



**TOP
DUTCH**

**Naturally leading
the transition**

ENERGY

The TopDutch region is historically the energy production and knowledge region of the Netherlands. Now, we're expanding our expertise to power not just the Netherlands, but the whole of Europe with green energy and hydrogen. We're investing heavily in the infrastructure, education and innovation needed to lead the energy transition.

TopDutch is energy. Located on Europe's largest natural gas reserve, the TopDutch region is the main energy provider for the Netherlands and large parts of Western Europe. Today, the main focus of TopDutch is realizing the opportunity presented by the combination of green electricity and natural gas available. We are determined to be the Green Hydrogen Capital of Europe, making the transition from gray, via blue, to green hydrogen production, distribution and utilization. Here, we power a sustainable future.

1. Natural gas legacy & switch to green gases

2. Europe's largest futureproof energy sourcing area

3. Leading the hydrogen transition

4. Innovation, education & talent

5. System-level energy transition

6. Unique triple helix collaboration

1. LARGEST NATURAL GAS RESERVE, BEST GAS INFRA- STRUCTURE ...

... in Western Europe and first to switch gases. Built on Europe's largest natural gas reserve, we've powered economies across the region for decades. Now, we're splitting up with fossil fuels and instead investing in infrastructure, education and innovation for green energy.



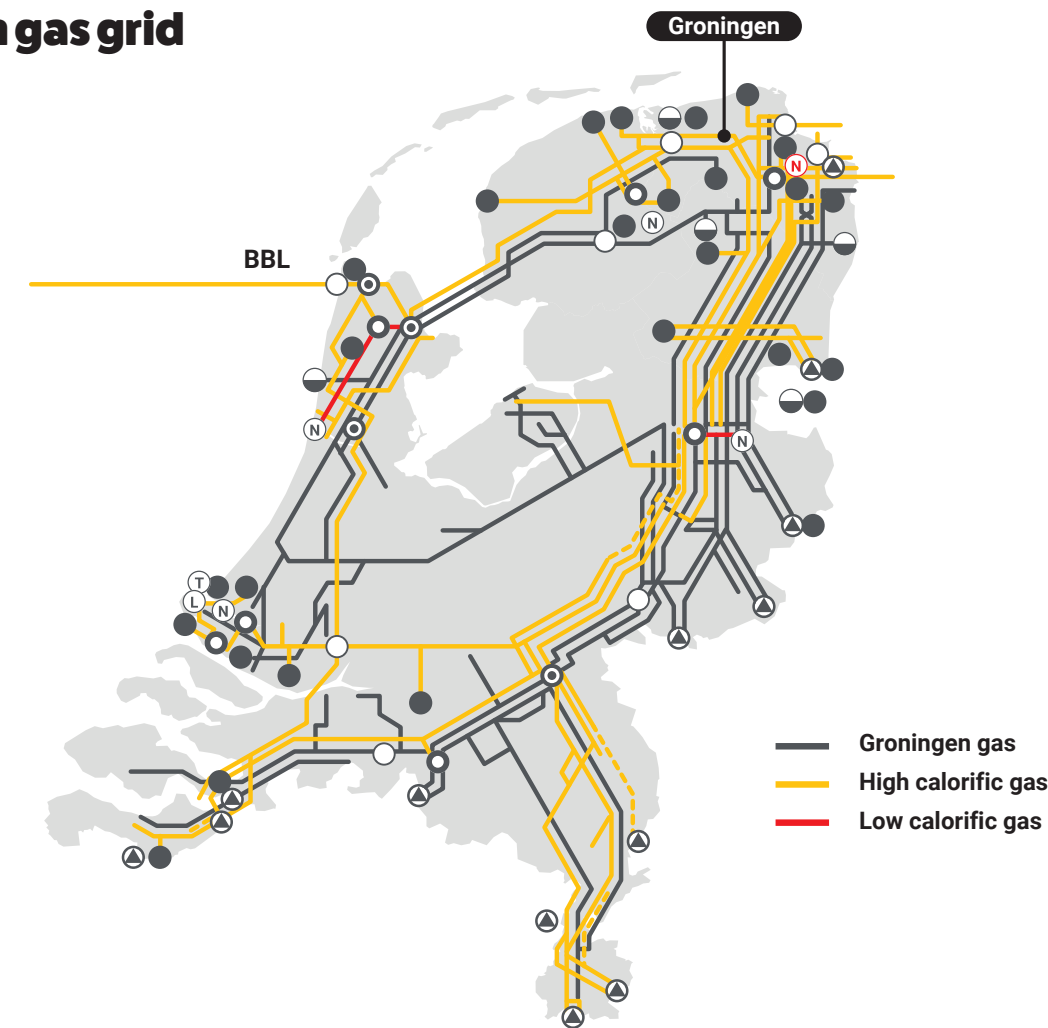
- A giant natural gas field was discovered in 1959 by the Nederlandse Aardolie Maatschappij (NAM) in the Northern Netherlands, which sparked the Dutch and subsequently the North-West European gas markets. It is the largest field in Europe, with original recoverable reserves of 2.7 to 2.8 tcm (95 to 99 tcf) – double that of the second largest field, in Norway.
- Rapid construction of natural gas production facilities and infrastructure. Production started in 1963, after intense work on the construction of the required production facilities, building the national gas transportation network and adjusting tens-of-thousands of Dutch homes. We now have the best gas transportation network in Europe.

- **Safety issues demanded radical decisions: quitting natural gas production.** The extraction of natural gas induces earthquakes at a shallow depth, having a high impact on buildings and the safety of households in the region. The Dutch Ministry of Economic Affairs and Climate decided to conclude natural gas production in Groningen by 2024.

- **The gas transition: From natural gas to green gas and green hydrogen.** Our regional gas network operator, Gasunie, will add carbon-neutral green gas to the mix of its current natural gas pipelines and switch to transporting green hydrogen, a transition that will be scaled by first transmitting natural gas based blue hydrogen, to its network. The redundant gas transmission network enables switching gases pipeline by pipeline, enabling the transition to both green gas and green hydrogen. We're upskilling our more than 15,000 experienced workers from the domestic natural gas industry to train the talent needed for the transition.



TopDutch gas grid



2. THE HEART OF EUROPE'S LARGEST FUTUREPROOF ENERGY SOURCING AREA

Located at the heart of the North Sea's coast, **we will power Europe's energy transition.** We are investing heavily in on- and off-shore wind and solar farms, and our reliable cross-border power grid **will transport green energy across the region.**

- **The North Sea as Europe's biggest green power plant.** The Netherlands, together with 8 other European countries, have pledged to expand offshore wind capacity to 120GW by 2030, and 300GW by 2050, representing €800bn of investment .

In the Netherlands, this represents a target to raise our offshore wind capacity from 11GW (2023) to 21GW by 2030, reflecting about 75% of our current electricity consumption.

Our culture of cooperation is leading joint infrastructure developments, with collaboration agreements with countries including the UK and Denmark meaning we will host Europe's biggest cross-border electricity link connected to an offshore wind farm.





- **The TopDutch region as a leading green powerhouse, and our coastline as a key energy port.** The TopDutch region has a long history of energy production, and we have no intention of slowing down. Among the approximately 2,500 MWs of wind projects currently operational in the Northern Netherlands is Gemini 1 - one of the largest offshore wind parks in Europe – producing sustainable energy for 800,000 houses.

We're scaling-up fast. We will generate 12.2 TWh of on-shore wind and solar power by 2030. In addition to the existing 600 MW production capacity in wind parks off the TopDutch coast, we have plans for another three sites totaling 4,700 MW. Our ambitions, knowledge and experience in wind park construction, maintenance and repair make us your ideal partner for expanding wind power in Europe.

With over half of the Dutch energy supply and one third of the European energy supply coming from the North Sea in a matter of years, our location presents large-scale energy storage and hydrogen production and storage potential on TopDutch's extensive coastline.

- **From the Northern Netherlands to the world: TopDutch as the Netherlands' 'wall socket'.** With TopDutch as the key energy port, the Dutch high voltage grid transports electricity through 24,500km of pipeline at 110Kv and higher, and connects across borders and seas to Germany, Belgium, Denmark, the United Kingdom and Norway.

The Netherlands has one of the most reliable grids in the world, with an average uptime of 99.994% over the past five years. The TopDutch region's excellent connections makes our reliability even higher.

Energyport Eemshaven is a 8,000 MW power point and balancing hub located on one of our seaports. Here, we host three large power stations and a floating LNG terminal, alongside converter stations connected to the NorNed and COBRACable undersea electricity cables.

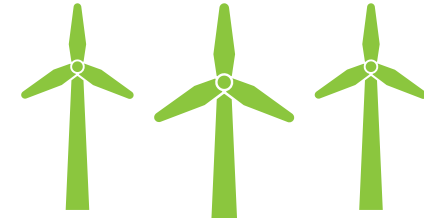
TopDutch on- and offshore windparks



- | | | |
|---|------------|--|
| ① | 100-120 MW | Wind farm N33 |
| ② | 276 MW | Wind farm Eemshaven |
| ③ | 130 MW | Extension wind farm Eemshaven |
| ④ | 85 MW | Wind farm Oostpolder |
| ⑤ | 20-150 MW | Wind farm Delfzijl |
| ⑥ | 48 MW | Search area for wind turbines |
| ⑦ | 700 MW | COBRAcable |
| ⑧ | 600 MW | Gemini Offshore Windpark |
| ⑨ | 700 MW | Gemini West + Clearcamp |
| ⑩ | 65 MW | Eneco Windpark Delfzijl Noord |
| ⑪ | 42 MW | Windpark Nij Hiddum-Houw |
| ⑫ | 383 MW | Windpark Fryslân |
| ⑬ | 175.5 MW | Windpark De Drentse Monden en Oostermoer |



11



9

8

7

COBRAcable

Eemshaven

2

3

4

Delfzijl

10

Emden

6

5

Groningen

1

Drenthe

13

Friesland

3. LEADING THE TRANSITION TO A HYDROGEN ECONOMY

TopDutch is Europe's first hydrogen valley, and is unique as the only cluster in the world developing an integrated hydrogen value chain: From innovation, to manufacturing, production and transportation, to applications in industry and mobility. We will continue to lead Europe's hydrogen economy by fulfilling a \$10 billion joint investment agenda by 2030.



Our inherent natural resources, and existing energy infrastructure make us the natural business location for a new hydrogen economy.

- **Born on Europe's largest natural gas reserve, we will be the first region to proactively conclude natural gas extraction**, and are instead upgrading and expanding our extensive transportation network.
 - By 2025, the TopDutch region will be home to 169km of hydrogen pipelines.
 - These will connect to a further 6,800km of pipelines across the Netherlands, Germany, Belgium and France by 2030.
- **The Northern Netherlands also has access to natural hydrogen storage locations in salt caverns.** The Netherlands has the 2nd largest salt cavern storage capacity in Europe – up to 150 PJ – of which 72% is in the TopDutch region.

- **HEAVENN: Europe's first hydrogen valley is a blueprint for the rest of the world.** Thanks to our ambition, infrastructure and knowhow, we were the first region to be selected as a 'Hydrogen Valley' by Europe's Clean Hydrogen Partnership. Led by our leading triple-helix 'New Energy Coalition', and fueled with a €20 million subsidy and €70 - 80 million of public-private investment, the project started in 2020.

Over six locations in the TopDutch region, HEAVENN is a large-scale program of 13 demo projects bringing together core elements: production, distribution, storage and local end-use of hydrogen (H2) into a fully-integrated and functioning "H2 valley". With the project now in full-swing, we are acting as a blueprint for replication across the world, and exporting our knowledge to other ambitious regions.

- **Our \$10 billion hydrogen investment agenda means we will continue to lead the transition.** Major multinationals including Engie, RWE and Shell, local energy heavy-hitters such as Gasunie, and our ambitious state are collaborating on an ~\$10 billion hydrogen production, storage and transportation joint investment agenda, allowing us to power Europe's future economy with 100PJ of hydrogen p.a. by 2030. Major projects include:
 - HEAVENN: A large-scale program of demo-projects, this €90-100 million cross-chain cluster development plan led us to being designated at Europe's first 'Hydrogen Valley'. Making up 13 individual projects across production, distribution, storage and end-use of hydrogen, it now serves as Europe's blueprint for a green hydrogen economy across the value chain.
 - HyStock: The first of four planned converted salt caverns – connected with an above-ground plant and our transportation network – will be available to store 200 GWh of hydrogen by 2028.
 - Ten noorden van de Waddeneilanden: Already endowed with an existing submarine natural gas pipeline and a planned 700MW capacity wind farm, in March 2023 the North of the Wadden Islands area was designated for the world's largest offshore wind-to-hydrogen project. The 500MW offshore production and transportation green hydrogen project should be operational by 2031.
 - NorthH2: A consortium of Eneco, Equinor, RWE and Shell aim to produce, store and transport 4GW by 2030 (and 10GW by 2040) of green hydrogen. They will do this by investing in large-scale offshore wind farms, an electrolyzer and a smart storage and transportation network beginning in the TopDutch region, and stretching across Northwestern Europe.

4. INNOVATION, EDUCATION & TALENT

TopDutch offers an energizing environment for innovation. Our open and connected knowledge networks facilitate breakthrough advancements from fundamental science to market. We're educating the green energy talent of the future, and upskilling the extensive gas knowledge and technical expertise we already host.



We're creating a generation of new energy-skilled talent via our world-leading higher education system.

- **17,000** vocational, applied science and research university students are trained for a role in the energy system per annum, and graduate into the TopDutch workforce ready to change the world.
- **We have the best knowledge cluster dedicated to the energy transition.** Dedicated education institutions include Energy Academy Europe, Energy Delta Institute, and Greenwise Campus from the University of the North. Dedicated vocational training on hydrogen technologies is offered in the Northern Netherlands to fuel the hydrogen industry.
- **We have an abundant supply of more than 15,000 experienced workers**, from the domestic natural gas industry which will scale down over the next three to five years.
- **The Netherlands has the world's most proficient non-native English speakers** among non-English-speaking countries. Regulators accept English documentation and disputes are settled in the English-speaking Netherlands Commercial Court.



TopDutch has a culture of open innovation, with a network of knowledge-sharing initiatives, living labs, shared testing facilities and innovation centers.

Innovation projects jointly focused on developing new applications for green energy technologies include:

- **EnTranCe** is a living lab for energy transition where entrepreneurs, authorities, scientists and researchers further develop their ideas, enabling them to arrive at working solutions. They offer state-of-the-art shared testing facilities and technical for start-ups, established companies and (international) consortia looking to validate a product, service or process that will help accelerate the energy transition. Shared facilities here include the Hydrohub MegaWatt Test Center, and the Green Hydrogen Booster SME 'test garden'.
- **Hive.Mobility** is an innovation center for smart and green mobility. They offer companies, government institutions, students and researchers the opportunity to jointly develop, test and apply smart and innovative solutions for mobility in the TopDutch region.
- **EnergieCampus Leeuwarden** is an entrepreneurial community for sustainable business. The campus offers space for students, start-ups and established firms to experiment, knowledge share and do business.
- **NXT Airport** is a living lab dedicated to smart and sustainable aviation. An initiative of our Groningen Airport Eelde, it provides business, government and academia with shared research and testing grounds. Their 'Power Up' initiative is exploring electric aviation, and helps businesses enter into innovative partnerships in the field of battery technology, electric aircraft engines and charging systems. They are currently developing an electrolyzer to produce green hydrogen as an emission-free energy carrier for light aircraft, drones and ground equipment.

5. AMBITIOUS COMPLIMENTARY INDUSTRIES FUELING A SYSTEM-LEVEL ENERGY TRANSITION

The TopDutch region is **determined to be the Energy Transition Capital of Europe**. We're not only generating the energy needed to fuel the sustainable transition, but also the **technologies that will accelerate demand for green energy in our existing industries, and the applications that will make sustainable systems smarter**.



Our Green Chemistry ecosystem, Chemport Europe, will be the first fossil-free and carbon dioxide-negative chemical cluster.

- From its location in the 'Hydrogen Backbone Delfzijl', our chemical companies produce bleach, green methanol, amongst others with feedstock from its on-site 20MW electrolyzer. Demand is growing rapidly, so this will soon scale-up to a 100MW electrolyzer.
- In its Emmen location, a 4MW electrolyzer and the GETEC 'green steam' gas turbine will directly connect to our chemical and heavy industry companies via a newly constructed pipeline.

Our digital innovation cluster is making the New Energy System smarter with AI.

- **The AI Hub Northern Netherlands** (AI Hub NNL) aims to make the TopDutch region a testing ground for concrete applications of Artificial Intelligence (AI). The coalition of partners are building a roadmap for AI in the energy transition. This roadmap allows us to identify knowledge gaps in this sector as well as knowledge institutes in the AI domain in the Northern Netherlands. By bringing the two sides together we will accelerate the energy transition through efficiency gains and smarter energy systems
- **Our island of Ameland** is one of the two 'pilot islands' in the European Union's IANOS research program. We are contributing to integrated solutions for decarbonization and smartification of islands by developing a reliable and sustainable smart grid, integrated with a Virtual Power Plant (VPP) based on artificial intelligence.

We have one of the most developed green mobility markets, leading in ZEV policy, innovation and production.

- **The Netherlands' mobility target is to sell only zero-emission vehicles by 2030 (BEVs or FCEVs) and have 3,000 heavy-duty FCEVs on the road in the Netherlands by 2025.** To support that, we are accelerating a number of demand- and supply-side policies including the recent construction of 2,000 charging points across the provinces of Groningen and Drenthe, and the deployment of 20 new hydrogen-fueled buses in the region.
- **We produce several new energy vehicles**, including the cult-classic EV three-wheeler Carver, and host Europe's first ever hydrogen truck plant.





We are super-charging innovation in battery technology across the value chain.

We are accelerating innovation in 6 key competencies across the battery technology value chain:

1. Battery concepts: materials and cell designs
2. Equipment for cells, modules and packs
3. Electric mobility: heavy duty and flying
4. Stationary storage: grid stability
5. Safety and data security
6. Circular batteries: re-use, second use and recycling

Researchers in our world-renowned knowledge institutions are deepening fundamental science for battery concepts.:

- **Zernike Institute for Advanced Materials** applies operando spectroscopy techniques in catalysis and materials research to fundamentally or industrially interesting catalytic processes and materials, providing unprecedented insights in catalysts properties and reaction mechanisms, including electrochemical processes in batteries and fuel cells.
- **ZIAM director, Prof. dr. Moniek Tromp, is steering committee member of BatteryNL** – a coalition academics, high-tech start-ups, multinationals and societal partners from across TopDutch and the wider Netherlands. Together, the consortium are developing the next generation of batteries by investigating and improving the electrode-electrolyte interface using scalable technologies.
- **Top-100 University of Groningen hosts world-class research in the field of battery technologies**, particularly from the Advanced Production Engineering faculty, the Energy and Sustainability Research Institute and the Stratingh Institute of Chemistry.

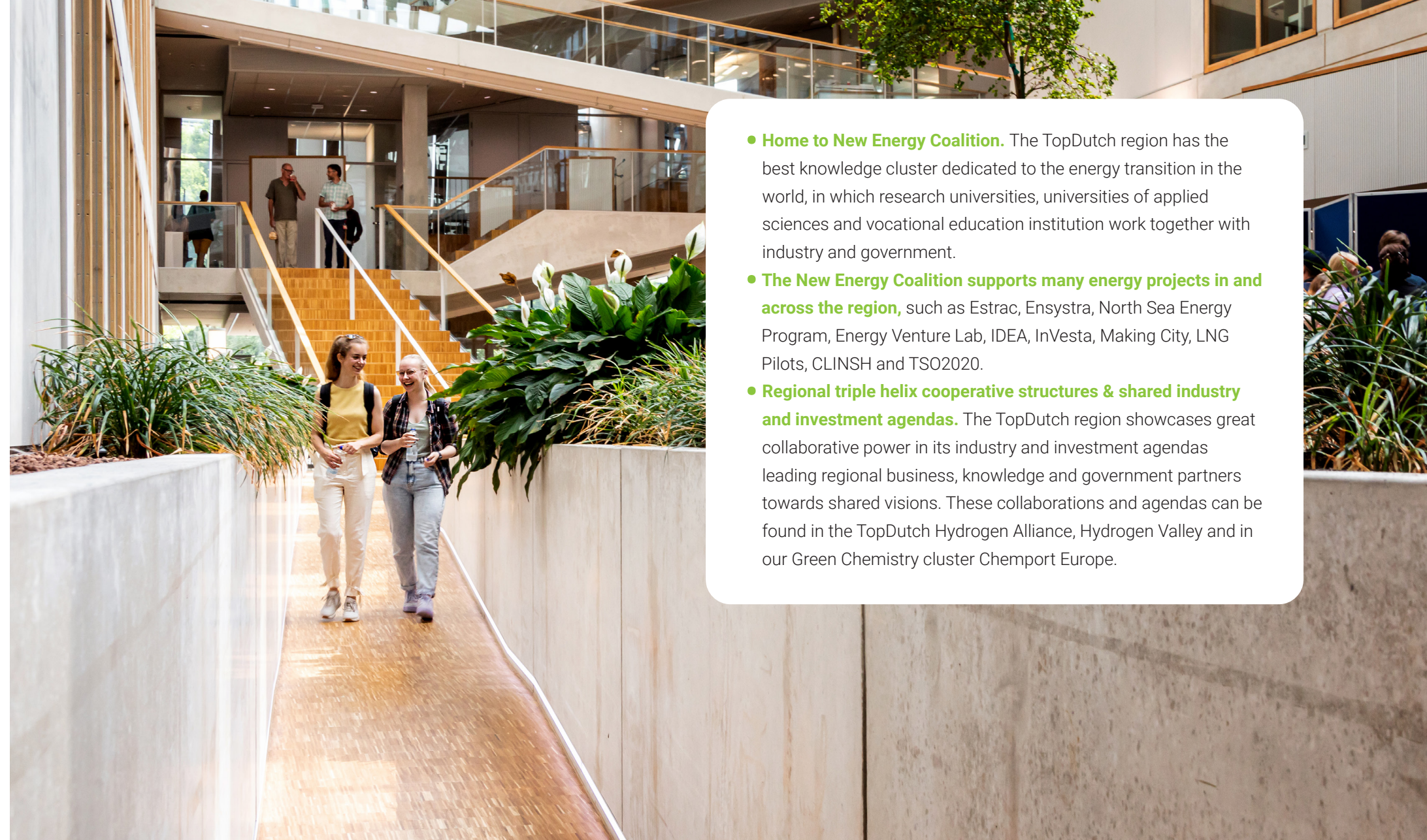
Together, the TopDutch Batteries ecosystem is a powerful catalyst for new technologies, solutions and applications

Examples of key players in battery innovation coming out of the TopDutch region include:

- **Ocean Grazer** – A spin-off from the University of Groningen developing utility-scale energy storage.
- **EVoltify** – A flexible, modular and adaptable mobile EV charging solution.

6. UNIQUE TRIPLE HELIX COLLABORATION

In the TopDutch region, our culture of cooperation naturally facilitates unique triple helix collaboration between government, business and knowledge institutions. With and within the New Energy Coalition, we develop breakthrough knowledge, innovation, applications, processes and leadership needed for a sustainable transition.



- **Home to New Energy Coalition.** The TopDutch region has the best knowledge cluster dedicated to the energy transition in the world, in which research universities, universities of applied sciences and vocational education institution work together with industry and government.
- **The New Energy Coalition supports many energy projects in and across the region,** such as Estrac, Ensysra, North Sea Energy Program, Energy Venture Lab, IDEA, InVesta, Making City, LNG Pilots, CLINSH and TSO2020.
- **Regional triple helix cooperative structures & shared industry and investment agendas.** The TopDutch region showcases great collaborative power in its industry and investment agendas leading regional business, knowledge and government partners towards shared visions. These collaborations and agendas can be found in the TopDutch Hydrogen Alliance, Hydrogen Valley and in our Green Chemistry cluster Chemport Europe.



● **The Dutch Climate Agreement brings together more than 100 stakeholders to structurally tackle the energy transition.**

- Overall target to have 49% less greenhouse gas emissions by 2030 compared to 1990 levels. International lobby by the Netherlands to further increase target to 55% by 2030 and climate neutrality by 2050.
- Electricity target of 84 TWh of renewable energy on the grid by 2030, covering 80% of today's electricity demand.
- Electrolysis target of 3 to 4 GW nationwide by 2030, enlarging the potential hydrogen supply.
- Strong support for off-grid power purchase agreements for local industry, if required.
- Mobility target to sell only zero-emission vehicles by 2030 (BEVs or FCEVs) and have 3,000 heavy-duty FCEVs on the road in the Netherlands by 2025.

● **TopDutch's entrepreneurial mindset extends to its government, with a state willing to co-invest and offer supply- and demand- side incentives.**

- Through the 'National Growth Fund', the Dutch government is investing €20 billion between 2021 and 2025 in two tracks aimed at sustainable economic development of the Netherlands: Knowledge Development; and Research, Development and Innovation.
- As part of the EU's Just Transition Fund, € 330 million will become available to support innovation to accelerate the energy transition in the Northern Netherlands, which can subsize up to 50% of investments in projects.
- The Nationaal Programma Groningen has allocated €1.15 billion in seed capital to invest in socio-economic development projects in the Province of Groningen, including in projects that will accelerate the energy transition and the circular economy of the TopDutch region.
- HyNorth is a public-private consortium dedicated to strengthening and growing our hydrogen cluster, and supporting our partners with research, networking and business development programs.
- The national government provides attractive incentives for companies active in sustainable development. This includes significant tax credits for R&D and a 9% effective tax rate on profits from self-developed innovations, as well as stimulation subsidies to support companies on their personal energy transitions.



Are you interested in exploring what your business possibilities could be? Connect with **Wim A.B.**, our Energy expert.

T: +31 6 270 871 72
E: ab@nom.nl

JOIN TOPDUTCH

Want to find out more about how the TopDutch region is naturally leading the transition, or view the digital edition? Head over to our website www.topdutch.com

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Economic region



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Ministerie van Economische Zaken en Klimaat



Netherlands Foreign Investment Agency

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