economy. Over 5GW of offshore wind energy will come ashore from the Borsele, Nederwiek and IJmuiden Ver wind farms. In the North Sea Ports port area, 12 electrolyser plants are being developed that can dispose of the green hydrogen fuel directly to nearby industry. The hydrogen backbone already exists here and will be connected from Zeeland to the rest of the Netherlands and Belgium. There is close cooperation between industry, governments and knowledge institutions in SDR.

To promote the development of Zeeland's hydrogen economy, the region is committed to 4 program lines with this roadmap:

- HCA Green Hydrogen Zeeland develops education for 8 MBO and 8 HBO courses.
- Lifelong Development (LLO) is shaped from the Energy Campus Zeeland.
- There will be hands-on research on system integration and water as a feedstock for hydrogen.
- Learning communities are needed to support SDR with support creation and job retention. They are also needed to assist business parks (VNO/NCW) with regional innovation and sustainability.

These program lines are developed by the region and, in addition to GroenvermogenNL, are connected to JTF, Regiodeal, LLO Catalyst, Delta Climate Center and regional funds. Coordination and timely synchronization with GroenvermogenNL is therefore also very important for successful development of the human capital agenda for the Zeeland hydrogen economy.

1 Exploration of the Zeeland area

1.1 Introduction

The delta region in the South-West Netherlands is home to a powerful cross-border industrial cluster of chemical, steel, energy and food companies. The companies in this cluster are committed to contributing to the climate goals of 2030 and 2050. The use of green hydrogen plays an important role in this. Large companies, SMEs, start-ups, scale-ups, governments and knowledge institutions are working together to scale up the application of green hydrogen. There are excellent and flexible integration opportunities at companies, the electricity from large offshore wind farms comes ashore here and with Smart Delta Resources there is a powerful cooperation platform. By responding to a combination of transitions (climate, raw materials and energy), the Delta region will be able to sustainably realize its social and economic value.

The RIS3 Strategy 2021-2027 (Hagens et al, 2021) states that the necessary ingredients are present in the Delta region to successfully deploy green hydrogen on a large scale. Zeeland plays an important role in the landfall of offshore wind, which provides opportunities for the production of green hydrogen, produced with large volumes of renewable energy from the sea. This provides an impetus for innovation in green hydrogen production ("electrolysers"). The efficient use of electricity from offshore wind directly on the coast in electrolysis means making the most of moments when the wind provides electricity, and that the electricity does not call on transmission grids towards the hinterland but finds its economic use directly on site ("resource efficiency").

The Regional Energy Strategy 1.0 for Zeeland (RES1.0) (Zeeland Energy Agreement, 2021-2023) mentions under other themes 4.7 Hydrogen that hydrogen is an "absolute priority" as a feedstock for industry. The second priority is hydrogen as a high-temperature source for industry. In the long run, hydrogen represents a third priority as a possibility for seasonal storage for renewable electricity. The fourth priority is heavy transport, choosing to follow the market. For the region, development of a green hydrogen program from the knowledge institutions is thus not only a necessity from the industry, but also anchored in Provincial policy objectives signed by many stakeholders in the Zeeland Energy Agreement.

The "System Study Energy Infrastructure Zeeland" (CEDelft, 2020) indicates that "the business case for hydrogen production in the region should be examined in conjunction with both the local demand for hydrogen and oxygen, and the national electricity market, as well as transport capacity of electricity grid and gas grid". Follow-up studies on this from Smart Delta Resources and investments in this from the national government indicate the opportunities for a green hydrogen economy for Zeeland.

The report "Hydrogen in the Delta Region" by Waterstofnet (Waterstofnet, 2021) indicates "Relying on European ambitions, the Flemish-Dutch Delta (VND) has a 'unique selling point', as the emphases of European hydrogen policy are reflected 'one to one' in the VND region." "The Delta region is special in Europe, as it is home to many unique technology developers and hydrogen technology manufacturers, widely distributed across the value chain. All these existing activities demonstrate the great potential this region has for the development of a hydrogen market." "In addition to the existing activities in the region, dozens of projects have been submitted by industry to develop hydrogen in the region

in the coming years. These projects are focused on the entire hydrogen value chain, from production to infrastructure and end use."

The activities that Region South-West wants to develop within the framework of GreenVermogenNL Human Capital Agenda are an integral part of making the process industry in Zeeuws- Vlaanderen and Vlissingen-Oost more sustainable with renewable energy and circularity of raw materials. Societal goals are the reduction of CO2 emissions, expanding the use of renewable energy and, above all, reduction of fossil produced hydrogen (steam methane reforming or "SMR") in exchange for green produced hydrogen (electrolysis). According to the SDR Regional Plan, the hydrogen demand in the SDR Region is 520,000 tons per year, making it by far the largest in the Netherlands. Currently, every kilo of hydrogen produced with SMR produces 9 kilograms of CO2. By encouraging industry to lead the way in the sustainable development toward green hydrogen, the region is also strengthening its economic resilience and thus livability. In the province of Zeeland, industry is the largest issue in terms of absolute volume in terms of sustainability, with 85 PJ of energy demand totaling 125 PJ in Zeeland (see Figure 2).

There is also a focus on hydrogen use and demand in other sectors. SMEs, whether clustered as business parks or not, are working to become more sustainable and looking for alternatives to using natural gas for business process and fuel for logistics. Due to grid congestion, electrification of business processes and logistics is becoming a major issue. This should also be seen as a major focus for the region's economic resilience. Recently, the province of Zeeland has also been declared a congestion area. This means that companies with expansion or sustainability plans cannot count on expanding the capacity of their electricity connection. Of course, the hydrogen infrastructure to be developed (as can be read in the pMic of Zeeland) is then immediately claimed. However, it is highly questionable whether this can go hand in hand with making the process industry more sustainable and its claim to the hydrogen infrastructure.

The National Hydrogen Roadmap outlines national ambitions with an important role for Zeeland. According to SDR's CES report, by far the largest reduction in CO2 emissions in the Scheldt Delta region must come from green hydrogen (Smart Delta Resources, Cluster Energy Strategy, 2022). The production of hydrogen by 2030 will be done as much as possible with electrolysers based on offshore wind energy or imported. The report "Zeeland in Stroomversnelling" (Berenschot, 2020) says of this:

"If the Netherlands manages to strengthen its role as a hydrogen hub internationally, knowledge and employment in this theme will also increase. A significant part of the Dutch Chemical sector is present in Zeeland, the possible arrival of a hydrogen knowledge center in the region (for example as a replacement for the Markaz) is therefore very conceivable. In addition, the offshore wind sector with a number of companies is located in the region, an increase in demand for renewable energy increases sales in this sector. In other words, Zeeland has many opportunities in the field of sustainable generation of electricity and hydrogen, among other things, and if there is cooperation with the existing industrial cluster and commitment from the State, much growth can be realized."

The Zeeland industry is already investing in the transition to green hydrogen. The first plants to produce "green" hydrogen have already received subsidies and are scheduled for completion in 2026 (Smart Delta Resources, Two Zeeland pioneering green hydrogen production projects receive subsidies, 2023). North Sea Ports is developing a hydrogen hub on a European scale. In their

hydrogen strategy states the 2025 ambition: "by 2025, 500MW of electrolysis capacity and connect to the European backbone." In addition, NSP wants to become European import and export hub (North Sea Ports, 2022).

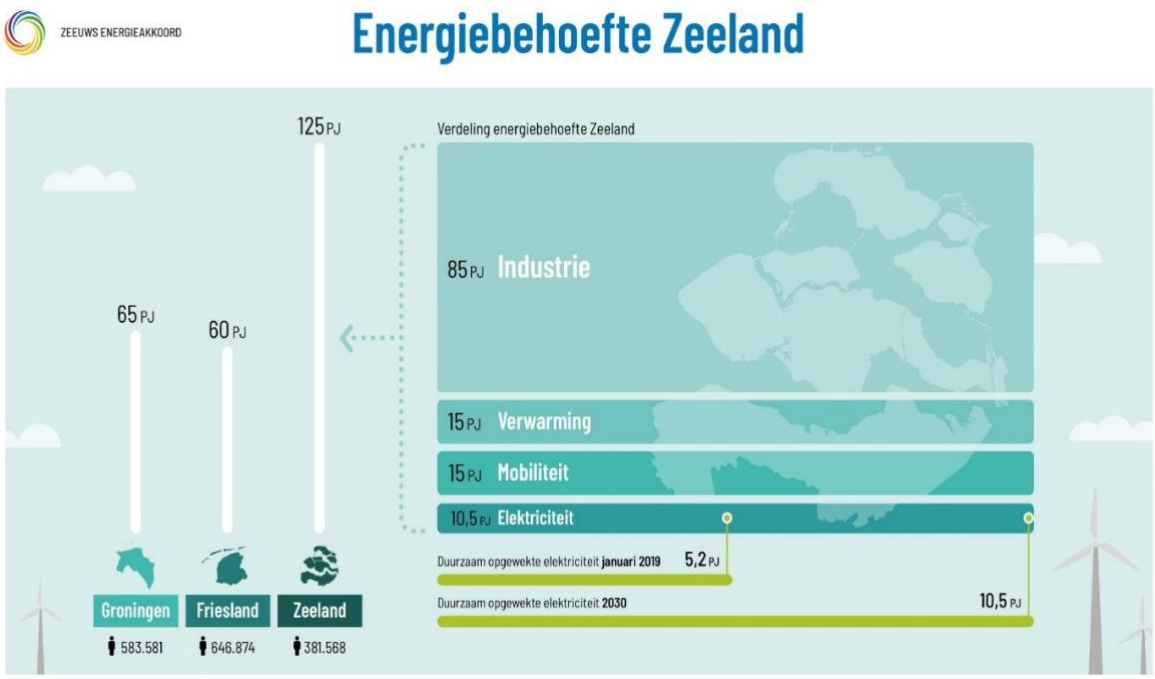


Figure 2 Energy demand in Zeeland (source: Zeeland Regional Energy Strategy, RES 1.0)

1.2 White spots region of Zeeland

The report "Actualization and policy evaluation Zeeland in Stroomversnelling" (Berenschot, 2020) indicates that the innovative strength of Zeeland has deteriorated compared to the rest of the Netherlands. "The factor where Zeeland scores significantly less than many other regions constitutes public investment in R&D." (Berenschot, 2020) Indicates that this requires extra attention and investment for Zeeland. The report (Berenschot, 2020) also indicates that "Zeeland has many opportunities in the field of sustainable generation of electricity and hydrogen. If we work together with the existing industrial cluster and commitment from the state, a lot of growth can be realized."

1.3 Labor market tightness and human capital needed for green hydrogen production

The report "ACTUALIZATION AND POLICY VALUATION SEELAND IN STROOMS" (Berenschot, 2020) lists under "Skills and labor market" the results of a 2019 UWV study showing that "The national labor market tightness is particularly noticeable in Zeeland. In 2019, Zeeland's labor market tightness was at the highest measured level of all provinces since 2016. That year, Zeeland experienced severe labor market tightness within 10 out of 11 occupational classes. (UWV, 2019). Exact numbers are not yet known and are being mapped in focus area 2 in cooperation with industry.

The RES1.0 (Zeeland Energy Agreement, 2021-2023) states in 4.5 Labor Market and Training: "To effectively implement the Zeeland energy transition, knowledge and manpower are needed. The demand for labor in the energy transition will increase in all provinces in the coming years. In Zeeland, compared to the other provinces, greater tension in the labor market is expected.
The SER states that current education and training provision is not yet adequately equipped to meet these changing needs." "Labor Market and Training are the Achilles heel of RES1.0. There is an urgent need for focus and direction to ensure that we actually have (or have access to) the hands, knowledge and experience to realize the energy transition in the various sectors." (Zeeland Energy Agreement, 2021-2023).

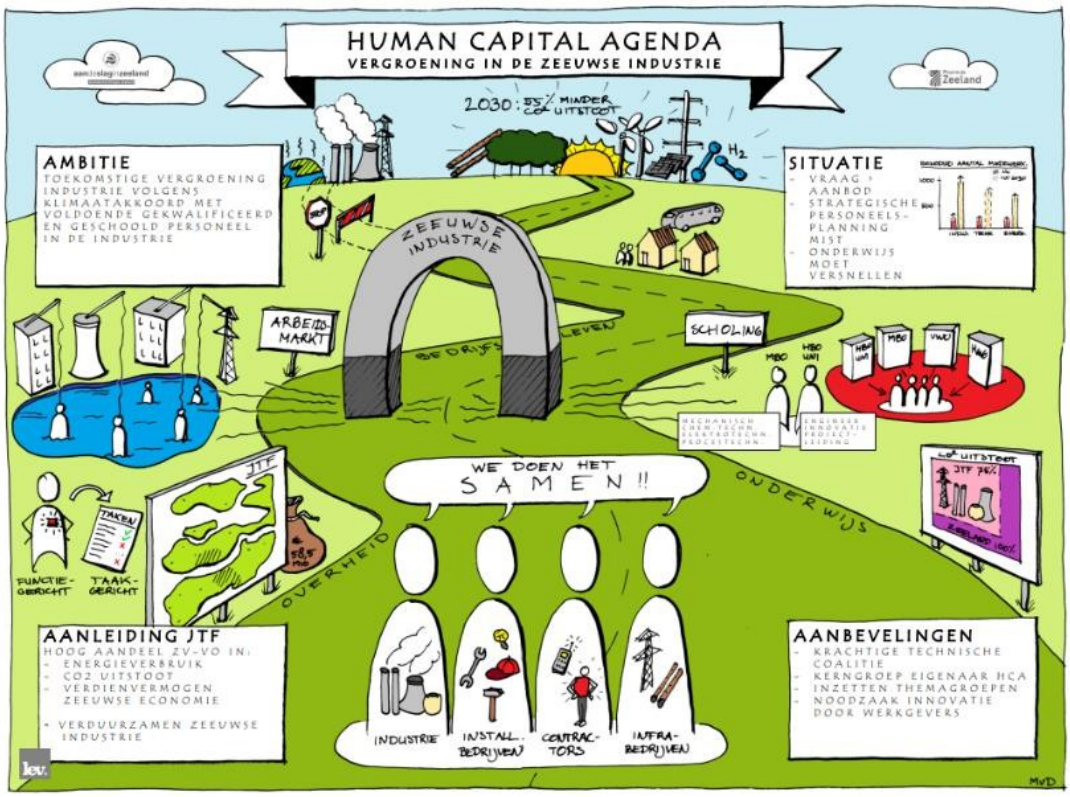


Figure 1: HCA Greening in Zeeland's industry.

Energy transition affects the chemical industry in Zeeuws-Vlaanderen and Vlissingen-Oost (ZV-VO) economically, socially, spatially and environmentally. The impact on human capital is significant. Recent studies (Arbeidsmarkt in zicht, Oct 2022 | Verkenning arbeidsmarkt JTF Zeeuws Vlaanderen, Sep 2021 |Rapport HCA Vergroening in de Zeeuwse industrie, Nov 2022) show that the human capital factor is crucial in the success of the energy transition.

Economically, the energy-intensive sectors are of great importance to ZV-VO. With 13.7% of direct jobs and 27.1% of the BRP, they are a large and economically important employer in the COROP area of Zeeuws- Vlaanderen (Verkenning arbeidsmarkt JTF Zeeuws Vlaanderen, Sep 2021). Chemical and industrial jobs are also of enormous socio-economic importance in other parts of Zeeland (including the Vlissingen-Oost Port Area) and in the Flemish part of the Canal Zone (including the Port of Ghent). These approximately 8,000 jobs are under pressure because of anticipated shrinkage of traditional refining and potential shrinkage of the chemical cluster if the transition is not

gone through . The climate transition requires a massive transformation of activities, processes and production. A transformation that sectors cannot make alone.

Province of Zeeland has commissioned research on labor market tightness for the energy transition. The report "HCA greening in Zeeland's industry" (East, 2022) indicates that the shortage in Zeeland's labor market for industry will reach 19,500 vacancies in 2030. Also, the report indicates that "An acceleration in (mainstream) education is badly needed to meet the 2030 greening industry targets."

The Labour Market Shortages in Engineering, Construction and Energy Attack Plan also indicates this tightness. (Techniek Nederland, 2023). UWV's Climate Jobs Energy System publication describes the tightness and the importance of developing an HCA (UWV, 2022). Current events on Oct. 26 show that the Netherlands is not yet on track to meet the tightened energy targets.
One of the causes is the shortage of skilled workers (NOS, 2023).

Training for green hydrogen still hardly exists in the Netherlands. HyDelta writes: "A complete and adequate MBO training for technical personnel is not available and will have to be developed. " (HyDelta, 2022). The study "Energietransitie InZicht" indicates that in Zeeland in 2021 4000 vacancies were posted for occupations in energy transition and that the labor market in this is very tight. (Labor Market in View, 2022).

Working with green hydrogen offers opportunities for structural reinforcement and economic growth, but also requires proper attention to training, working safely and certifying processes, installations and personnel. The knowledge institutes in Zeeland estimate that the current ambition for 2025 requires about 250 fte of technical personnel related to electrolysis activities on a structural basis. In the entire value chain, about 1,000 fte are structurally needed from 2025. This estimate is based on discussions with developers of hydrogen plants such as Orsted, Air Liquide and VoltH2 and experience with the development of the offshore wind sector in Zeeland.

Without human capital development, the opportunities for public investment and scale-up of hydrogen-related projects will not be realized. This involves, on the one hand, the training and (re)education of entrants and existing personnel for this labor market.
On the other hand, these are forms of cooperation in which working, learning and innovation contribute to a different approach to issues in which the use of hydrogen is addressed. The latter will potentially be of great importance for the perspective and livelihood of SMEs. Because projects in the region focus on the entire hydrogen value chain, human capital development should also include the entire value chain.

1.4 Investment agenda green hydrogen in Zeeland

Major industrial parties in Zeeland have been working together for years within Smart Delta Resources to increase sustainability. For example, Dow and Yara have realized the first hydrogen pipeline to achieve circularity through residual streams between the companies. Chemical company DOW is working on a 1 billion investment in Carbon Capture and Storage, to be realized before 2030. The multinationals Orsted and Air Liquide have been recognized for the IPCEI scheme for investments in electrolysis (Haddock and ELYgator projects) of strategic importance for the EU's energy transition. Its location close to the North Sea (Figure 3) makes not only the import of green hydrogen an option, but also the production of green hydrogen from offshore wind energy locally (1.4 GW connected now, 2030 5.4 GW).

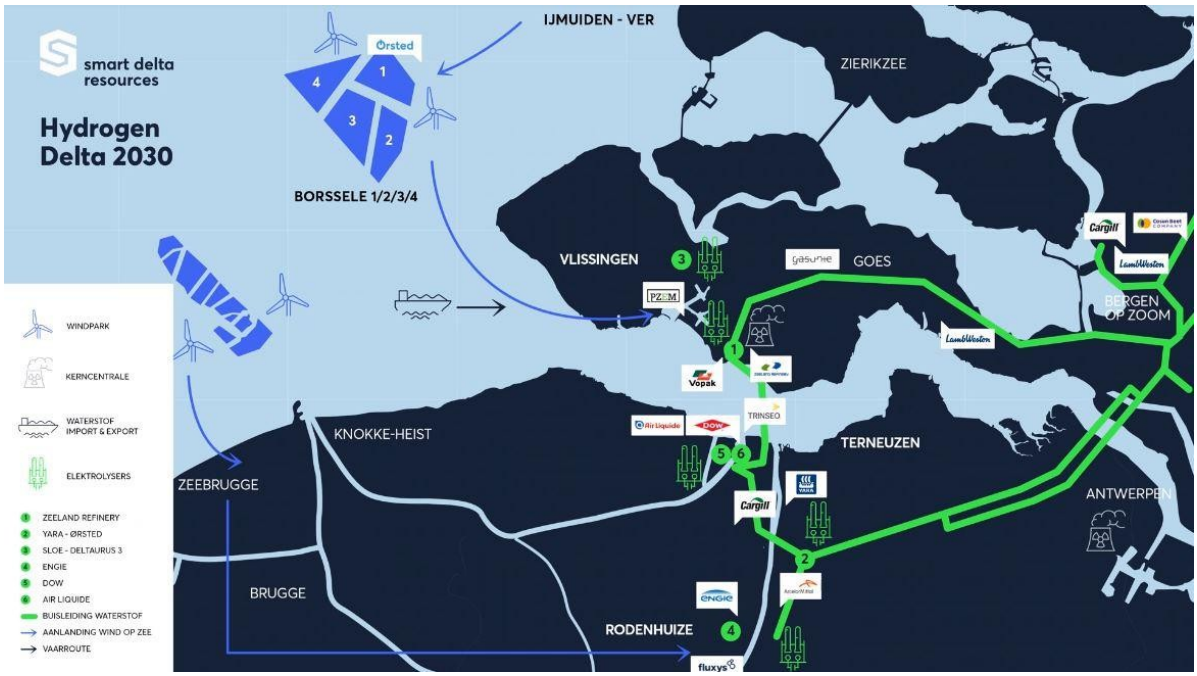


Figure 3 Development of electrolysis in Zeeland (Smart Delta Resources (SDR), May 27, 2021)

The pipeline of large-scale electrolysers to be realized in Zeeland is well advanced and is also at the forefront of the introduction of green hydrogen production internationally (see Figure 4). The timelines of these projects mean that there has already been an increasing demand in Zeeland for employees with knowledge of working safely with sustainable hydrogen since early 2022, and thus the supply of skilled workers has actually been falling short of the demand from employers since last year.

Initiatiefnemer	Projectnaam	Categorie	MW_e	Jaar	Locatie
Air Liquide		Elektrolyser	200 200	2024 2030	Terneuzen
Ørsted	SeaH2Land	Elektrolyser	500 500 500 500	2025 2030 2033 2035	Vlissingen-Oost Kanaalzone
Volt H2		Elektrolyser	25 75	2023 2024	Vlissingen-Oost
Volt H2		Elektrolyser	25 25 25 25	2023 2024 2025 2026	Axelse Vlakte
Yara / Orsted		Elektrolyser	100	2025	Sluiskil
Zeeland Refinery	H_2ero	Elektrolyser	150	2027	Vlissingen-Oost
Air Liquide		E-boiler	50	2024	Terneuzen
Dow	Multi-Generation Plan	Blue H_2 project Elektrificatie kraakfornuizen	200 700 700	2025 2030-2033	Terneuzen

Figure 4: Pipeline of electrolysers in Zeeland Source: personal communication with Province of Zeeland, June 1, 2021.

The development of electrolysers is still growing, for example, RWE is also known to be in an advanced stage of planning an electrolyser of 100 MW or more. At the date of writing, there are no concrete initiatives in Zeeland for the application of green hydrogen in the built environment, and initiatives for mobility on green hydrogen have also found little traction to date. We therefore foresee for the time being that investments and HCA demand will come mainly from industry in ZV-VO.

1.5 Investments by SMEs

VNO/NCW indicates that about 10% of the 500 business parks in the region face serious grid congestion in making their energy supply more sustainable and expanding their business activities. Currently, we see a fragmented and ad hoc approach where it is unclear who is in charge and who is taking the initiative. The current state of affairs shows a different director or coordinator for each business park. Often people start at a specific technological solution without properly exploring the problem.

Entrepreneurs, province and municipalities all have input but point to each other in taking responsibility. It is necessary to follow a uniform process so that the different business parks can learn from each other and thus avoid wasting a lot of time and effort. This uniform process should be facilitated by municipality and province by bearing the guidance costs of a process director/coordinator.

It hasn't escaped the notice of local municipalities and businesses that there is considerable investment in hydrogen as a carbon-neutral energy carrier. But mostly it will not be the best option for business parks. All the more so because the required connection to the H2 backbone will not get there, or not in time, or because there are

economically better options that remain underexposed. It therefore fits better in this roadmap to examine how to prevent entrepreneurs at business parks from achieving sustainability without investing in hydrogen technology solutions.

To achieve this, it is necessary to work on knowledge building and knowledge sharing about hydrogen. Here the EnergyCampus can play a supporting role.

2 Impact HCA-GVNL in Zeeland

GroenvermogenNL is part of the energy transition portfolio of the knowledge institutions in Zeeland. The cohesive strategy for developing a human capital agenda for energy transition in Zeeland is defined by the Smart Delta Resources (SDR, 2023) agenda. "In Smart Delta Resources (SDR), energy- and resource-intensive companies in the Flemish-Dutch Scheldt-Delta region have joined forces within a unique, cross-border collaboration of industry, port, knowledge institutions and governments."

SDR's agenda is decisive in developing the human capital agenda for the energy transition in Zeeland because:

- In SDR 3 of the Netherlands' top 10 CO2 emitters are connected.
- SDR's member companies are Zeeland's largest employers.

The agenda is specifically described in the Cluster Energy Strategy of the Scheldt-Delta Region (SDR, CES Scheldt-Delta Region, 2022).

Figure 2: SDR Region Partners

The human capital agenda for energy transition in Zeeland is being developed from the following grants. A small group of project managers and liaisons is overseeing this portfolio that includes some €50,000,000 for the next 4 years. This poses a huge challenge for the small knowledge institutions working on coherence and overview.

Grant	Treasurer	Target
RIF Wind at Sea	Scalda	MBO training for wind mechanics
EU T-Shore	Scalda	International training for wind mechanics
JTF HCA Green Hydrogen	HZ	Green hydrogen education for 16 existing engineering courses + hydrogen lab
JTF Flex Intensity	HZ	Research on system integration of offshore electrolyzers
JTF Heat Transition Lab	HZ	Research and education on heat transition for industry
JTF Energy Campus	Scalda	Energy Campus at knowledge yard
RFO Airtub 2.0	Fieldlab Zephyros	Hands-on research on offshore wind farm maintenance
Delta Climate Center	UCR, HZ, Scalda	Practorship Smart Delta Technology Practorship Energy in the Delta Lectureship Sustainable Materials
Interreg Energetic Education	Avans	MBO Nuclear Safety
Growth Fund Catapult New Waves	Dockwize	Scaling up PPPs Water, Energy, Food
Green PowerNL	HZ	National hydrogen academy Learning communities Knowledge platform

The Human Capital Agenda of GroenvermogenNL largely serves to realize the project HCA Green Hydrogen Zeeland. Figure 3: JTF HCA projects Zeeland gives a limited overview of the JTF HCA energy transition projects in Zeeland.

Inhoudelijk overzicht HZ/SCALDA - projectaanvragen JTF			
Energy campus Project: €10 miljoen JTF: 5 miljoen (Spoor 3) Status 10-7-2023: in behandeling	**HCA Warmtetransitie** Project: €1 Miljoen JTF: €0.5 miljoen (Spoor 3) Status 10-7-2023: in voorbereiding	**HCA Groene Waterstof** Project: €2.8 Miljoen JTF: €1.4 miljoen (Spoor 3) Status 10-7-2023: in aanvraag	**FLEX Intensity (systeemintegratie waterstof)** Project: €5-€10 Miljoen JTF: 2,5-5 miljoen (Spoor 1) Status 10-7-2023: aangevraagd 6 juli
Inhoud werkpakketten 1. Projectmanagement 2. Communicatie	**Inhoud werkpakketten** 1. Projectmanagement 2. Communicatie	**Inhoud werkpakketten** 1. Projectmanagement 2. Communicatie	**Inhoud werkpakketten** 1. Projectmanagement 2. Communicatie
Innovatie in het bedrijfsleven 3.1. Energy Challenges 3.2. Intrapreneurship 3.3. Social Lab			**Innovatie in het bedrijfsleven** 3. Opschalings-pilot offshore electrolyser
Ontwikkelfaciliteiten in het gebied 4.1. Smart Grid (Technum Scalda Vlissingen) 4.2. Smart Energy (Technum Scalda Vlissingen) 4.3. Real-scale faciliteit (KAAP Vlissingen)	**Ontwikkelfaciliteiten in het gebied** 3-5. Duurzame warmte (Scalda Terneuzen) 3-5. Duurzame warmte (HZ Vlissingen)	**Ontwikkelfaciliteiten in het gebied** 6a. Waterstofonderwijs (HZ Vlissingen) 6b. Waterstoflab (HZ Vlissingen)	
Onderzoek als katalysator 5.1. Warmte in de industrie 5.2. Duurzame energietransitie Mineralen 5.3. Governance van de energietransitie		**Onderzoek als katalysator** 5. Maatschappij en waterstof	**Onderzoek als katalysator** 4. Systeemintegratie waterstof
Leven Lang Ontwikkelen 6.1. Makelaarsfuntie 6.2. Scholingsaanbod 6.3. Specialisaties	**Onderwijs** 6-7. Onderwijsmodules duurzame warmte	**Onderwijs** 3-4&7. Onderwijsmodules waterstof	**Onderwijs** 5. Onderwijsmodules systeemintegratie industrie

Figure 3: JTF HCA projects Zeeland

HZ UAS and Scalda want to develop training programs for greening the large hydrogen demand in ZV-VO (520,000 tons of industrial hydrogen per year) in a timely manner in a process that is grafted onto developing wind turbine technician training in a short time. Other pressing issues are integrating electrolysis into the energy system and the supply and disposal of water that is sufficiently pure for the processes and does not impair the water supply in ZV- VO. For partial funding, the institutions are aligning here with the EU JTF program for the Zeeuws-Vlaanderen / Vlissingen Oost JTF region.

In terms of content, we now foresee four broadly supported tracks;

- Timely training for personnel needs for the brand new industrial process of large-scale electrolysis (NB: neither NL nor EU has experience in this)
- Integrate opportunities and knowledge about Lifelong Development in the training to be developed for setting up and managing electrolysis process;
- Applied research with spin off to training on integrating renewable energy production (particularly offshore wind energy) into industrial processes, the electricity grid and the electricity market;
- Applied research with spin off to training on the supply of the right qualities and quantities of water to electrolysers and the proper disposal of wastewater with circularity and environment in mind;

Given the high coherence of these issues in the ZV-VO region, the starting point is not to broaden this scope (built environment, mobility) and accommodate it in an integrated and centralized program, aligned and sponsored by GroenVermogenNL in addition to other resources and stakeholders.

2.1 Educational development: project HCA Green Hydrogen Zeeland

The ambitions of the knowledge institutions in Zeeland are:

- By 2025, Zeeland will be self-sufficient in conducting hands-on research and providing employees who will operationally establish the use of the new green hydrogen and system integration technology and help realize new green hydrogen projects.
- Realize the HCA Green Hydrogen Zeeland project to start providing Human Capital for the green hydrogen economy in an innovation environment based on reasoned desirability and cultural feasibility.

The right training for green hydrogen is socioeconomically essential to put the region on a timely and proper track away from fossil resource production to sustainable technology without losing jobs. MBO and HBO technicians are not only needed for the technical realization of the energy transition but, because of their knowledge and general skills, they also function as energy consultants at the organizations where they come to work. With their up-to-date knowledge, they contribute to properly informing society about how the energy transition can be shaped. Preferably, this even creates opportunities so that the region can start exporting knowledge and technology in this field. This transition keeps the regional industry competitive against countries and regions that also decouple their industry from the prices of CO2 emissions and natural gas in this way.

The knowledge institutions focus on the knowledge and training needs of the region for the hydrogen transition. To enable the hydrogen transition in Zeeland, in addition to training new professionals, retraining of the existing workforce is needed. This requires not only re-skilling and up-skilling of existing personnel through lifelong development, but also appropriate training for new workers. To provide the required training, a professionalization program is needed to retrain teachers and the right knowledge infrastructure such as laboratories for teaching and research. To bring stakeholders and environment along with the developments, knowledge transfer to all (non-technical) stakeholders is also needed to guide this social transition and create sufficient support in the region. This Roadmap focuses on the development of the total hydrogen education program with infrastructure for MBO and HB.

The HCA Green Hydrogen Zeeland project runs from 1-1-2024 to 31-12-2027 and is 50% funded from EU JTF. The region plans to use GVNL HCA to cover the remaining 50% and the development of the learning communities. Educational development will be coordinated with the National Hydrogen Academy.
This exceptionally rapid and unusual investment in education on a particular category of technology is something institutions cannot afford from normal funding and operations. Groenvermogen NL and the EU Just Transition Fund ("Just Transition Fund") supports the regions most affected by the transition to climate neutrality, by enabling economic development and diversification and helping people adapt to a changing labor market. Given our proposal, this combination seems appropriate, after all, where old practices disappear (such as "steam methane reforming") and new ones appear (electrolysis), employees and students and therefore educators and stakeholders will have to acquire the new knowledge.

2.2 Practice-oriented research

Knowledge institutions, hydrogen plant developers and partners are exploring the development of a research line on water for hydrogen through the R&D WP1. In addition, the table of JTF projects reflects the design of JTF Flex Intensity in which hands-on research is being conducted on system integration of offshore wind with electrolysers.

2.3 Lifelong development: flexible training offerings from the Energy Campus

An agile and resilient workforce requires training. This involves attracting and training employees in the relevant professions, as well as permanent further education: lifelong development. The Energy Campus is the umbrella for all energy transition projects and LLO of the Zeeland knowledge institutions. From the Energy Campus, the learning community for LLO is developed, based on contacts with industrial companies, SMEs and other partners.
This creates a flexible and permanently developing educational offering. This involves developing new offerings, specializations and minors to provide additional curricular opportunities.

In doing so, the Energy Campus aims to:

- Shape the "broker function" for industry inquiries. Brokerage function is important because of its ability to pick up questions and encourage collaboration. This is not always in projects.
- Clearly present the public and private education offerings.
- Furnishing opportunities for Lifelong Employee Development.
- A structural connection with big business and SMEs to shape this.

2.4 Learning Communities

Smart Delta Resources

In Zeeland, knowledge institutions are working closely with industry from Smart Delta Resources. "In Smart Delta Resources (SDR), energy- and resource-intensive companies in the Flemish-Dutch Scheldt-Delta region have joined forces within a unique, cross-border collaboration of industry, port and governments." "SDR helps industry develop their sustainability plans with concrete, innovative programs focused on CO2 reduction, circularity, sustainable raw materials and green energy.
One of the programs is the Hydrogen Delta Program, which aims to help make the Benelux's largest hydrogen cluster more sustainable by phasing out gray hydrogen by investing in clean hydrogen. The collaboration makes a substantial contribution to European and national climate goals. The ambition: a competitive and climate-neutral industry in the region by 2050." (Resources, 2022). Smart Delta Resources is committed as a partner to the plans in the roadmap.

North Sea Ports

"North Sea Port is the 60-kilometer cross-border port area stretching from Flushing in the Netherlands on the North Sea to Ghent - 32 kilometers inland in Belgium." (Ports, sd). "North Sea Port has the ambition to be a hub in the European hydrogen network. The switch to low-CO2 hydrogen is necessary to make the most energy-intensive clusters such as steel and chemicals climate-neutral. The focus here is on importing green hydrogen and on attracting local large-scale hydrogen production. This requires infrastructure such as pipelines to distribute hydrogen between companies in the port area and connecting these pipelines to the "backbone" with other European ports and industrial areas. The large local demand for hydrogen and the favorable central location of North Sea Port make it possible to make the port a hydrogen hub in the European network.
By 2025, 500 MW of green power will be converted to hydrogen annually in the port area." The knowledge institutions and North Sea Ports are partners in several energy projects from which North Sea Ports will be connected to the developments in this roadmap.

Orsted

An MoU has been signed with Orsted (Appendix 3) to jointly establish green hydrogen education and research for the region. Orsted supports the knowledge institutions as a partner with the development of this program.

Energy Port Zeeland

From knowledge and innovation networks such as Platform Energy Port Zeeland (PEPZ), in which 340 Zeeland companies are affiliated to share knowledge about the energy transition, the learning community is set up to work, learn and innovate together and best support the green hydrogen transition. "The platform is the place where professionals from education, government and business meet both offline and online, exchange ideas and create initiatives together around Zeeland's growing offshore wind sector." (PEPZ, sd).

VNO/NCW Zeeland/West Brabant

The regional business community and in particular SMEs are represented by VNO/NCW. The Zeeland Energy Council is currently looking for a way to shape more local energy initiatives. This is called the local approach. The province of Zeeland plans to apply for a SPUK allowance for next year to increase the level of organization at business parks. Impuls and VNO-NCW Co-Creation will also explore how to work on a joint approach for all of Zeeland.

Collaboration & Cohesion

In Zeeland, the following partners are working together from the triple helix:

Cooperation between knowledge institutions and knowledge infrastructure

Knowledge institutions HZ, Scalda and UCR work together to organize education and research programs in coherence. To this end, they already share knowledge infrastructure such as the knowledge yard in Vlissingen (Kenniswerf, sd) where knowledge institutions HZ and Scalda share education and research facilities with companies, regional incubators such as Dockwize (Hub, sd) and regional development company Impuls Zeeland. An example of shared research infrastructure is Fieldlab the KAAP where World Class Maintenance has Fieldlab Zephyros. In this fieldlab, companies and knowledge institutions work together on practical research to reduce on-site maintenance on offshore wind farms. HZ and Scalda have research laboratories and workshops for training such as the Joint Research Centre Zeeland (JRCZ) and Technum. In these laboratories and workshops VMBO, MBO and HBO are trained and practical research is conducted with companies. Together with incubator Dockwize, the knowledge institutions support the business community with innovation and valorization.

Collaboration with industry and government

Industry has big plans to build severalande hydrogen plants. The national hydrogen backbone will have its first branch in Zeeland. The industry and ports of North Sea Ports have joined forces with governments and knowledge institutions to form Energy Port Zeeland to shape the energy transition together by exchanging information. Within Smart Delta Resources, industrial partners are developing projects to reduce their CO2 emissions.
The Province of Zeeland and partners have indicated from the Zeeland Energy Agreement that they will implement the Regional Energy Strategy 1.0 in which the region's ambitions for energy transition are given. Various knowledge and innovation networks such as Energy Port Zeeland and the VL-NL cooperation are working on setting up projects to realize the RES1.0.

Cooperation between regions

Programs focused on HCAs Energy Transition, other HCAs from the National Growth Fund the play in the region (w.o. AiNed, Scaling up PPP Vocational Education and LLO Catalyst) and the Just Transition Fund from the EU;

3 Activities

- HCA Green Hydrogen Zeeland develops education for 8 MBO and 8 HBO courses.
- Lifelong Development (LLO) is shaped from the Energy Campus Zeeland.
- There will be hands-on research on system integration and water as a feedstock for hydrogen.
- Learning communities are needed to support SDR with support creation and job retention. They are also needed to assist business parks (VNO/NCW) with regional innovation and sustainability.

Educational development in project HCA Green Hydrogen Zeeland and LLO is aligned with the National Hydrogen Academy although the development in Zeeland is several years ahead. The learning communities play a central role for demand articulation and verification.

4 Operationalization

4.1 WP1 Project Management

Project management and roadmap implementation.

4.2 WP2 Communication

Communication to the learning community and the region about realization of the roadmap.

4.3 WP3 Professionalization program for MBO and HBO teachers.

In this work package a professionalization program is set up to retrain teachers of 8 technical MBO courses and 8 technical HBO courses in knowledge about green hydrogen. First the needs will be inventoried by looking at competences for working safely with green hydrogen and introducing technology and methods for the optimal use of the varying supply of renewable energy (offshore wind energy) in the industry in Zeeuws-Flanders and Vlissingen-Oost. Then the program of requirements will be drawn up and the professionalization program designed. External training at UGent (UGent, 2023) will be used for the first group to bring knowledge in-house. After the first round of training, the program will be improved so that it can be offered from the knowledge institutions themselves. WP1 makes use of the national MBO-HBO platform for teacher professionalization that is being established in the framework of GroenvermogenNL. A representation of teachers from HZ and Scalda is connected to this platform.

The hydrogen course va Ugent has only 40 spots per year. Given to professors who are real experts and do a lot of research with companies. There is a lot of interaction and discussion with the participants. https://www.ugain.ugent.be/waterstof2024.htm

Work package 3 consists of:

No.	Project Activity	Result	Partner	Role
3.1	Inventory of professionalization needs tbv green hydrogen among teachers of MBO courses	Program of requirements for professionalization program for MBO teachers tbv green hydrogen	Scalda	Implementation
3.2	Inventory of professionalization needs for green hydrogen among teachers of HBO courses	Program of requirements for professionalization program for HBO teachers tbv green hydrogen	HZ	Implementation
3.3	Design of professionalization program green hydrogen for MBO teachers	Professionalization program green hydrogen for MBO teachers	Scalda	Implementation
3.4	Designing professionalization program green hydrogen for college teachers	Green hydrogen professionalization program for college teachers	HZ	Implementation
3.5	First training round 10 MBO teachers	First 10 MBO teachers trained in green hydrogen	Scalda	Implementation
3.6	First round of training 10 college teachers	First 10 college teachers trained in green hydrogen	HZ	Implementation
3.7	Improve MBO professionalization program following PDCA first round	Final green hydrogen professionalization program for MBO teachers	Scalda	Implementation
3.8	Improve HBO professionalization program following PDCA first round	Final green hydrogen professionalization program for college teachers	HZ	Implementation

4.4 WP4 Full-time educational modules for MBO and HBO.

In work package 4, full-time educational modules are being developed for 8 technical MBO and 8 technical HBO courses. These include courses in mechanical engineering, electrical engineering, process engineering, maintenance, motor vehicles, maritime, logistics, and technical business administration. The Smart Energy lectorate and the mechanical engineering course at Avans University of Applied Sciences have also indicated their interest in student participation in Zeeland's green hydrogen modules. Introductory lessons on energy transition are being developed by Interreg Energiek Onderwijs. These are not only applicable in year 1 of MBO-HBO but also suitable for the continuous learning line VMBO - MBO. This work package focuses on the development of in-depth full-time educational modules that cover production, storage, transport and use of green hydrogen in industry, shipping and ports. It also looks at introducing technology and methods for making the best use of the varying supply of renewable energy (offshore wind energy) in industry in Zeeuws-Vlaanderen and Vlissingen-Oost. These are also suitable for the continuous learning line MBO-HBO. The possibility of taking existing educational modules, such as the SBB-certified elective K1049 Hydrogen Technology or the "hydrogen in industry" module being developed in Drenthe (Greenwise Campus Drenthe, 2023), and adapting them to the Zeeland need and context, is being considered. This elective deals with the application of hydrogen in a broad sense while the desire is to choose the focus of industry, shipping and ports for Zeeland because it fits the main business activities in Zeeland for which green hydrogen plays an important role. This choice was validated in sessions with stakeholders from the professional field on February 8, 2023. Specific attention was given to the

continuous learning line MBO-HBO and connecting the modules to each other. In the National Knowledge Platform that is being established under GroenvermogenNL, there will be a National Knowledge Bank in which educational modules will be shared with each other. In this way, the developed modules can also be used and applied in other regions.

Work package 4 consists of:

No.	Project Activity	Result	Partner	Role
4.1	Activate regional network providing input for full-time educational development	Professional field committee on green hydrogen for MBO and HBO	HZ and Scalda	Implementation
4.2	Retrieve full-time training needs from regional field and (inter)national studies	Report requested MBO and HBO expertise in Zeeland for green hydrogen	HZ and Scalda	Implementation
4.3	Exploration of existing full-time green hydrogen education modules	Overview of existing MBO and HBO education for green hydrogen	HZ and Scalda	Implementation
4.4	Inventory of opportunities for hydrogen modules in curricula of existing MBO and HBO courses	Overview of opportunities for in-depth green hydrogen modules in curricula of existing MBO and HBO courses	HZ and Scalda	Implementation
4.5	Program of requirements for full-time green hydrogen education modules for MBO and HBO	Program of requirements indicating for MBO and HBO which existing modules will be brought in house and what will be newly developed.	HZ and Scalda	Implementation
4.6	Educational development: adaptation of existing full-time modules to the Zeeland context or development of new full-time modules	Full-time educational modules with deepening green hydrogen in Zeeland context for MBO and HBO ready for implementation	HZ and Scalda	Implementation
4.7	Implementation first edition full-time green hydrogen modules under the guidance of the project team	Successful first edition of new full-time green hydrogen modules	HZ and Scalda	Implementation
4.8	Improving green hydrogen modules following PDCA results first edition	Final full-time green hydrogen modules	HZ and Scalda	Implementation
4.9	Field validation and certification/accreditation of educational modules	Validated, certified and accredited full-time green hydrogen education modules	HZ and Scalda	Implementation
4.10	Transfer of educational materials and coordination of hydrogen modules from project team to training team	Hydrogen modules integral part of training courses and managed by training team	HZ and Scalda	Implementation

4.5 WP5 Lifelong development and LLO

In work package 5, part-time green hydrogen modules are being developed for BBL courses at MBO and Part-time courses at HBO. This will allow existing professionals to be retrained in the context of lifelong development. The design of the work package follows the structure of work package 4 of inventory, design, initial implementation and improvement but pays specific attention to the combination of working - learning on the one hand and the differences in target group on the other, which are important for successful part-time education for adults already working in the sector. An example of a part-time course for which a green hydrogen module will be developed is the Associate Degree Energy Transition Engineering jointly developed by HZ and Scalda, which started in 2022.

Work package 5 includes:

No.	Project Activity	Result	Partner	Role
5.1	Build lifelong development team and activate regional network for part-time education	Professional field committee green hydrogen for lifelong development	HZ and Scalda	Implementation
5.2	Retrieve need for part-time education for green hydrogen professionals	Report requested part-time education in Zeeland for green hydrogen	HZ and Scalda	Implementation
5.3	Explore existing part-time green hydrogen education	Overview of existing MBO and HBO part-time green hydrogen education programs	HZ and Scalda	Implementation
5.4	Drafting program of requirements for part-time educational modules on green hydrogen	Program of requirements for part-time green hydrogen education modules for BBL and HBO	HZ and Scalda	Implementation
5.5	Part-time educational development: adaptation of existing part-time modules to Zeeland context or development of new part-time modules	BBL and HBO part-time green hydrogen modules ready	HZ and Scalda	Implementation
5.6	Implementation of first part-time green hydrogen modules under the guidance of the project team	Successful first edition of new part-time green hydrogen modules	HZ and Scalda	Implementation
5.7	Improving part-time green hydrogen modules following PDCA results first edition	Final part-time modules green hydrogen	HZ and Scalda	Implementation
5.8	Field validation and certification/accreditation of educational modules	Validated, certified and accredited part-time education modules green hydrogen	HZ and Scalda	Implementation
5.9	Transfer educational materials and coordination of hydrogen modules from project team to part-time training team	Hydrogen modules integral part of part-time courses and managed by training team	HZ and Scalda	Implementation

4.6 WP6 Hydrogen Lab

In recent years, HZ and Scalda have invested heavily in physical knowledge infrastructure such as the JRCZ and the renovation of the Technum training center for technical education at Scalda. However, these laboratories do not offer the requested facilities for safe working with green hydrogen that is required by the Zeeland industry. The specific safety requirements involved in green hydrogen education and research necessitate a specialized hydrogen laboratory. Because of the investments made in JRCZ and Technum and the speed of the hydrogen transition, HZ and Scalda want to develop the hydrogen laboratory from JTF.

HZ and Scalda started preparations for the hydrogen laboratory in 2022 from an initial investment of their own and with the support of the Zeeland Public Interests Foundation (SZPB). The investments needed for the conversion of an existing ecology laboratory that needs to be converted have been identified. An inventory has also been made of the equipment needed for the MBO and HBO training program and practice-based research from Scalda's Energy in the Delta research center and HZ's Delta Power research center. This preparatory work will continue in 2023. Work package 6 contains the requested investment in the realization of the hydrogen laboratory with the necessary equipment.

In addition, WP6 includes lab development by a technical staff member who:

- Remodeling and furnishing must coordinate
- Need to write an operational management plan
- Practical education for HZ and Scalda will set up for 8 MBO and 8 HBO programs, including scheduling.
- Validating practical education for 8 MBO and 8 HBO programs. All these 16 programs have their own accreditation. So the hydrogen modules and practical education must be validated and accredited separately according to the final standards of their own domain.
- Developing the hydrogen lab's business case beyond the project period. The teaching and research facilities of the hydrogen lab have a return on investment when used. The project period will be used to prove the usefulness and necessity and realize structural use. This should lead to stable revenue streams that cover operating costs. Purely an existing location is being enhanced where the basic facilities are already set up and funded. The expected revenues include the coverage needed to make reinvestments necessary to provide the services structurally.

Work package 6 includes:

No.	Project Activity	Result	Partner	Role
6.1	Perform hydrogen laboratory conversion	Hydrogen laboratory as space safe and ready for MBO and HBO education and practical research	HZ	Implementation
6.2	Purchasing and installing hydrogen equipment	Hydrogen equipment for teaching and research installed, inspected and ready for use	HZ and Scalda	Implementation
6.3	Lab development guided by technical assistant	Lab developed and operational management plan implemented. Lab management set up	HZ	Implementation
6.4	Developing the hydrogen lab business case beyond the project period	The project period is used to prove utility and necessity and achieve structural use. This should lead to stable revenue streams that cover operating costs.	HZ	Implementation

4.7 WP7 Regional Liaison and learning community

The liaison function focuses on aligning educational developments on the energy theme. The energy transition is more than just hydrogen. It includes sources such as wind, solar and water. It includes production, storage and transportation. It is more than just a technical transition, but also an economic and social one. HZ and Scalda are working closely with governments and industry to develop projects and education within the energy transition that cover the full breadth of the transition. To properly oversee and coordinate this total of projects and development of educational programs, a liaison function is needed. An example of the liaison function is participation in SDR's Hydrogen Delta Sounding Board.
The hydrogen program to be developed cannot stand on its own but must liaise with industry developments and all other energy transition developments within education and research. This work package provides that liaison function and will also be a point of contact for government and industry.

4.8 WP8 Practical research

Practical research on system integration of offshore wind and hydrogen is taking place in JTF Flex Intensity. Together with Orsted and a consortium of knowledge partners, research is being conducted on system integration of an offshore electrolyser, a wind farm and the power grid.
A consortium of partners in Zeeland is exploring opportunities for a research program on water requirements for electrolysis and the potential of salt water.

5 KPIs/Key-results and monitoring

This involves gaining an agile and resilient workforce; attracting talent to chemistry and broader engineering, future-proof labor market through lifelong development. For the transition to green chemistry, innovation, electrification, hydrogen, energy infrastructure and associated new skills are key.

The HCA Green Hydrogen roadmap contributes to this by:

- Develop a continuous learning line from MBO and HBO
- Develop full-time and part-time education that meets the demand for workers trained for occupations in the low-carbon economy, specifically hydrogen
- The existing Delta Power lectureship at the HZ will be strengthened by this project and a new practical lectureship at Scalda will contribute to strengthening education and research at the MBO level.
- The establishment of a Hydrogen Lab helps to ensure that practical skills around the new green hydrogen economy can also be trained in education. Lecture and practical chairs can conduct practical research on green hydrogen with students and companies.

The roadmap supports the JTF in the following activities and types of actions:

1) **Further training and retraining of workers and job seekers.**
   a) Support for the adaptation of workers, companies and entrepreneurs to change, for example, through accelerated and flexibly adaptable training for occupations where there are many shortages, retraining and upskilling programs aimed at chemical and process operators (such as BioBasedEurope Training Center) or an additional impetus for Lifelong Development for technical occupations aimed at the untapped labor potential;
2) **Other education and social inclusion activities.**
   a) Measures to modernize and strengthen education and labor market institutions and services to assess skill needs, meet them, and provide timely and tailored assistance.
   b) Adapting training for the benefit of lifelong learning for workers/ job seekers (changing skills needs). This includes optimizing training opportunities (also at/with companies), increasing intake in directions relevant to the transition and maximizing outflow from training to jobs in the area.
   c) The development of continuous learning lines with educational and knowledge institutions aimed, among other things, at professions for the low-carbon economy. This can build on the Energy and Raw Materials Alliance and the opportunities and attraction of technology can be structurally highlighted in education.

Indicator	Target
Classroom capacity for new or modernized educational facilities in number of people > Hydrogen lab	*16*
Number of users (persons) of modernized educational facilities in the year before the start of the project	0
Number of users (persons) of new or modernized educational facilities in the year after project completion	585
Number of apprenticeships supported in SMEs	
SME personnel completing training in skills for smart specialization, industrial transition and entrepreneurship in number of participants	
Number of participants achieving qualification after participation	
Number of participants who are employed after participation, including self-employment	

Expected student numbers for the hydrogen modules per year after completion of the project: 265 MBO and 320 HBO professionals will be trained regionally in green hydrogen each year. This follows from discussions with the 8 MBO and 8 HBO programs.

MBO	*BOL*	*BBL*
Mechanical Engineering	*20*	*20*
Electrical Engineering	*20*	*10*
Process Engineering	*20*	*10*
Maintenance	*20*	
Maritime	*25*	*15*
Motor Vehicles	*25*	*15*
Logistics	*25*	
Construction and Infra	*30*	*10*
Total	*185*	*80*

HBO	*Full-time*	*Part-time*
Engineering	*30*	
AD Energy Transition Engineering		*15*
Technical Business Administration	*25*	*15*
Maritime Officer	*25*	
Logistics Engineering	*40*	
Civil Engineering	*50*	
Architecture	*60*	
Chemistry	*60*	
Total	*290*	*30*

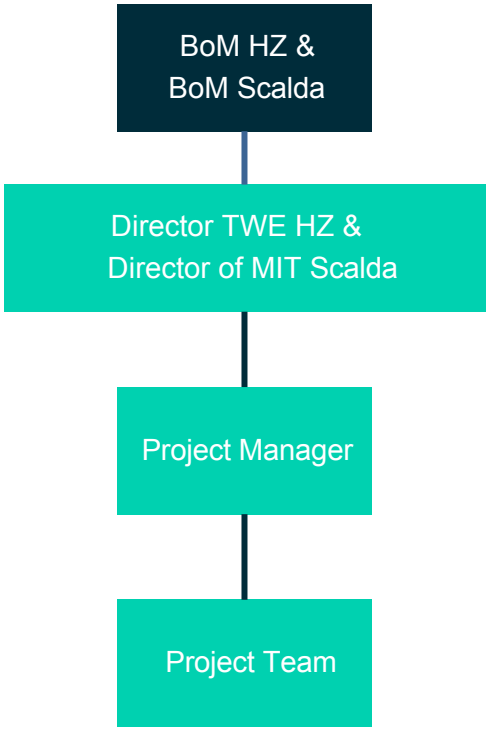
6 Organization, planning and execution

6.1 Project organization

Organization name:	HZ University of applied sciences
Role within the project:	Treasurer
Business activities:	- providing higher education - conducting applied research within 19 lectureships. - within the technical field, the Engineering program and the Delta Power lectureship are committed to enabling the energy transition by meeting the urgent need for skilled workers and applied research in this field. - establish valuable collaborations on energy transition tasks in general and with regional offshore wind farms and green hydrogen developments in the regional industry in particular.
Size of organization:	*great*
Reason and importance of participation:	HZ UAS notes that industry in Zeeland consumes 85PJ of energy annually, generated almost entirely from fossil fuels, out of a total energy demand of 125 PJ. Industry is also an above-average part of the economy, alongside recreation and healthcare. Energy transition and an aging workforce threaten the activity and livability in the industrial sector, as described in detail in the JTF territorial plan of the Province of Zeeland for the region of Zeeuws-Vlaanderen and Vlissingen-Oost. HZ UAS wants to carry out this project to investigate and stimulate the opportunities of successful, flexible integration of large volumes of offshore wind energy in industrial processes in practice, to connect companies and knowledge institutions and to inform students and teacher-researchers about these opportunities and developments. This can lead regionally to sustainable innovation and economic growth, job retention and even growth, and influx of new (international) students and employees.
Specific expertise/contribution:	- Educational Development - knowledge and experience from the electricity industry - knowledge of offshore wind energy - knowledge and experience from the chemical process industry.
Organizational structure:	*Foundation*

Organization name:	***Scalda***
Role within the project:	*Participant*
Business activities:	*MBO Educational Institution*
Size of organization:	*great*
Reason and importance of participation:	- This project provides an exceptionally rapid and unusual investment in education in a particular category of technology. Institutions cannot afford this from normal funding and operations.
Specific expertise/contribution:	- Educational Development - knowledge and experience from the electricity industry - knowledge of offshore wind energy - knowledge and experience from the chemical process industry.
Organizational structure:	*Foundation*

Project structure



6.2 Vision of educational development

For educational development, HZ and Scalda use the methodology of the HZ Educational Compass (HZ, 2022), see

Figure *4: HZ Educational CompassAccording to* this educational compass, development follows the cycle of research, development, testing, evaluation and improvement. The development therefore takes place over several school years, to arrive at a tested and validated program. This structure is reflected in the design of WP2 and WP3 where the main development work takes place. The development of practice areas and making practice education safe and validated for 8 MBO and 8 HBO programs also follows this multi-year cycle. All these 16 courses have their own accreditation. So the hydrogen modules and practical education must be validated and accredited separately according to the final standards of their own domain.

Figure 4: HZ Educational Compass

Location

The activities will be carried out at the HZ and Scalda locations on Edisonweg in Vlissingen and at the Center for Top Technology in Terneuzen. Scalda's location houses the technical courses and is therefore the most appropriate location for this project. The hydrogen lab will be located at the HZ location in Vlissingen. The students of Scalda will also make use of this location. Use will be made of Winddock's facilities at Technum. This is located next to the hydrogen lab which is under development making wind and hydrogen closely linked.

Figure 5: Scalda and HZ locations.

6.3 Planning

Gantt Chart					2024		2025		2026	
			Start	einde	jan-jun	jul-dec	jan-jun	jul-dec	jan-jun	jul-dec
WP	taak	Projectactiviteit			M1-6	M7-12	M13-18	M19-24	M25-30	M31-36
WP1	1.1	Projectmanagement	M1	M36						
WP2	2.1	PR- en communicatieverplichtingen	M1	M36						
	2.2	Social media, websites, nieuwsbrieven en filmpjes								
	2.3	Artikelen								
WP3	3.1	Inventarisatie van de professionaliseringsbehoefte tbv groene waterstof bij docenten van MBO opleidingen	M1	M6						
	3.2	Inventarisatie van de professionaliseringsbehoefte tbv groene waterstof bij docenten van HBO opleidingen	M1	M6						
	3.3	Ontwerpen van professionaliseringsprogramma groene waterstof voor MBO docenten	M7	M12						
	3.4	Ontwerpen van professionaliseringsprogramma groene waterstof voor HBO docenten	M7	M12						
	3.5	Eerste scholingsronde 10 MBO docenten	M13	M24						
	3.6	Eerste scholingsronde 10 HBO docenten	M13	M24						
	3.7	Verbeteren MBO professionaliseringsprogramma nav PDCA eerste ronde	M25	M36						
	3.8	Verbeteren HBO professionaliseringsprogramma nav PDCA eerste ronde	M25	M36						
WP4	4.1	Regionale netwerk activeren dat input levert voor voltijd onderwijsontwikkeling	M1	M6						
	4.2	Ophalen aan voltijd scholingsbehoefte vanuit het regionale werkveld en (inter)nationale studies	M1	M6						
	4.3	Verkenning bestaande voltijd onderwijsmodules groene waterstof	M1	M6						
	4.4	Inventarisatie van mogelijkheden voor waterstofmodules in curricula van bestaande MBO en HBO opleidingen	M7	M12						
	4.5	Programma van eisen voor voltijd onderwijsmodules groene waterstof voor MBO en HBO	M7	M12						
	4.6	Onderwijsontwikkeling: aanpassing bestaande voltijd modules naar Zeeuwse context of ontwikkeling van nieuwe voltijd modules	M13	M24						
	4.7	Uitvoering eerste editie voltijd groene waterstofmodules onder begeleiding van het projectteam	M13	M24						
	4.8	Verbeterslag groene waterstofmodules nav PDCA resultaten eerste editie	M25	M36						
	4.9	Validatie door werkveld en certificering / accreditatie van onderwijsmodules	M25	M36						
	4.10	Overdracht onderwijsmaterialen en coördinatie waterstofmodules vanuit projectteam naar opleidingsteam	M25	M36						
WP5	5.1	Leven lang ontwikkelen team samenstellen en regionale netwerk activeren voor deeltijdonderwijs	M1	M6						
	5.2	Ophalen behoefte aan deeltijd onderwijs voor professionals voor groene waterstof	M1	M6						
	5.3	Verkenning bestaande deeltijdonderwijs groene waterstof	M1	M6						
	5.4	Opstellen van programma van eisen voor deeltijd onderwijsmodules groene waterstof	M7	M12						
	5.5	Deeltijd onderwijsontwikkeling: aanpassing bestaande deeltijd modules naar Zeeuwse context of ontwikkeling van nieuwe deeltijd modules	M13	M24						
	5.6	Uitvoering eerste deeltijd groene waterstofmodules onder begeleiding van het projectteam	M13	M24						
	5.7	Verbeterslag deeltijd groene waterstofmodules nav PDCA resultaten eerste editie	M25	M36						
	5.8	Validatie door werkveld en certificering / accreditatie van onderwijsmodules	M25	M36						
	5.9	Overdracht onderwijsmaterialen en coördinatie waterstofmodules vanuit projectteam naar deeltijd opleidingsteam	M25	M36						
WP6A	6.1	Aankoop apparatuur voor onderwijs	M7	M12						
	6.2	Aansluiten en in gebruik nemen praktijkopstellingen	M7	M12						
	6.3	Service contracten of kosten voor service/aanpassing	M13	M36						
	6.4	Keuringskosten, veiligheid	M13	M36						
WP6B	6.5	Verkenningsfase waarbij andere waterstof labs en onderzoekslocaties bezocht worden	M7	M24						
	6.6	Inventariseren van de benodigdheden voor onderzoek en certificering	M7	M24						
	6.7	Programma van eisen waterstoflab opstellen met werkveld	M13	M24						
	6.8	Concept ontwerp waterstoflab	M25	M36						
	6.9	Exploitatiebegroting ontwikkelen	M13	M24						
	6.10	Operationeel beheersplan ontwikkelen	M25	M24						
	6.11	Nieuwe subsidiestroom vinden voor realisatie waterstoflab en plan schrijven	M25	M36						
WP7	7.1	Liaison	M1	M36						

References

EZK. (2022). Overview Growth Fund Proposals Energy Transition and Sustainability.
EZK. (2022). Overview of schemes Energy Transition and Sustainability.
NIS. (2023, 10 26). Netherlands not yet on track for tightened energy targets. Retrieved from https://nos.nl/collectie/13871/artikel/2495428-nederland-nog-niet-op-koers-voor-aangescherpte- energy targets
NWP. (2022). Hydrogen Roadmap.
Oosten, K. v. (2022). HCA Greening in the Zeeland industry. SDR.
(2022). CES Scheldt-Delta region.
SDR. (2023). Retrieved from https://www.smartdeltaresources.com/
Engineering Netherlands. (2023). Attack plan Labor market shortages Techics, Construction and Energy. TSE. (2022). MMIP recalibration overview.
UWV. (2022). Climate jobs Energy system.

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)

Innovatiemotor van de groenewaterstofeconomie

www.groenvermogennl.org