Green Horizon

How to green the carbon in the chemical industry

Jacqueline Vaessen
Chair ChemistryNL

NL

ChemistryNL

ChemistryNL

- 1 of the 10 high priority sectors in the Netherlands
- Leads the innovation agenda on Circular Economy
- Boosts innovation in the chemical industry
- Connects public and private organisations in an open, inclusive and inventive way

ChemistryNL

Chemical sector in The Netherlands

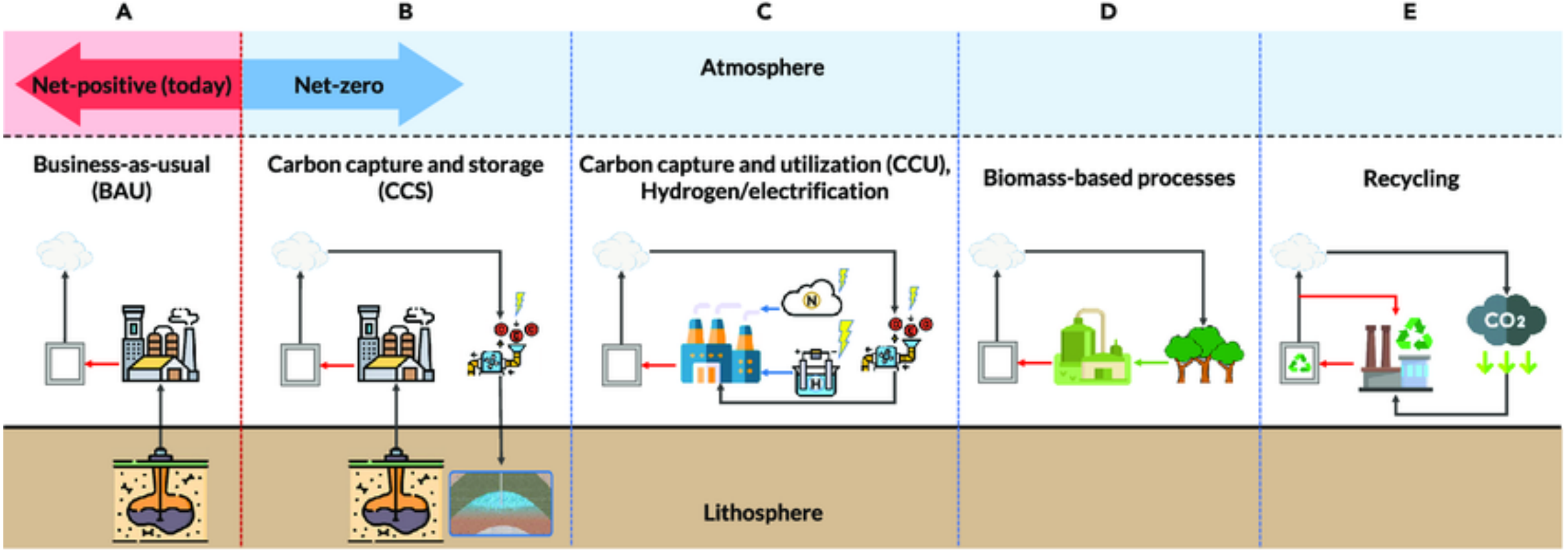
Key figures	Chemicals
Anual turnover in EUR:	83 billion
People working (in FTE):	85.000
Number of companies:	2530
Annual added value in EUR:	66 billion
Annual R&D expenditure in EUR:	Approx. 1,5 % of turnover

- **80% of chemical production is exported**
- **2 % contribution to GDP**

Netherlands

ChemistryNL


Challenge: How do we green the carbon in the chemical industry



Building elements

- Fossil fuels reservoir
- Fossil-based (BAU) chemical synthesis plant
- Chemical product end-of-life
- Chemical product end-of-life with recycle
- Chemical product
- Carbon-based product (fossil hydrocarbon, CO_2)
- Carbon-free product (hydrogen, nitrogen)
- Biomass

Required to achieve net-zero carbon emissions

- CCU / electrification chemical synthesis plant
- Biomass-based chemical synthesis plant
- Recycle-based chemical synthesis plant
- Generic carbon removal (biomass, CO_2 capture, CO_2 capture and storage)
- Permanent geological CO_2 storage
- CO_2 capture (direct air, point-source capture)
- Sustainable biomass
- Low-carbon electricity
- Low-carbon hydrogen
- Low-carbon nitrogen

Defossilising Chemical industry:

Sustainable carbon supply (keep carbon in the loop)

- Biobased feedstock
- Recycling
- CCU

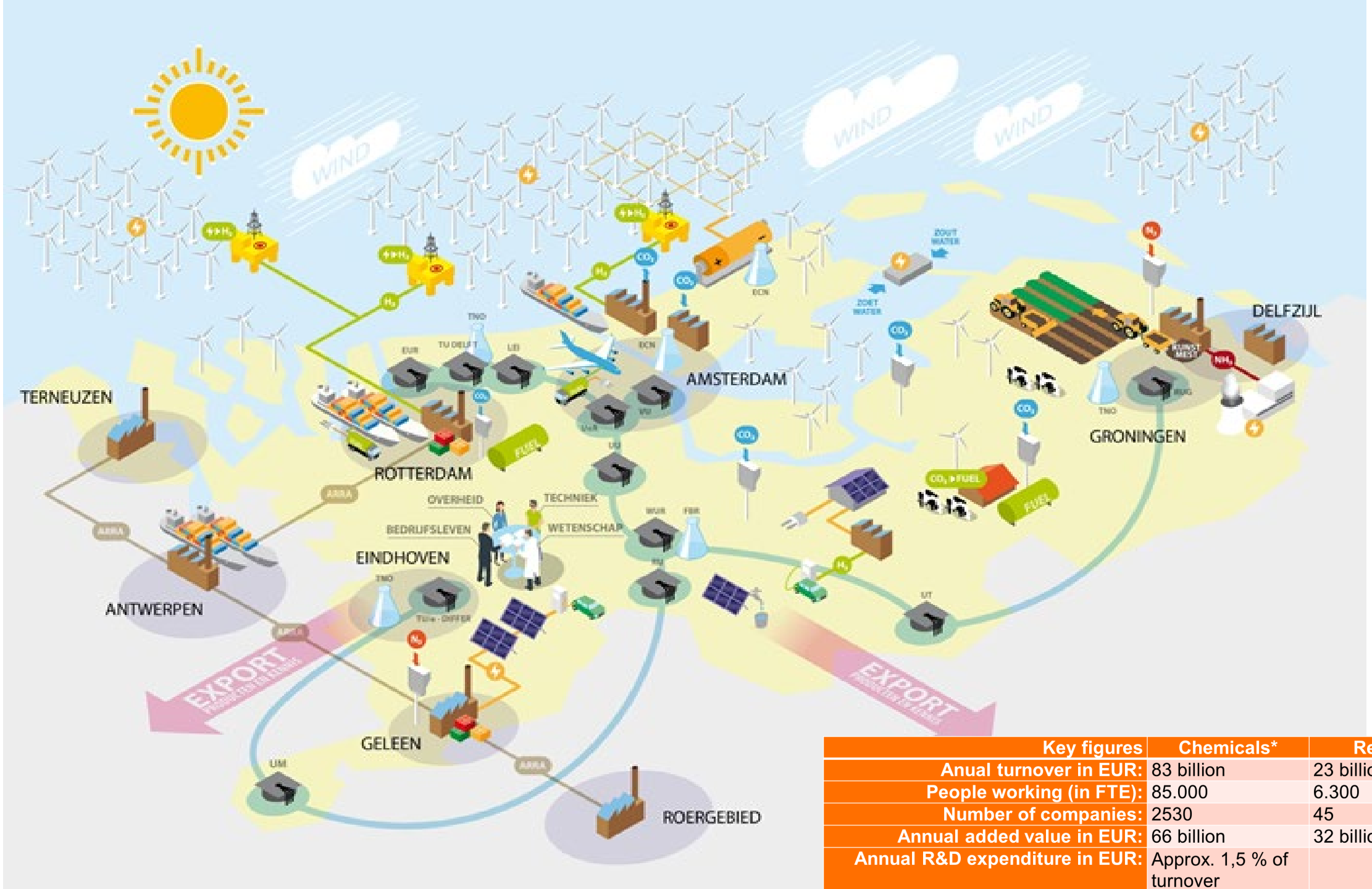
Sustainable energy supply

- Increase of renewable energy production (solar-PV, Wind)
- Increase of supply of renewable energy by providing energy storage solutions
- Sustainable supply of critical materials

It is a worldwide opportunity

Netherlands

ChemistryNL



Key figures	Chemicals*	Refining
Anual turnover in EUR:	83 billion	23 billion
People working (in FTE):	85.000	6.300
Number of companies:	2530	45
Annual added value in EUR:	66 billion	32 billion
Annual R&D expenditure in EUR:	Approx. 1,5 % of turnover	

International collaboration

ChemistryNL takes initiative and direction by using the competences of Dutch chemistry in (inter)national cooperation.

Bilateral cooperation

- Collaboration in research and innovation
- International network with innovation attachés (IA's) at key strategic /partnering countries.

- **Brazil** is one of the focus countries for the chosen theme **biobased chemistry**

- Webinar Nov2022 -> NWO –FAPESP KIC Call in-prep

- Innovation Mission Brazil on circular bio economy 11-15 Dec 2023

ChemistryNL

see more info on ChemistryNL webpage

Example of academic coloboration from the NWO-FAPESP program

- The partners: São Paolo State University and TU Delft
- The project: reengineering Escherichia coli that it can synthesize polyhydroxyalkanoates under anaerobic conditions
- The goal: developing a new and more cost-competitive way of producing feedstock for bioplastics

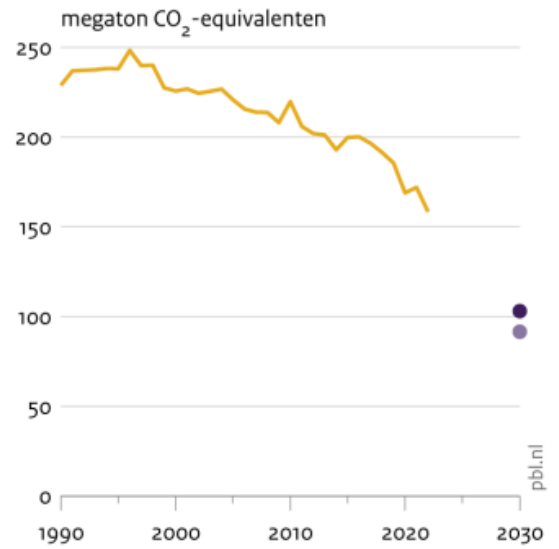
> *We wanted to use sucrose for the bacteria to grow on. That is why Brazil is a perfect match for us, since it is the largest producer of sucrose.*
>
> ***Karel Olavarria Gamez***
> *Delft University of Technology*

> *The Dutch biotechnology is very much oriented towards practical applications, like it is here in Brazil.*
>
> ***Jonas Contiero***
> *São Paulo State University*

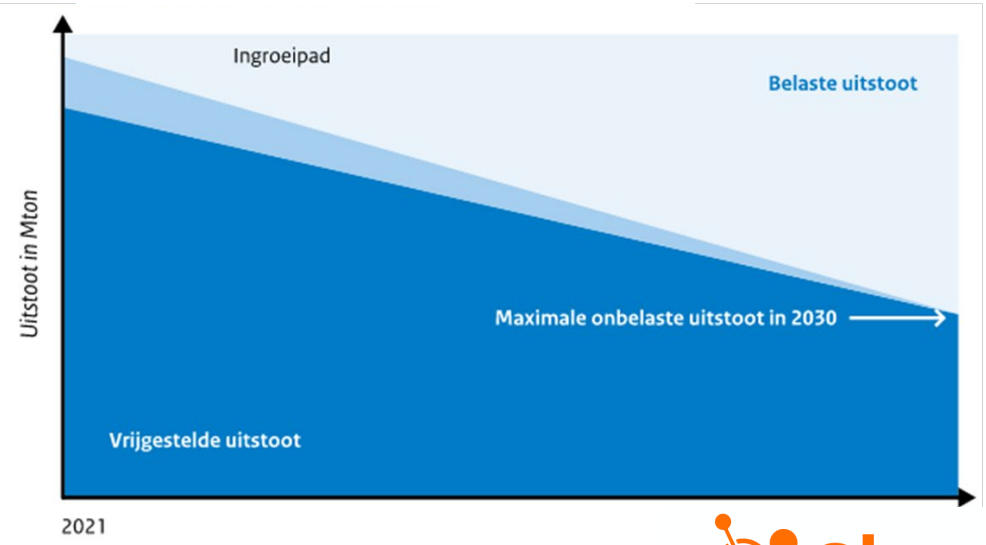
ChemistryNL

NL targets to sustainability and circularity

- **National goal:** -55-60% CO2-reduction by 2030 (relative to 1990), set by law. 2022: 158mton, target 2030 103mton
- **Targets in 5 sectors** based on analysis of national cost-effectiveness
- Intensive stakeholder process through negotiations **on National Climate Agreement** (75 parties signing)
- For **Industry** task is to reduce emissions from 54mton (2021) to 29mton (2030), 50% target since 1990 is reached. Instruments: European Trading System (ETS), national CO2-levy, and subsidies e.g. for H2(-market) and tailormade approach with biggest emitters



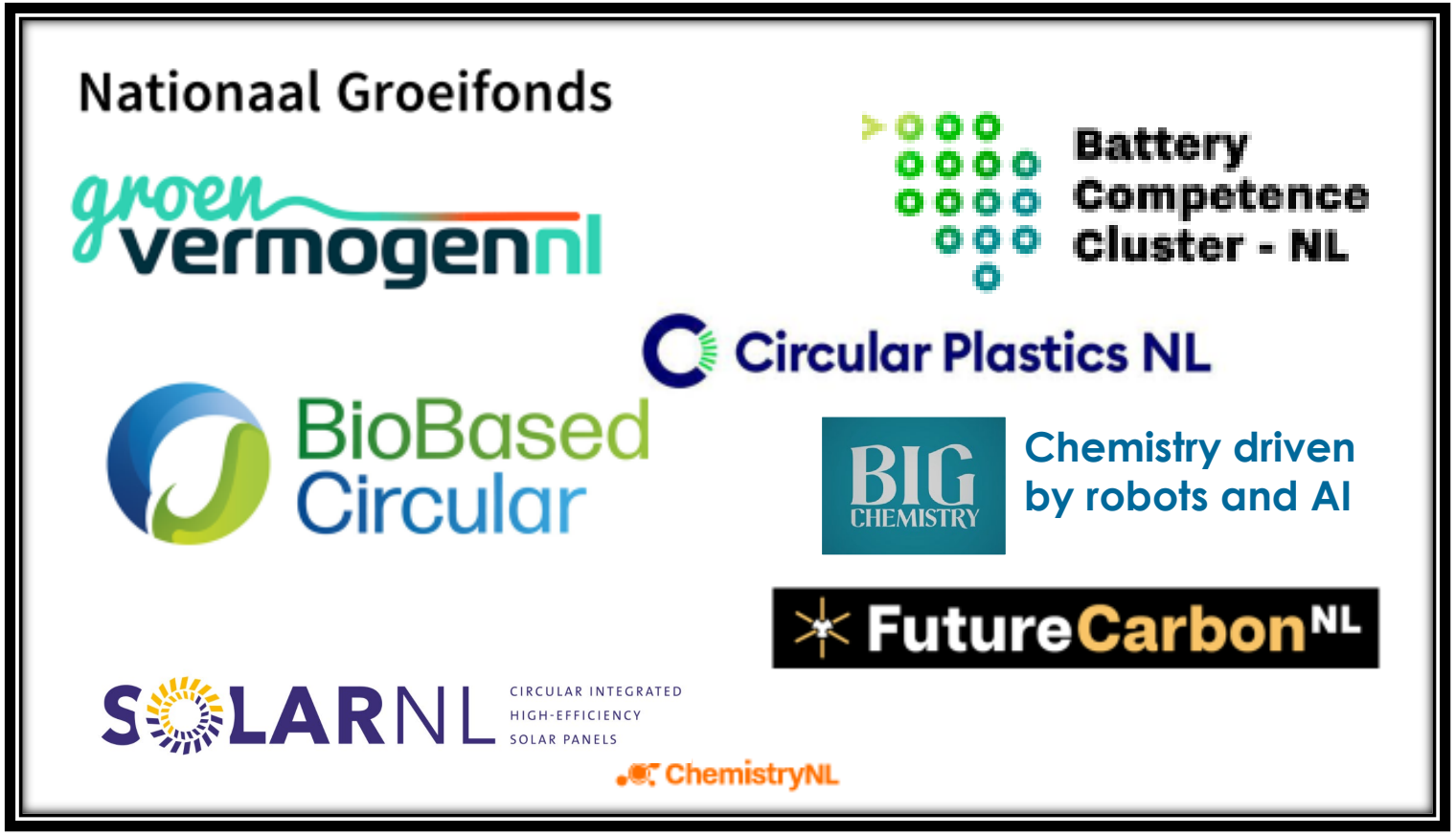
1. **CCS**
2. **Efficiency**
3. **Reduction**
4. **Circularity**
5. **Electrification**
6. **Hydrogen**



Netherlands

ChemistryNL

ChemistryNL fosters the ambition to renew Dutch Industry for a strong Europe

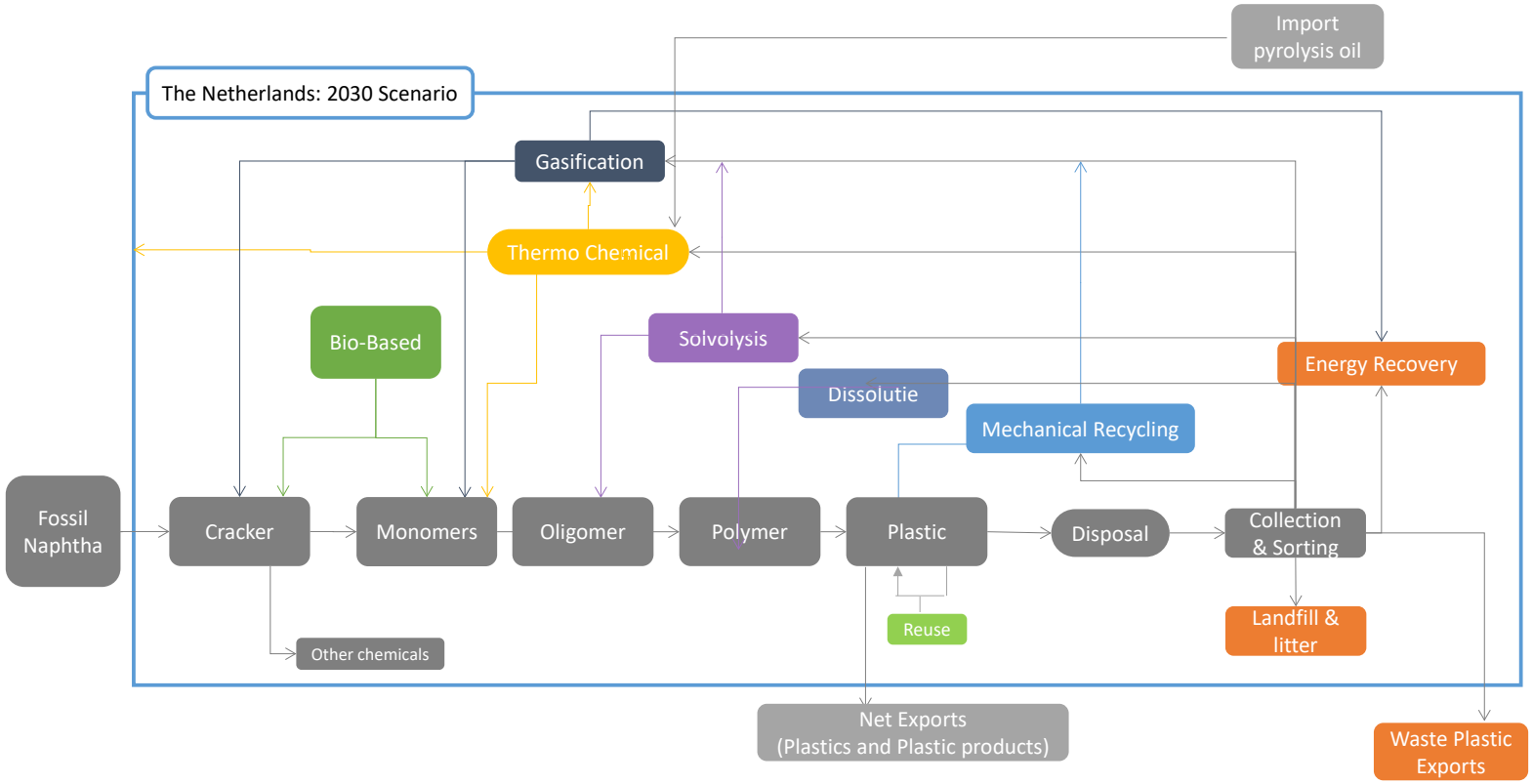


ChemistryNL

CircularPlasticsNL (M€ 220)

Programme lines

- **P1. System integration and design (incl. microplastics)**
- **P2. Characterizing, sorting, washing**
- **P3. Recycling of polyolefin packaging**
- **P4. Recycling of styrene based materials**
- **P5. Chemical depolymerization**
- **P6. Thermochemical recycling**
- **P7. Brightlands Circular Space**
- **P8. Seed fund for fundamental research**



Circular Plastics NL

ChemistryNL

Implementing new value circles in the Netherlands

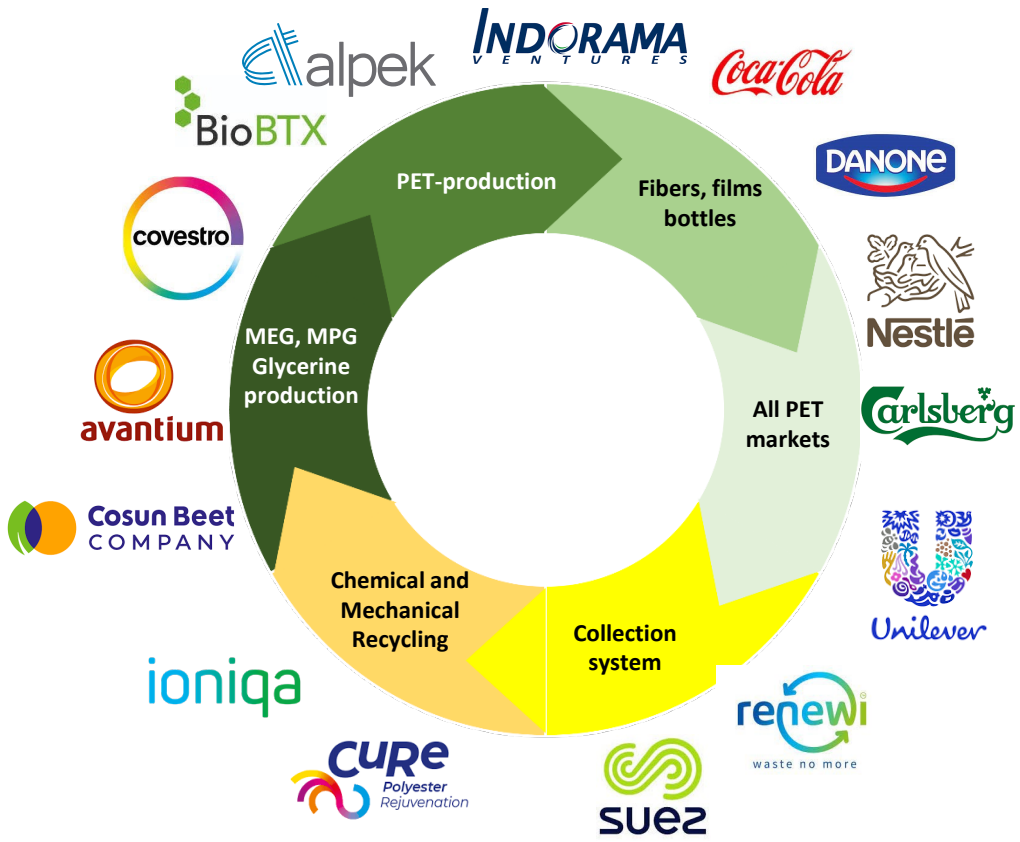
BBC growthfund

- 5 value circles at scale
- Time: 8 years
- Budget: € 340 mln from fund
- > 125+ organizations

Impact in 2050

- ~ 2.5 Mton CO_2 emissions reduction
- 3500 jobs
- € 1.5 bln economic growth

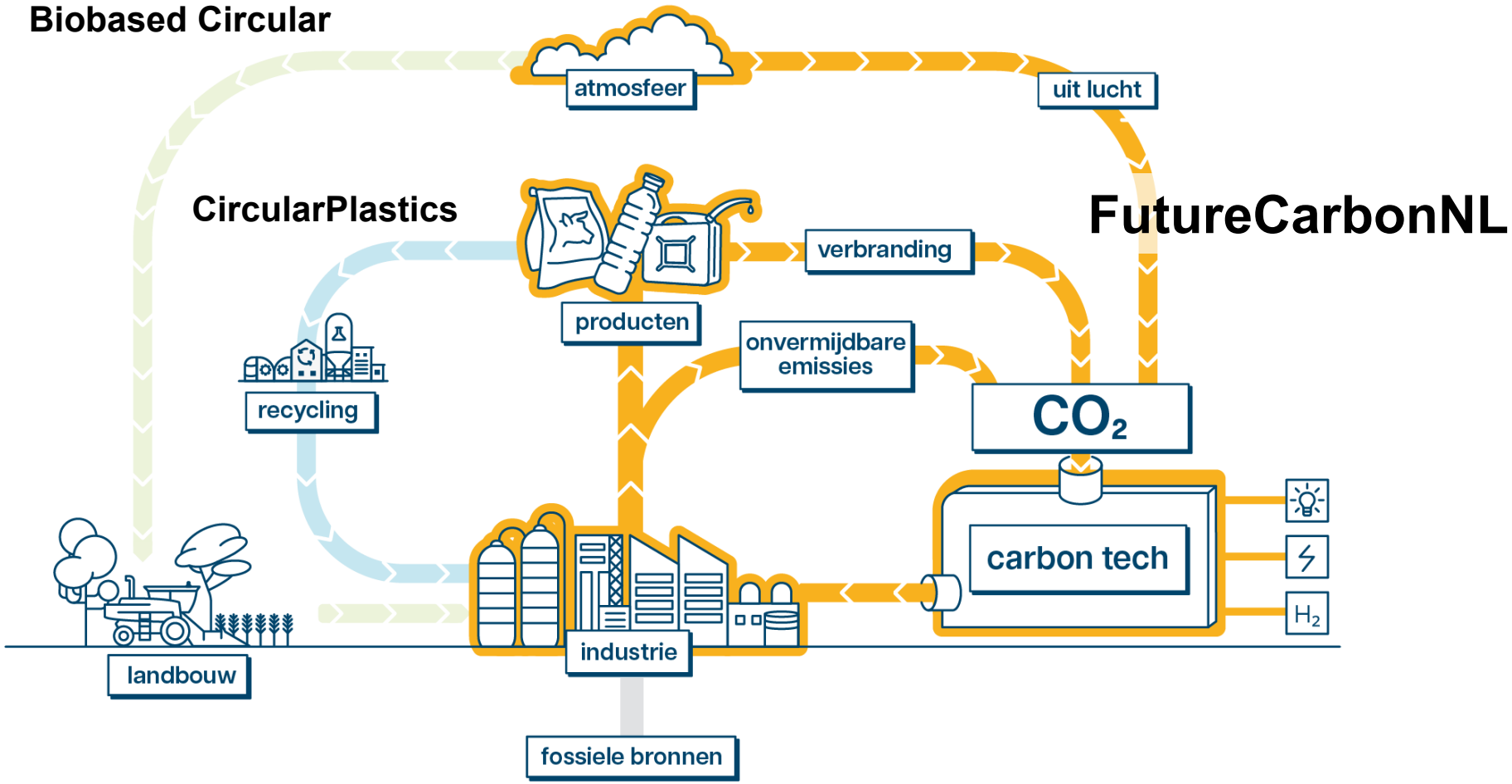
2050 – circular PET chain



BBC Focus

- Carbohydrates / Polyesters
- Packaging, textile, building
- Recycling
- Design for circularity
- TRL 4-9

Closing the carbon cycle - FutureCarbonNL



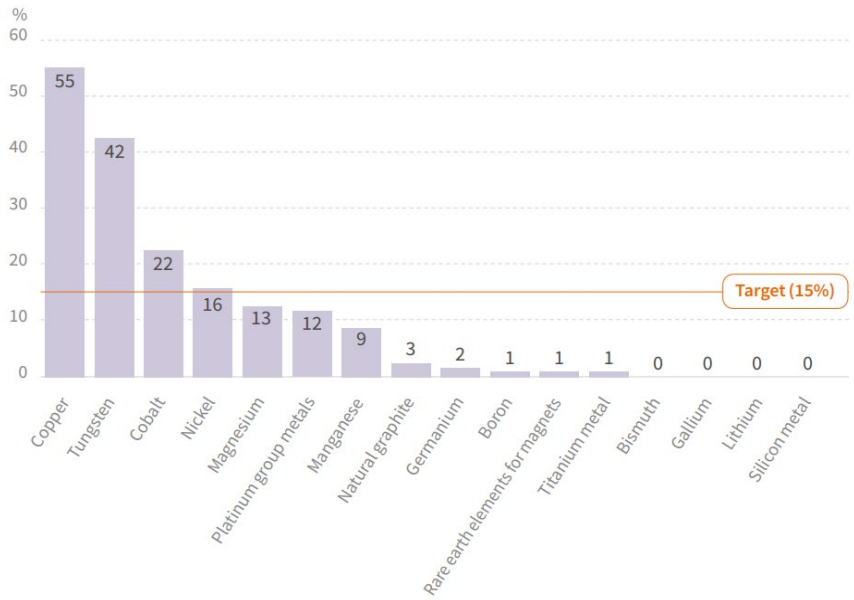
Carbontech (CCU) is a necessary tool for circularity and the raw material transition.

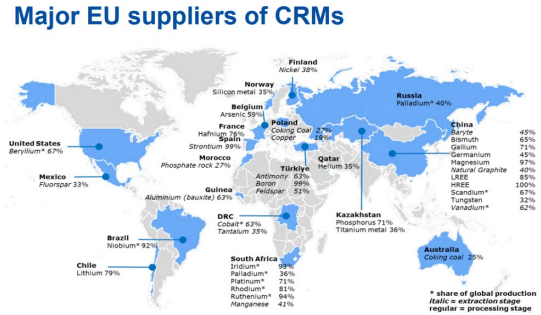
ChemistryNL

Innovation agenda on strategic autonomy of raw materials

Knowledge questions and directions for solutions have been formulated from four perspectives:|

1. Insight into product chains, material streams, delivery risks and impact on the economy and society.
2. Technology, industry and value creation.
3. Developing competencies.
4. Governance, behaviour and chain responsibility.





ChemistryNL

ChemistryNL

Let’s keep in touch!

Visit www.chemistryNL.com
for ao technological roadmaps and the ‘Business Portal’.

Sign up for the newsletter

Ask a question through:
info@chemistrynl.com

ChemistryNL