TOP DUTCH
A good place to be great

GREEN CHEMISTRY

Become part of the most complete and ambitious ecosystem for Green Chemistry: Where, 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 the world's 9th and Europe's 2nd largest natural gas field right under their feet. Together with naturally large reserves of sodium and natrium 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, CO_2 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. **Cohesive ecosystem for Green Chemistry**

2. **Access to green feedstock & energy**

3. **First CO_2 negative, fossil-free & circular cluster**

4. **Hydrogen Capital of Europe**

5. **Reliable government & fast business development**

6. **World-class knowledge & access to talent**

1. COMPLETE AND COHESIVE ECOSYSTEM FOR GREEN CHEMISTRY

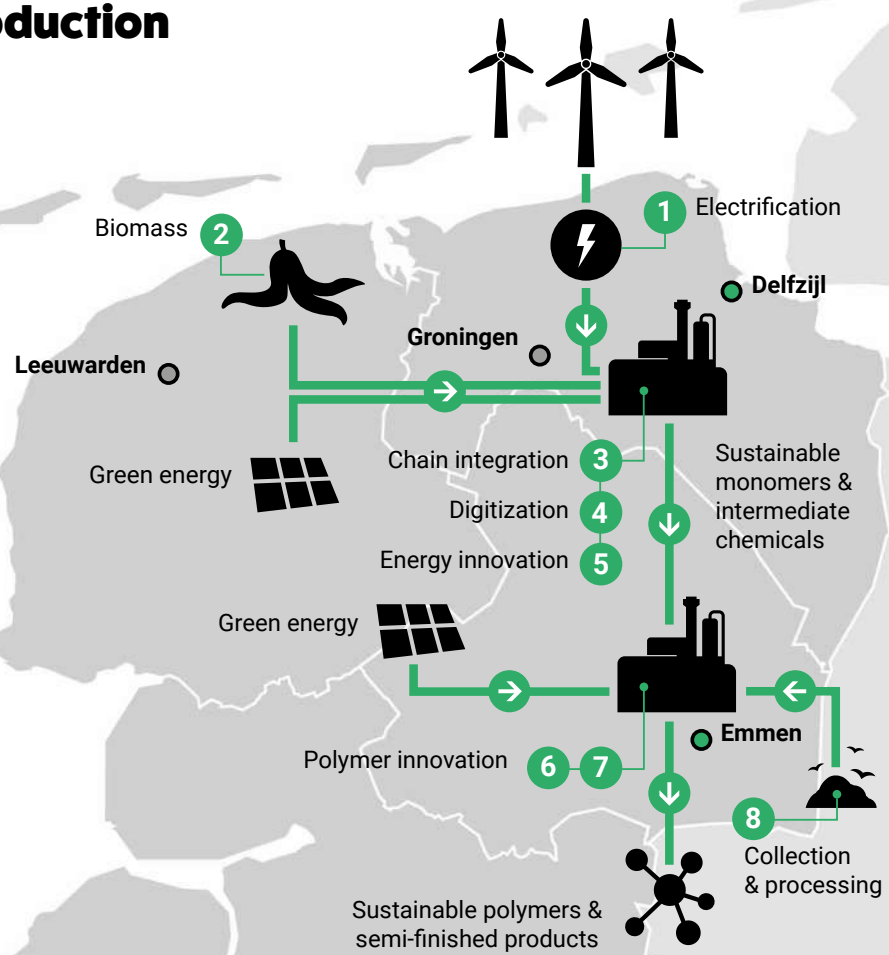
The Northern Netherlands offers a more complete and cohesive ecosystem for Green Chemistry than any other region in Europe.

- **Home to Chemport Europe.** Chemport Europe consists of two integrated chemical production clusters. Chemport Eemsdelta is focused on intermediate chemicals, Chemport Emmen is focused on polymers and polymer applications. Entrepreneurs, government and knowledge institutions collaborate in Chemport Europe with the shared motto ‘Changing the nature of chemistry’. From feedstock to end-product; Chemport Europe is determined make chemistry green.

- **Green processes via chain integration.** Companies collaborating in the Chemport Europe ecosystem join chains and exchange feedstocks with each other. In the near future, the chains will close, producing a circular economy. Infrastructure and a close-knit community encourage smart integration of production chains.

- **Closing the loop via recycling.** Besides a strong focus on using green building blocks for green intermediate chemicals, Chemport Europe is expanding its network with recycling companies to kick start the circular economy.

A coherent and innovative R&D and production ecosystem



Related Research & Development

1. 1 MW Test Centre
2. Zernike Advanced Processing (ZAP)
3. Chemport Industry Campus (CIC)
4. Smart Industry Hub
5. EnTranCe
6. Sustainable Polymer Innovation Cluster (SPIC)
7. Green PAC Polymer Application Centre
8. Kenniscentrum Recycling

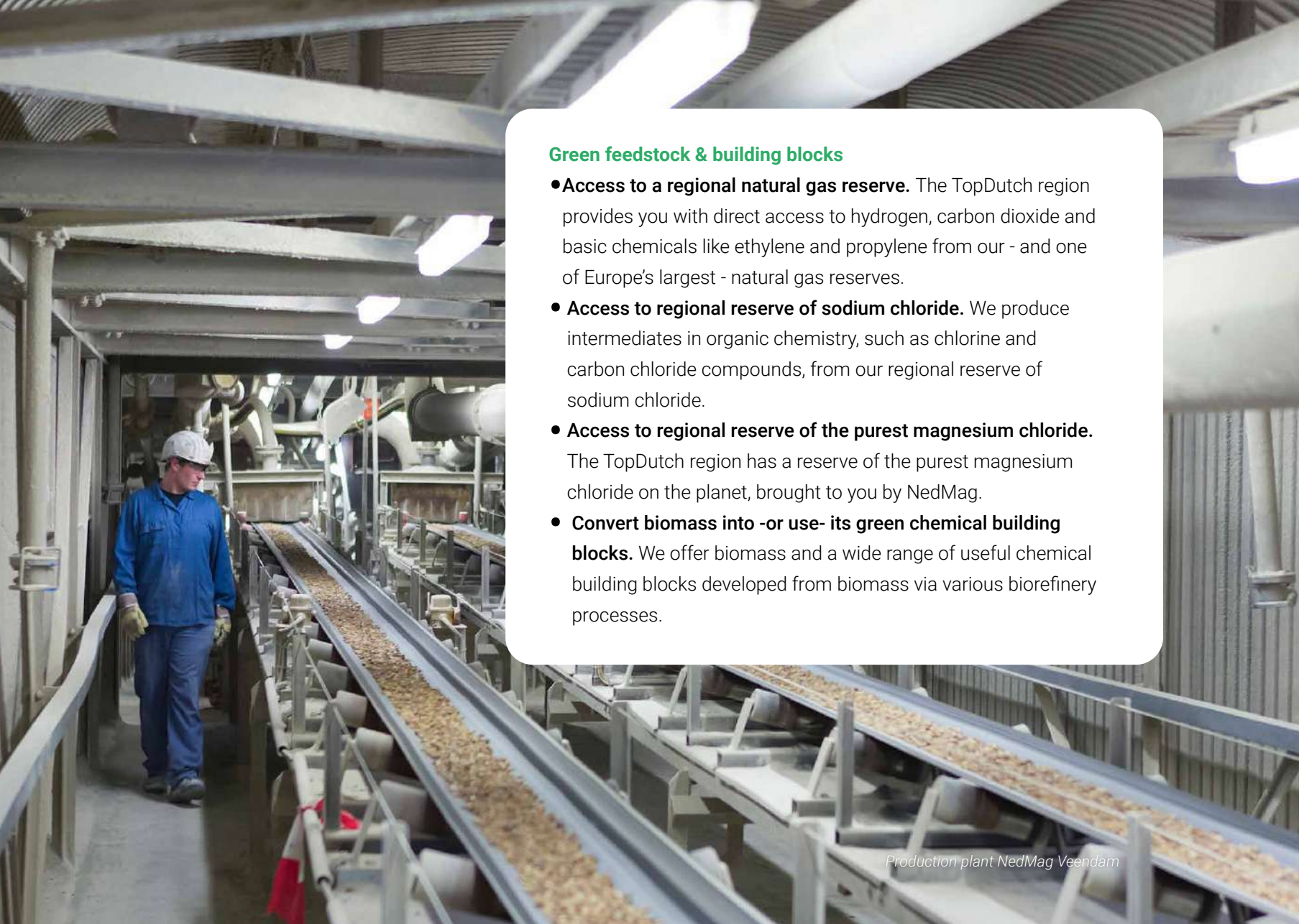
- **Developing breakthrough technologies.** Chemport Europe hosts many pilot facilities in which a substantial number of breakthrough technologies have been developed and are now in operation, being supported by the existing ecosystem dedicated to Green Chemistry. Examples of new technologies include: 2nd generation sugars, MEG, Bio-BTX, chemical recycling, acetate, etc.

- **A large knowledge cluster.** The TopDutch region offers a large knowledge cluster at its world-renowned University of Groningen with the largest chemistry faculty of the Netherlands, Zernike Campus and a complete research and development ecosystem related to chemistry.

- **No petrochemical industry.** Unique to these chemical clusters is that there is no petrochemical industry located, which makes the transition to fully green chemistry easier!

2. DIRECT ACCESS TO GREEN FEEDSTOCK AND GREEN ENERGY

The Northern Netherlands is rich in green resources with its agricultural hinterland and is located near and well-connected to Germany and Scandinavia.



Green feedstock & building blocks

- **Access to a regional natural gas reserve.** The TopDutch region provides you with direct access to hydrogen, carbon dioxide and basic chemicals like ethylene and propylene from our - and one of Europe's largest - natural gas reserves.
- **Access to regional reserve of sodium chloride.** We produce intermediates in organic chemistry, such as chlorine and carbon chloride compounds, from our regional reserve of sodium chloride.
- **Access to regional reserve of the purest magnesium chloride.** The TopDutch region has a reserve of the purest magnesium chloride on the planet, brought to you by NedMag.
- **Convert biomass into -or use- its green chemical building blocks.** We offer biomass and a wide range of useful chemical building blocks developed from biomass via various biorefinery processes.

Production plant NedMag Veendam

- **Use raw and biorefined agricultural feedstock.** Our rich agricultural hinterland provide us with valuable and waste feedstock, such as sugars and starches, from which we can produce chemical building blocks. We have both 1st and 2nd generation sugar production facilities.
- **Import additional feedstock or specialized chemical building blocks** via our regional seaports, which are close to the agricultural hinterlands of Germany and Scandinavia.

Access to green energy

- **Solar energy.** We have access to the sun, so also here many plants and private houses produce green energy through solar panels.
- **Wind energy.** The rather flat coastal regions are ideal for wind turbines. Even better are our offshore wind parks located north of the region in the North Sea.
- **Biomass energy.** We produce some green electricity by burning biomass.
- **Imported green energy.** Our chemical clusters are connected to the NorNed cable (to Norway) and COBRA cable (to Denmark) for direct access to (imported) green electricity.

Energy efficiency

- **Optimize energy efficiency.** We optimize the energy efficiency of our processes, by reusing heat and waste flows and investing clean technologies.
- **Exchange residual heat.** Via a pipeline network, we exchange residual heat and biosteam.

3. MOST AMBITIOUS ECOSYSTEM:

The first fossil-free, CO_2 negative and circular chemical cluster in the world.

Chemport Europe is changing the nature of chemistry, not by talking, but by working together towards their shared vision and goals.

Chemport Europe is determined to close the plastics loop.
The TopDutch region is leading the New Plastics Economy, by having a strong focus on:

- becoming 100% circular
- making 100% green products
- designing plastic products that can (easily) be recycled
- developing technologies and establishing systems to collect, recapture, filter and recycle all types of plastics.

Chemport Eemsdelta will be the first CO_2 negative and fossil-free chemical cluster in the world, and will succeed by:

- using only green building blocks and therefore also be 100% fossil-free
- optimizing all processes
- reusing CO_2
- collaborating and investing together.

4. HYDROGEN CAPITAL OF EUROPE

The TopDutch region is dedicated to producing 100 percent green hydrogen, one of the most used and basic chemicals in chemistry and as facilitator for chemical processes.

From natural gas to hydrogen:

- Located on one of Europe's largest natural gas reserves, the TopDutch region has developed large-scale (gray) hydrogen production.
- The region will stop extracting natural gas in 2030 and has therefore the strongest motive to transition to green hydrogen (via blue hydrogen).

Transition transmission network via blue hydrogen at scale:

- We have the best gas infrastructure in Europe with redundancy in our pipeline application system. Therefore, we'll be able to apply redundant pipelines for the transport of emission-free hydrogen.
- We'll have the first Northern hydrogen transmission pipeline network from Groningen Seaports to Rotterdam and Limburg ready by 2021, to be expanded to Germany's Ruhr district by 2023.

Building the Green Hydrogen Economy:

- After switching to a hydrogen transmission pipeline network, we can gradually transition the mix of hydrogen from blue to green.
- The region will have a green hydrogen production capacity of 2.5GW by 2030 - and 1 GW by 2023 - together with our 20 industry partners, including Eneco, ENGIE, Equinor, NAM, Gasunie, Nouryon, Vattenfall, Shell and others.
- From here we will increase green hydrogen production and increase the impact of the green hydrogen economy on the chemical industry at large, being used for industry processes and as feedstock.

The current gas pipelines, like these belonging to the Gasunie, will be converted en-masse to build a strong hydrogen transmission pipeline network.

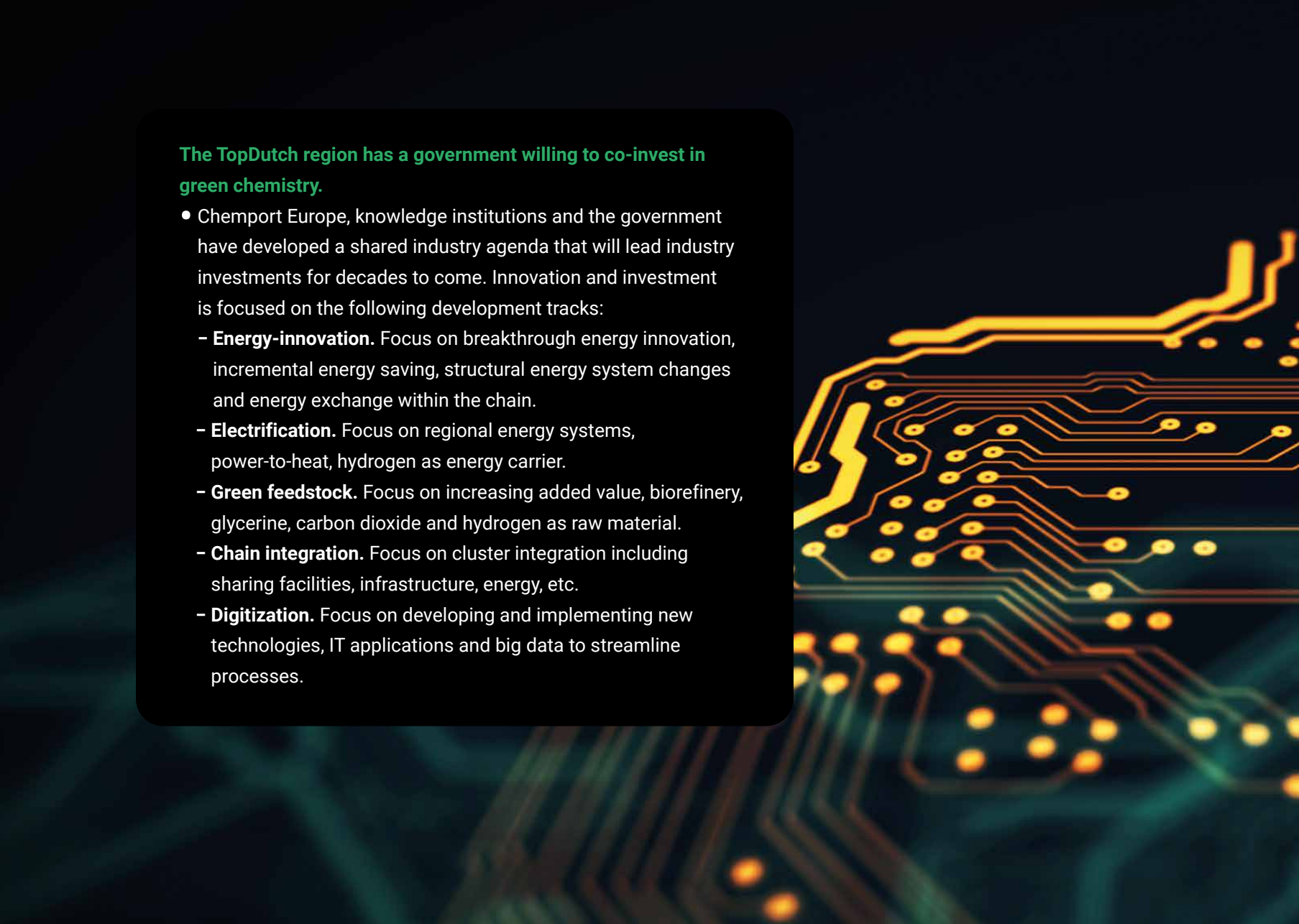
5. RELIABLE GOVERNMENT AND FASTEST BUSINESS DEVELOPMENT

The Netherlands has a stable regulatory framework and the Northern Netherlands offers one of the most attractive business establishment procedures for new companies in Europe.

The Netherlands has a competitive economy and a stable regulatory framework.

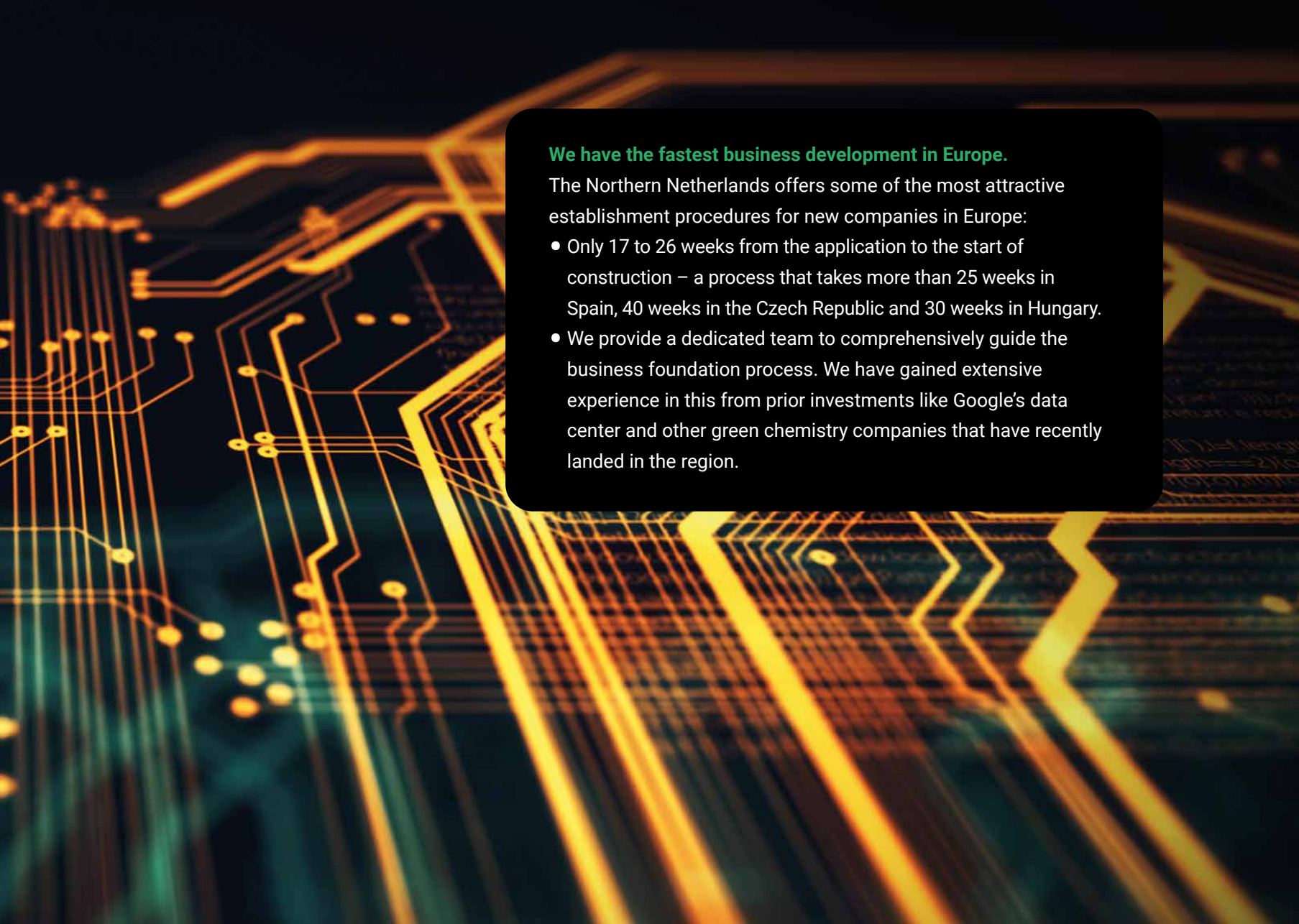
- The Netherlands ranks first in 2019 among the European countries on the World Economic Forum's Global Competitiveness Index, after our peers Germany and Switzerland. In particular, it is rated highly for macroeconomic stability, business dynamics, and institutional functionality.

Parliament building in The Hague



The TopDutch region has a government willing to co-invest in green chemistry.

- Chemport Europe, knowledge institutions and the government have developed a shared industry agenda that will lead industry investments for decades to come. Innovation and investment is focused on the following development tracks:
  - **Energy-innovation.** Focus on breakthrough energy innovation, incremental energy saving, structural energy system changes and energy exchange within the chain.
  - **Electrification.** Focus on regional energy systems, power-to-heat, hydrogen as energy carrier.
  - **Green feedstock.** Focus on increasing added value, biorefinery, glycerine, carbon dioxide and hydrogen as raw material.
  - **Chain integration.** Focus on cluster integration including sharing facilities, infrastructure, energy, etc.
  - **Digitization.** Focus on developing and implementing new technologies, IT applications and big data to streamline processes.



We have the fastest business development in Europe.

The Northern Netherlands offers some of the most attractive establishment procedures for new companies in Europe:

- Only 17 to 26 weeks from the application to the start of construction – a process that takes more than 25 weeks in Spain, 40 weeks in the Czech Republic and 30 weeks in Hungary.
- We provide a dedicated team to comprehensively guide the business foundation process. We have gained extensive experience in this from prior investments like Google's data center and other green chemistry companies that have recently landed in the region.

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.

The largest chemistry faculty in the Netherlands belongs to the University of Groningen in the TopDutch region. Besides educating over 25,000 research university students, this particular chemistry faculty is home to:

- Nobel laureate Ben Feringa, for the discovery of the molecular motor.
- Fionn Ferreira, winner of the Google Science Fair for his revolutionary new strategy for extracting microplastics from water, who chose the University of Groningen at only 19 years old.

Zernike Campus Groningen

Research center at Campus Groningen

The TopDutch region is home to an extensive ecosystem of leading research and development facilities, stretching the innovation and applications of our knowledge far beyond the chemical industry

- **Zernike Campus**
- **Zernike NanoLab**
- **Innolab Chemistry & AgriFood**
- **EnTranCe**
- **Hydrohub**
- **Northern Innovation Lab Circular Economy**
- **Zernike Advanced Processing**
- **Zernike Institute for Advanced Materials**
- **Water Application Center**
- **Food Application Technologies Center**
- **Green PAC**
- **BioBizzHub**
- **Pilot Center for Sustainable Chemicals and Processes**
- **SPIC Emmen**
- **EMMTEC services**

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

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Want to find out more about what makes the TopDutch region a good place to be great, or view the digital edition? Head over to our website www.topdutch.com

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