



**TOP
DUTCH**

Naturally leading
the transition

GREEN CHEMISTRY

Become part of the **most complete and ambitious ecosystem for green chemistry**. Here, with support from strong **green education and pioneering government**, companies are building fully-green and circular chains. From **green feedstock and building blocks all the way to final products**.

In 1959, TopDutch discovered Europe's largest natural gas field right under their feet. Together with naturally large reserves of sodium and sodium chloride and a flourishing agricultural hinterland, it didn't take long before the TopDutch developed a mature chemical industry.

Today's focus is fully on becoming the greenest chemical cluster in the world: fossil-free, CO2 negative, fuelled with green building blocks and closing the loop. United in Chemport Europe, the entire chemical ecosystem collaborates towards their shared vision and goals. Here, we change the nature of chemistry.

1. Changing the nature of chemistry

2. Complete & cohesive ecosystem

3. Sustainable feedstocks

4. Biobased chemistry

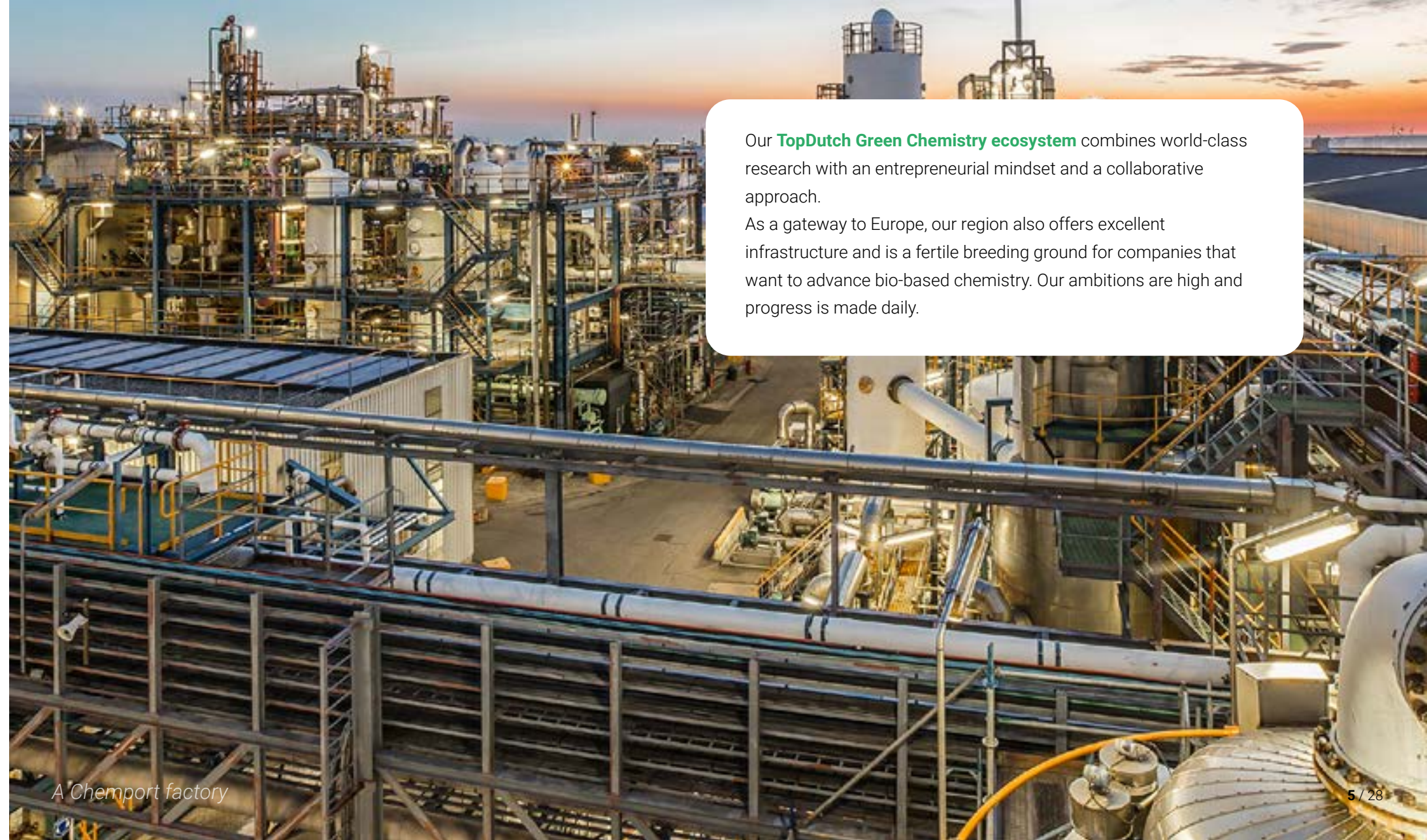
5. Sustainable & circular plastics

6. Access to knowledge & talent

7. The missing links

1. CHANGING THE NATURE OF CHEMISTRY

We're taking bold steps to become the first green chemical cluster in the world. By 2050, we'll be fossil-free, along with a negative carbon footprint and a fully closed plastics loop. And we've got all the ingredients to change the nature of chemistry right here.



A Chemport factory

Our **TopDutch Green Chemistry ecosystem** combines world-class research with an entrepreneurial mindset and a collaborative approach.

As a gateway to Europe, our region also offers excellent infrastructure and is a fertile breeding ground for companies that want to advance bio-based chemistry. Our ambitions are high and progress is made daily.

2. COMPLETE & COHESIVE ECOSYSTEM

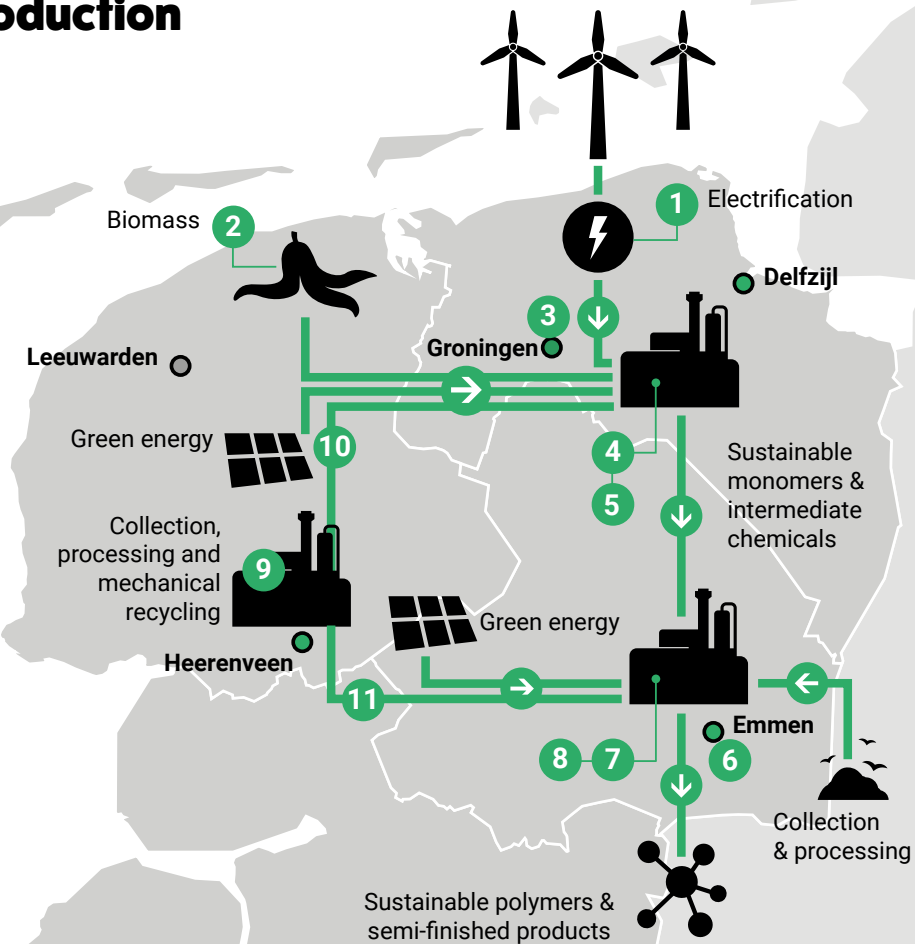
Our region offers one of the **most complete and cohesive** green chemistry ecosystems in Europe.

- **Around 150 chemical companies** call the Northern Netherlands their home and form a close knit network with a shared vision and shared goals for sustainability and circularity.
- **The cluster's collaborative culture** creates opportunities for everyone from start-up to multinational to scale innovations quicker.



Chemport Delfzijl

A coherent and innovative R&D and production ecosystem



Chain for circular chemistry

1. Sustainable feedstock: Green energy
2. Sustainable feedstock: Biomass
3. Science: Chemistry research and material science
4. Production: Sustainable monomers and intermediate chemicals
5. Innovation: Chain integration, digitalization and energy
6. Science: Research group circular plastics
7. Production: Sustainable polymers and semi-finished products
8. Innovation: Polymer and energy innovation
9. National Test Center Circular Plastics
10. Recycling: Chemical recycling by pyrolysis and gasification
11. Recycling: Chemical recycling by depolymerization

Home to Chemport Europe, which consists of three integrated chemical clusters, each with their area of expertise. All three clusters work together closely to speed up the transformation to sustainable chemistry.

- **Chemport Delfzijl** specializes in sustainable intermediate chemical production.
- **Chemport Emmen** is Europe's leading fiber-based chemistry cluster, accelerating innovation in monomers, polymers and composites.
- **Chemport Heereveen** dedicates itself to accelerating the circular economy with cutting-edge recycling innovations.

Chain integration to close the loop

Companies in our ecosystem can join a chain and exchange raw materials with each other. Crops such as sugar beet, potatoes and also grass and wood are increasingly being used to produce sustainable chemicals. By closing the chains, we're creating a circular economy.

3. SUSTAINABLE FEEDSTOCKS

We're moving away from fossil feedstock. The sooner we get there, the better. That's why we're taking big steps to use sustainable feedstocks like biomass, carbon dioxide and hydrogen.



Eemshaven, Groningen. Photo: Johan Bosma

• Biomass

A number of the chemical companies in the Chemport Europe ecosystem are involved in developing biorefinery processes to turn biomass into useful chemical building blocks. There's a huge potential in using sugars as a feedstock for the chemical industry.

In the Chemport ecosystem, the entire chain from agriculture to organic base chemicals and intermediates to final products is present. And coincidentally, the fertile TopDutch lands are perfectly suited for growing sugar beets.

- **Green energy**

Our flat coastal region is ideal for wind turbines, and one of the world's biggest wind farms is located just off the coast in the North Sea. Green electricity is also imported through the NorNed cable (to Norway) and COBRA cable (to Denmark).

- **Carbon dioxide**

CO₂ to chemicals is steadily evolving to a healthy and commercially viable stage. To support and accelerate this, the knowledge institutes in the Chemport region work on strategies for CO₂ valorization.

Photanol is one of our pioneers, using cyanobacteria to convert carbon dioxide into organic acids. With the help of regional and national funding, and in partnership with innovative companies like Nobian, their demonstration plant is operational at Chemport Delfzijl

- **Hydrogen**

In February 2018, a hydrogen filling station was opened in Delfzijl, servicing regional buses with green hydrogen from the Nobian Specialty Chemicals chlorine plant.

At the Delfzijl chemistry park, Evonik Peroxide produces bleach (H₂O₂) from hydrogen. Any excess hydrogen produced by the chlorine plant is used for heating, through the Nobian Delesto cogeneration power plant.

4. BIOBASED CHEMISTRY

With the help of crops from its sizable agricultural hinterland, the TopDutch region is able to count on sustainable building blocks for green chemistry. The perfect place to kickstart the transition towards biobased chemistry!

- **Chemical building blocks**

Companies in Chemport Delfzijl are focussed on producing intermediate chemicals such as methanol, amines, MCA, glycerin, BTX and MDI. There are a number of projects working on the development of bio-based versions of these chemicals, from early research to pilot plants to commercial production.

Examples of bio-based solutions coming from the TopDutch region include planned commercial-scale production of plant-based FDCA (Avantium) and BTX (BioBTX), both vital for circular plastics and other products. BioMCM is Europe's largest producer of biomethanol, and companies such as Nobian and Paques Biomaterials have intense R&D activities for bio-based chemistry in the region.

- **Biopolymers**

Several products are already being produced from biopolymers in Chemport Emmen, ranging from biobased nylon for the automotive industry, to 3D printing filaments, yarns and ropes to foamed biopolymer for things like mattresses and furniture..

5. SUSTAINABLE AND CIRCULAR PLASTICS

In the TopDutch region, we're actively working together to **close all aspects of the plastics loop**, from production and design to recycling and repurposing. We do this by combining **world-class research** with an **entrepreneurial mindset** and a **collaborative approach**.

• Circular polymers

The Northern Netherlands is a hotbed for innovative plastic recycling. We have everything in place to recycle all possible kinds of plastics, using mechanical and chemical recycling to turn recycled plastics back into chemical building blocks. And we're also pioneering thermochemical recycling, with the first pilot plant already up and running, so we can also use mixed plastics that would normally be burned.

• Recycling innovations

Chemport Heerenveen is home to the National Test Centre Circular Plastics, the first independent test center with facilities for sorting and washing on industrial scale in Europe. The center conducts testing, data analysis and provides a setup for experiments with new sorting technologies.

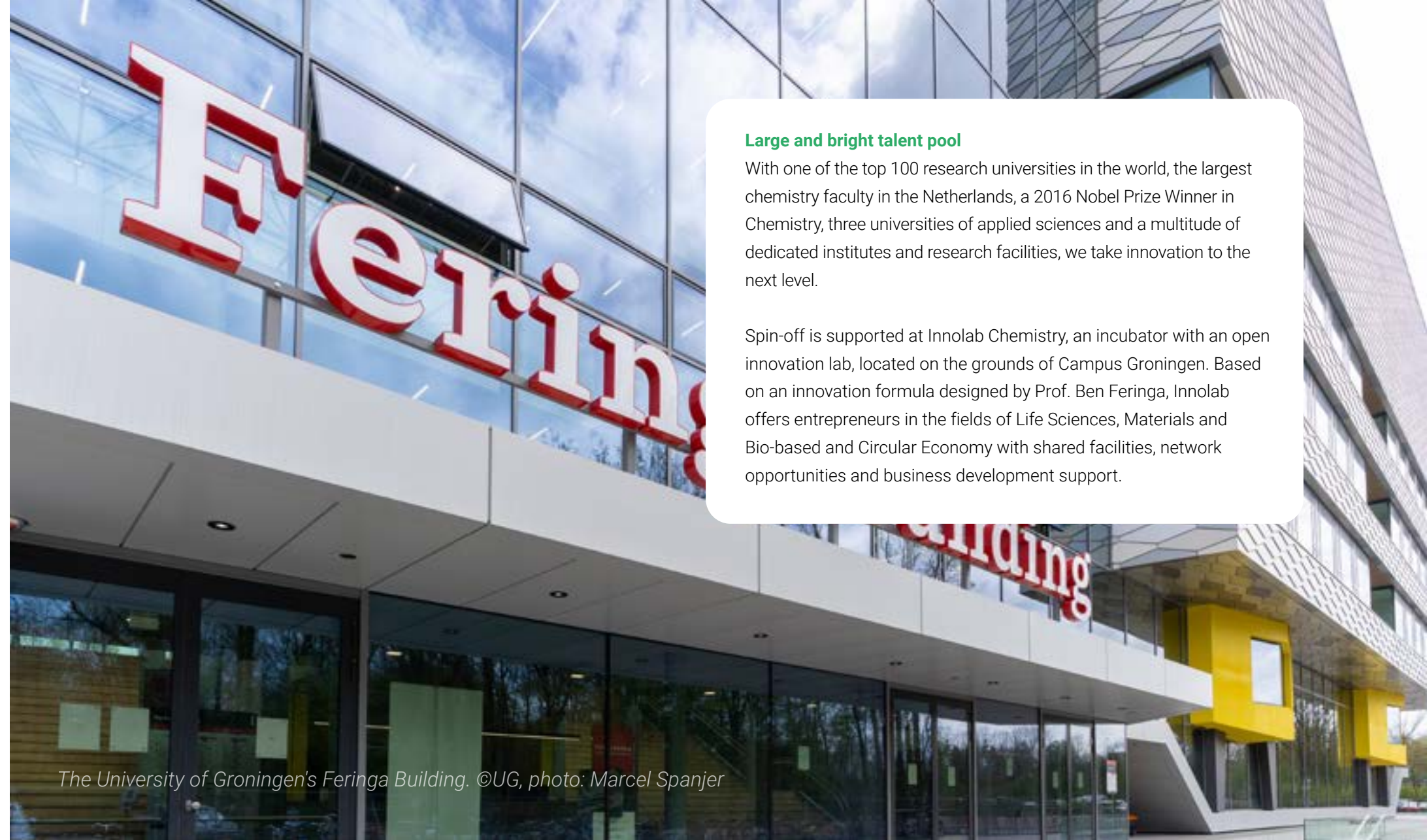


Close-knit clusters.

- **SUSPACC.** The Sustainable Products and Chemicals Cluster consists of a proactive SME business network that is investing in the green and circular industry. Further developing the green chemical sector is one of their main drivers, as well as strengthening mutual relationships. SUSPACC does this by co-developing a yearly updated R&D agenda together with the local government and knowledge institutes; which in turn results in a more cohesive & innovative industrial ecosystem and maintaining future talents.
- **SPIC.** Chemport Emmen hosts an impressive cluster of companies involved in the production and recycling of plastics. Together with nearby universities, these companies formed the Sustainable Polymer Innovation Cluster (SPIC). The cluster offers technology, expertise and products to companies that aim to make plastic products more sustainable. SPIC also offers state-of-the-art equipment and services for developing and upscaling new biobased or recycled plastics and products.

6. WORLD-CLASS KNOWLEDGE DEVELOPMENT AND ACCESS TO TALENT

We have a highly skilled and well-trained workforce that knows green chemistry and offer leading research and development facilities.



Large and bright talent pool

With one of the top 100 research universities in the world, the largest chemistry faculty in the Netherlands, a 2016 Nobel Prize Winner in Chemistry, three universities of applied sciences and a multitude of dedicated institutes and research facilities, we take innovation to the next level.

Spin-off is supported at Innolab Chemistry, an incubator with an open innovation lab, located on the grounds of Campus Groningen. Based on an innovation formula designed by Prof. Ben Feringa, Innolab offers entrepreneurs in the fields of Life Sciences, Materials and Bio-based and Circular Economy with shared facilities, network opportunities and business development support.

The University of Groningen's Feringa Building. ©UG, photo: Marcel Spanjer

An extensive ecosystem of leading research and development facilities

Cross-cluster collaboration stretches the innovation and applications of our knowledge far beyond the chemical industry.

Fundamental research/ knowledge institutions

- Stratingh Institute for Chemistry
- ZIAM
- ZAP
- Research Centre Biobased Economy (Hanze UAP)
- Northern Innovation Lab Circular Economy

Applied research and shared test centers

- Hydrohub
- GETEC.Park Emmen shared lab
- EnTranCe
- National Test Center Circular Plastics
- GreenPAC
- Zernike Nanolab
- Water Application Center (WAC)
- FACT

Business development and facilities

- Chemport Innovation Center
- Innolab Chemistry
- Innolab AgriFood
- Campus Groningen
- BioBiz Hub

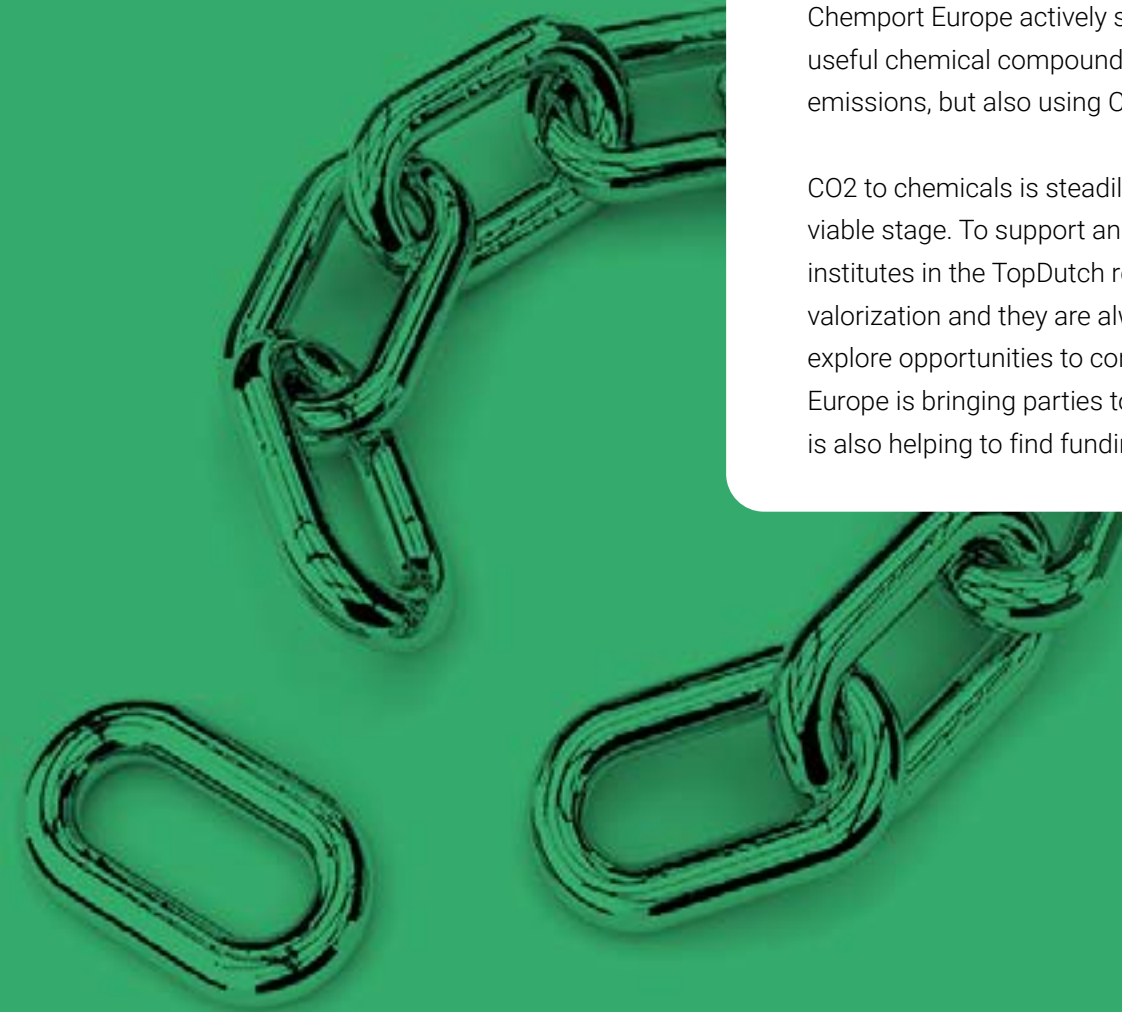
7. MISSING LINKS

In the TopDutch region, we're working on sustainable solutions for global problems and we invite the rest of the world to help build the future. And we are certainly interested in a little help and expertise in the following fields:

• Carbon feedstock

Chemport Europe actively supports initiatives to convert CO₂ into useful chemical compounds. Not only to reduce greenhouse gas emissions, but also using CO₂ to replace fossil fuels as feedstock.

CO₂ to chemicals is steadily evolving to a healthy and commercially viable stage. To support and accelerate this, the knowledge institutes in the TopDutch region work on strategies for CO₂ valorization and they are always on the lookout for organizations to explore opportunities to connect and for joint projects. Chemport Europe is bringing parties together to form an innovative chain and is also helping to find funding to realize these projects.





- **Smarter and more sustainable recycling**

The TopDutch region has a very strong plastic recycling cluster - active in chemical, mechanical, and advanced recycling. We're open to companies who can make these processes even more efficient, either through new technologies or by optimised separations, for example by applying AI.

- **Biomass feedstock**

Make use of the TopDutch region's high-yield hinterland, great infrastructure, and expertise in bio-based chemistry to pilot or scale-up [H₂]-gasification or basic chemical production on the basis of biomass. We're particularly interested in companies working on bio-based solutions for graphite and plastics.



Are you interested in exploring what
your business possibilities could be?
Connect with **Sil Faber**,
our **Green Chemistry expert**.

T: +31 6 552 204 53
E: faber@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

The TopDutch collective:

Economic region



Executive partners



Ministerie van Economische Zaken
en Klimaat



*Netherlands Foreign
Investment Agency*

Regional partners



Knowledge partners



Industry partners



TOPDUTCH.COM

Naturally leading the transition