circularsummit
fryslân2025

Circulair Friesland Association

# Circular Plastics

## June 12th

Circulair Friesland

# Planning

11:00 – 11:45 Keynotes Speakers

- Ineke Ganzeveld – Greenwise Campus
- Françoise Bonnet – ACR+
- Vincent Voet – NHL Stenden

11:45 – 12:00 Q&A

12:00 – 13:00 Lunch Break

13:00 – 14:30 Work Session

- Biobased Plastics
- Reuse of Plastics

# Ineke Ganzeveld

SNN

Co-funded by the European Union

Ministerie van Economische Zaken

# Circular Plastics in the North of the Netherlands

## Our cooperation & approach

greenwise | circular plastics

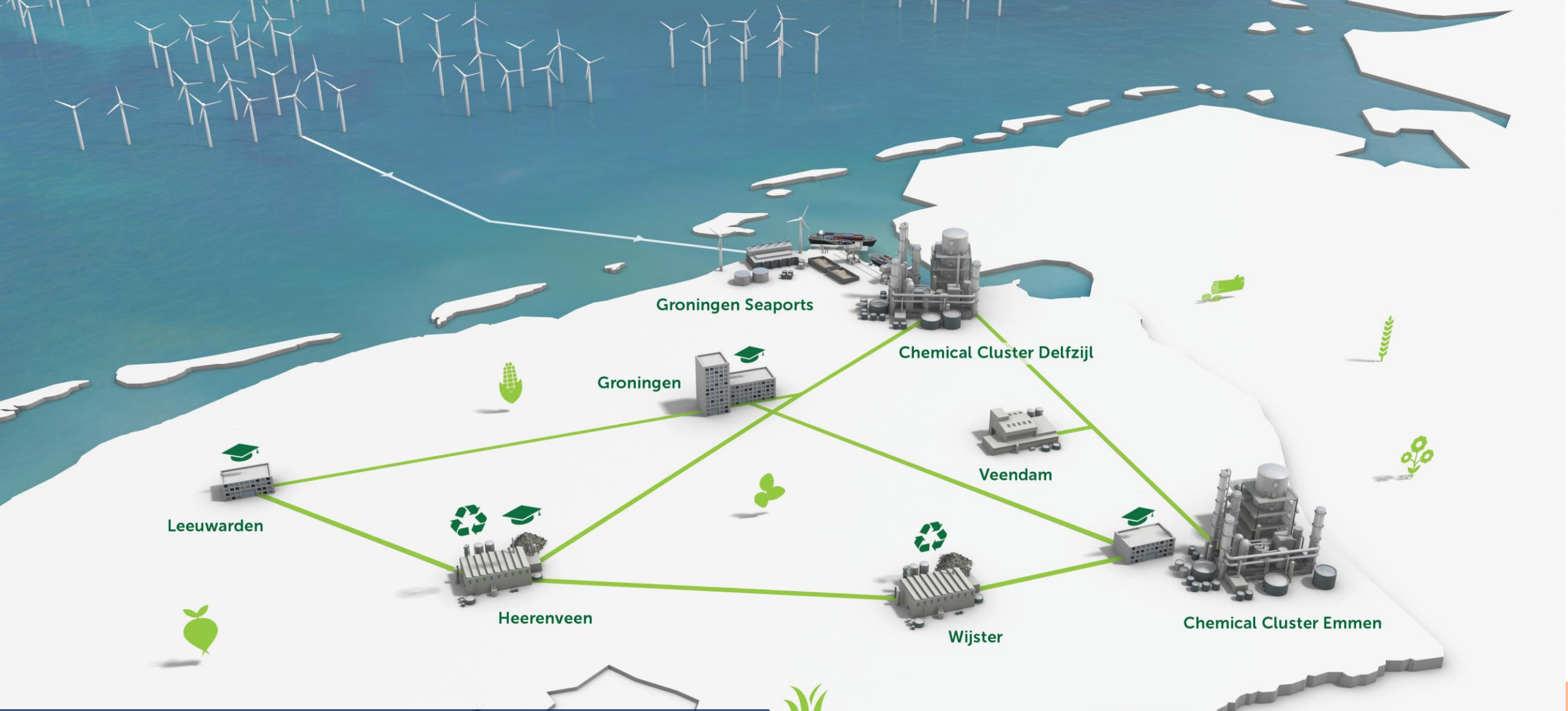
Part of CHEMPORT EUROPE

# North of the Netherlands

- Region
  - 1.8 million inhabitants
- One of the five chemical clusters in the Netherlands
  - > 600 hectare
- Concentration of plastics related industry & knowledge
- Frontrunner in the transition to a sustainable plastics industry



greenwise | circular plastics




# NNL programme Circular Plastics

greenwise | circular plastics

# Ambition

## Become a centre of excellence in Europe for the sustainable production & recycling of (bio-)plastics

greenwise | circular plastics

**Challenge:** the demand for plastic materials will triple


## NNL programme Circular Plastics

Focus on our strengths

Structural solutions & chain approach necessary

Transition requires more than technological innovation

greenwise | circular plastics

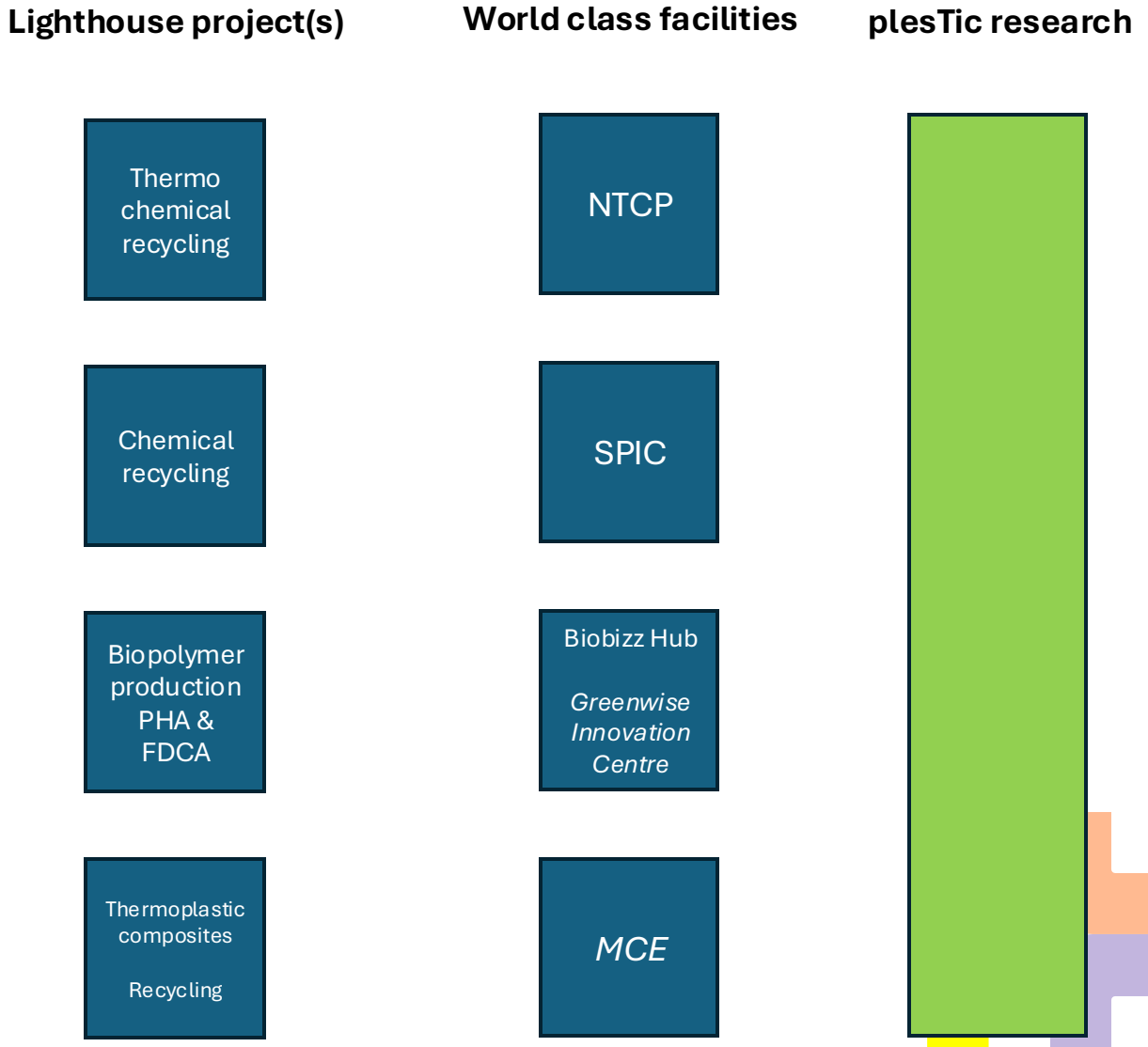
# Focus: our strengths

1. **Circular Packaging**
   - Sorting & separation
   - Mechanical recycling
   - Themochemical recycling

2. **Circular yarns & textiles**
   - Molecular recycling polyester & polyester blends
   - Technical textiles
   - Sorting & separation

3. **New feedstocks & applications**
   - PHA extraction
   - *Biodegradability research*
   - *FDCA/PEF*
   - *Biobased technical polyesters*

4. **(bio) composites in construction**
   - Vitrimers
   - Recycling thermosets
   - New thermoplastic composites
   - Large scale additive manufacturing of composites



# Circular Plastics chain approach

**Research & innovation hard to recycle waste streams:**

- Rubber
- PVC
- Polycotton blends
- PU / PA

**Scale ups in chemical recycling**

CuRe

BioBTX



**New biobased & biodegradable polymers**

Paques Biomaterials

Vitrimer research

Senbis Polymer Innovations






Morssinkhof recycling



Plastic sorting plants

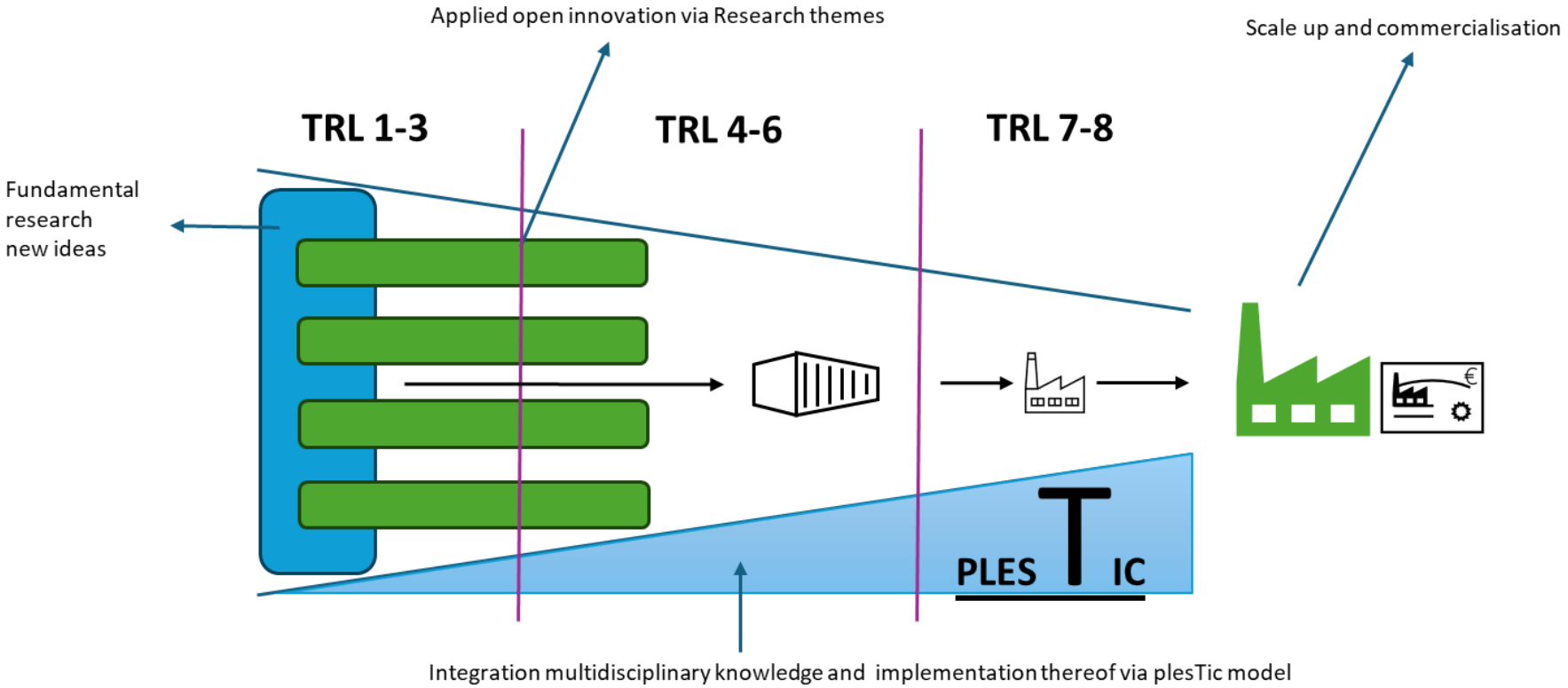


National Testcenter Circular Plastics

**Unique research & facilities sorting, washing & mechanical recycling**

**Circulair product design & development**

# plesTic approach




**P →** POLICY

**L →** LOGISTICS

**E →** ECONOMY

**S →** SOCIAL ACCEPTANCE

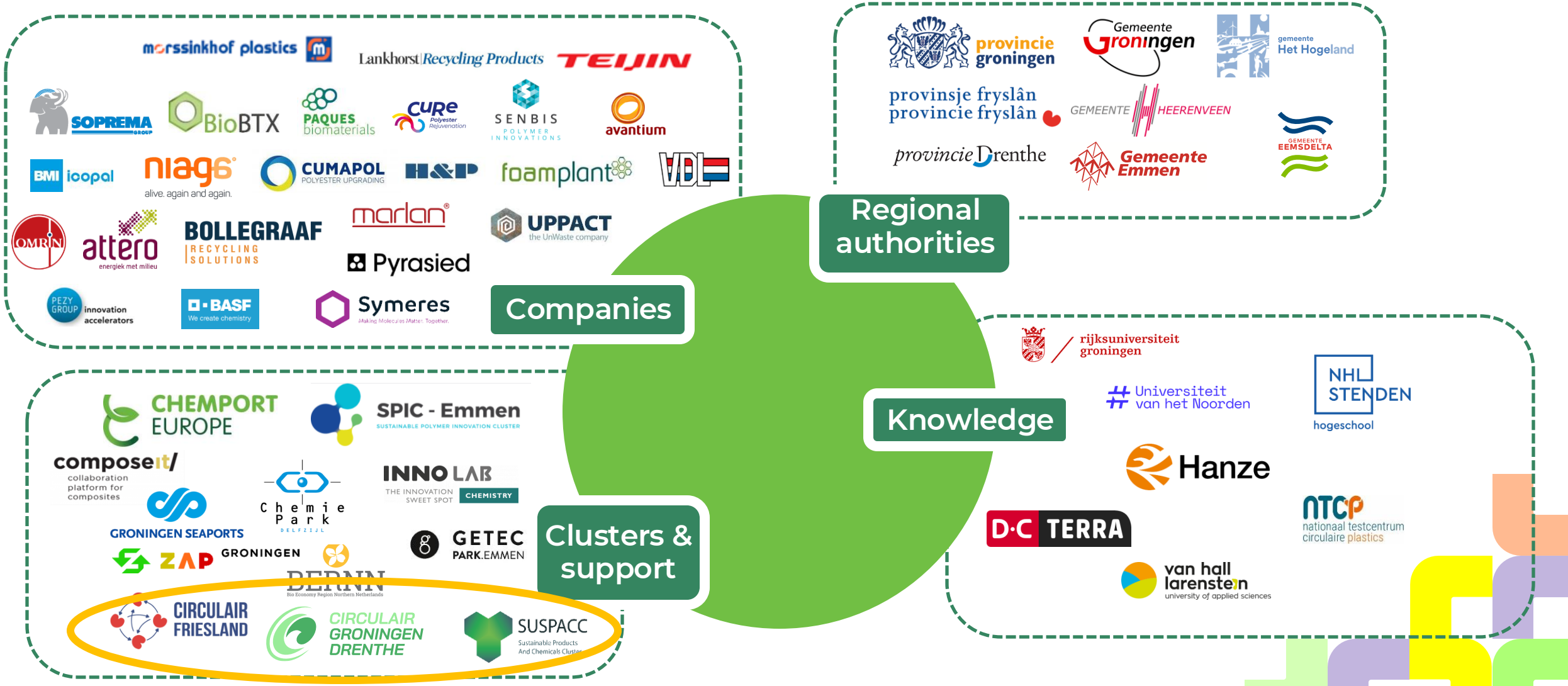
**T →** TECHNOLOGY

**I →** INNOVATIVE DESIGN

**C →** CORPORATE & COMMUNITY

greenwise | circular plastics

# Working together for our ambition



# Thank you for your attention!

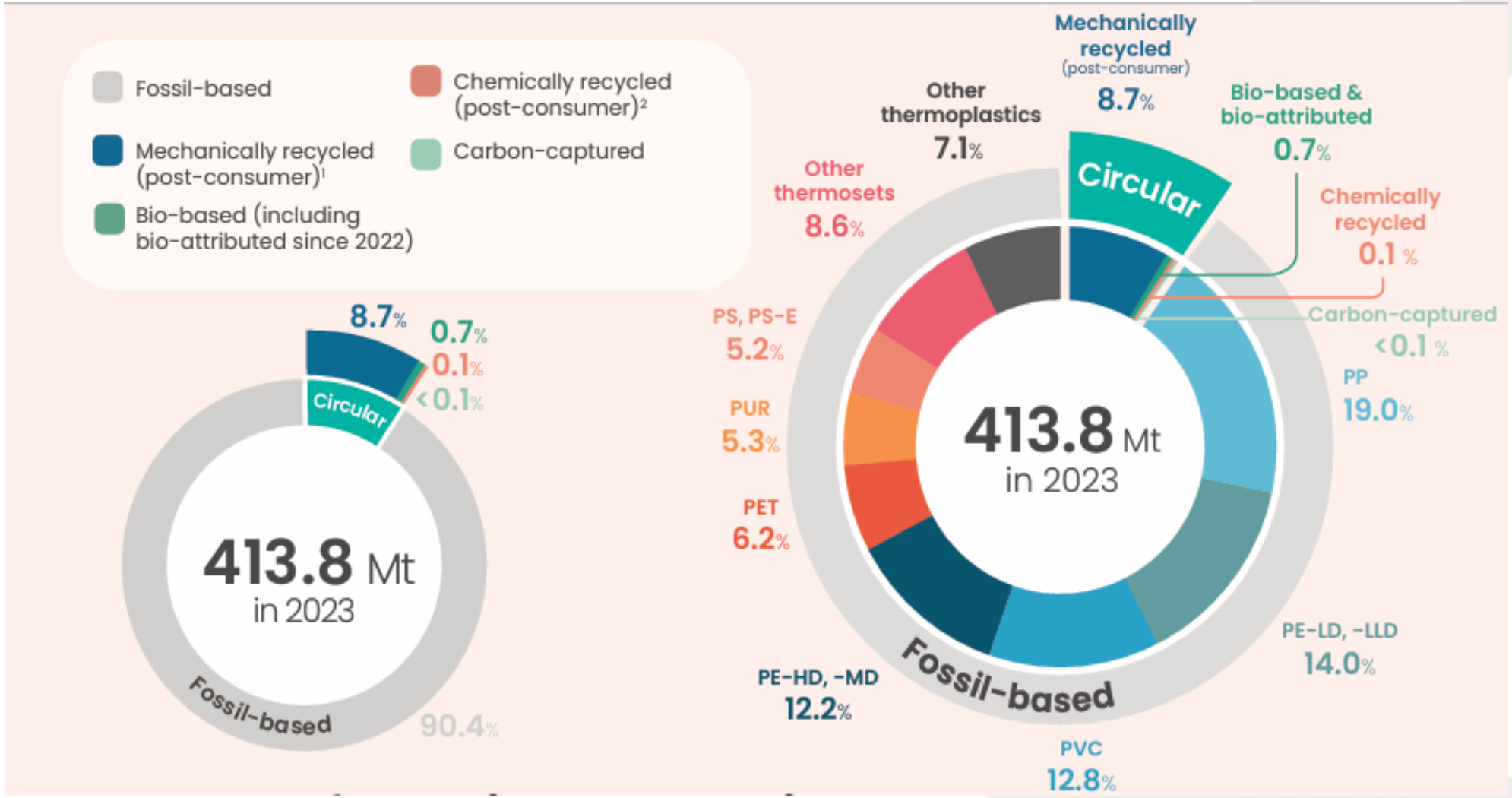
Ineke Ganzeveld
ineke.ganzeveld@greenwisecampus.nl

# Françoise Bonnet

# CIRCULAR PLASTIC: EU CONTEXT

Françoise Bonnet ACR+
fb@acrplus.org | www.acrplus.org

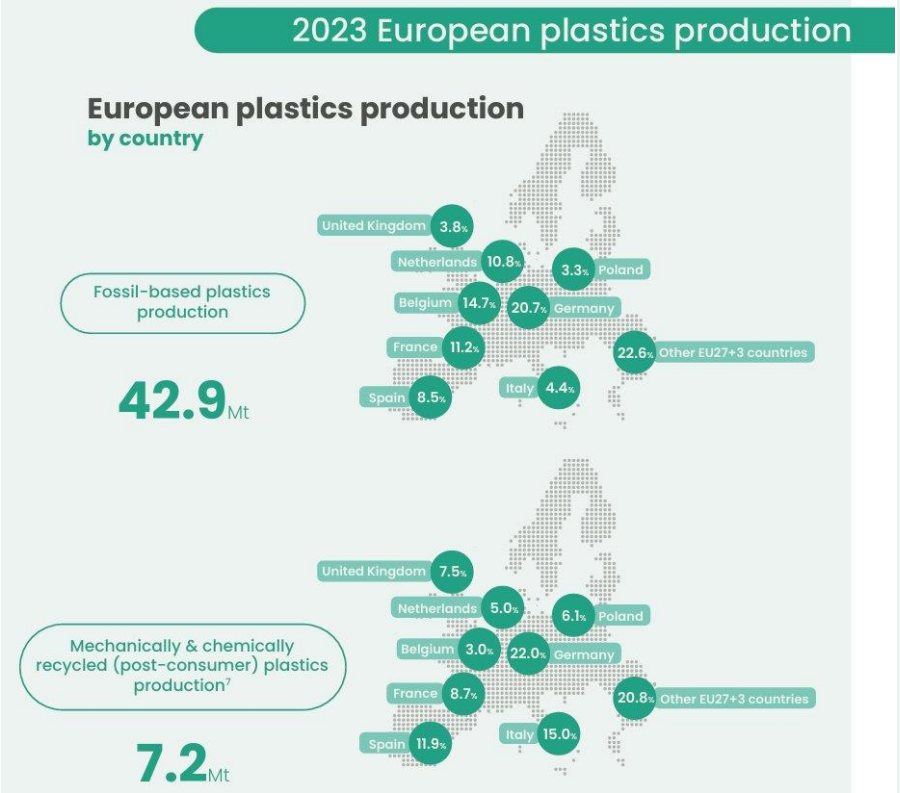
# CIRCULAR PLASTIC: FACTS AND FIGURES WORLD-WIDE

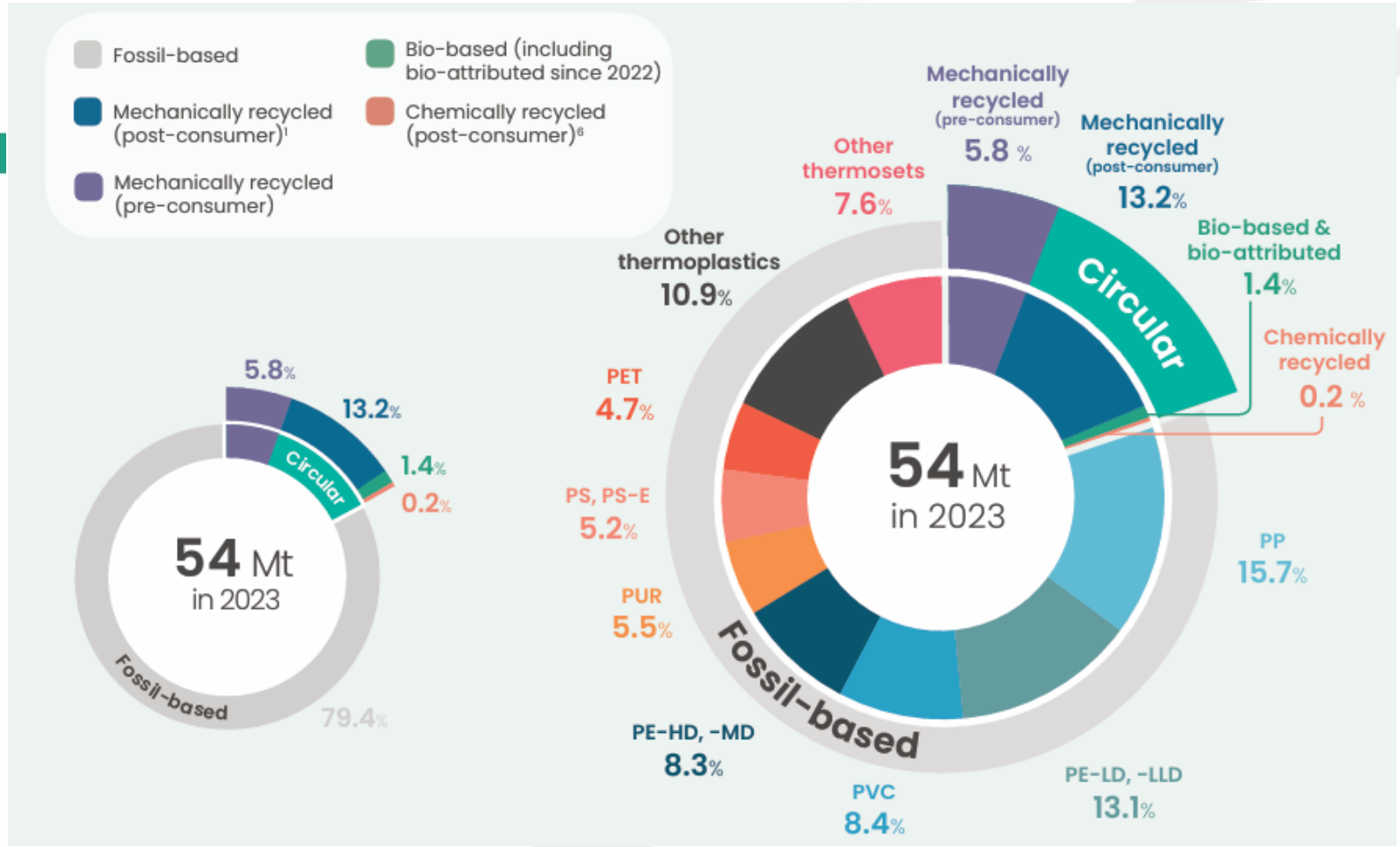



Source: Plastics Europe

ACR+

# CIRCULAR PLASTIC: FACTS AND FIGURES IN THE EU

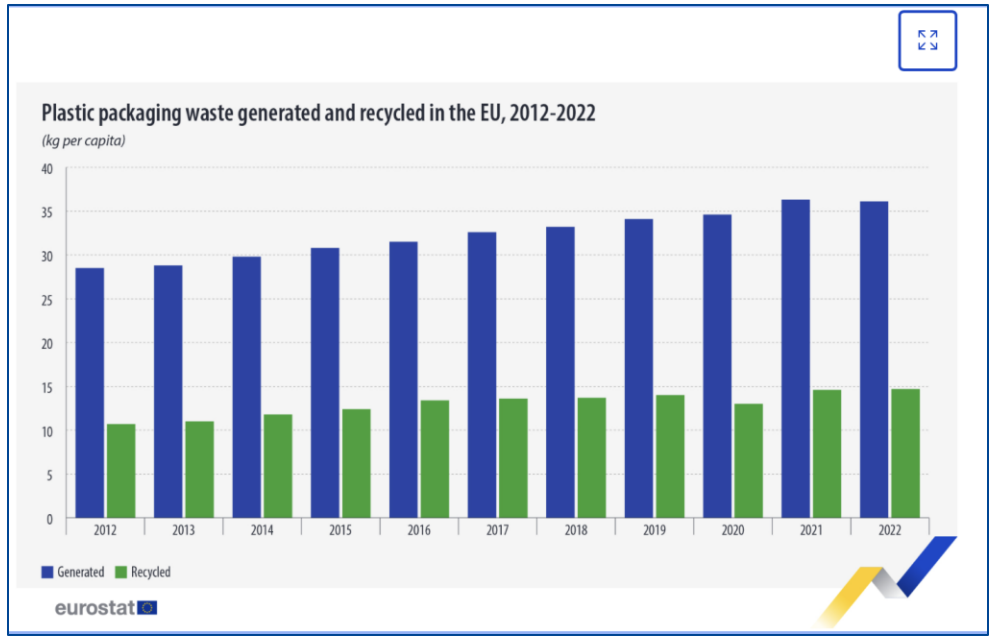


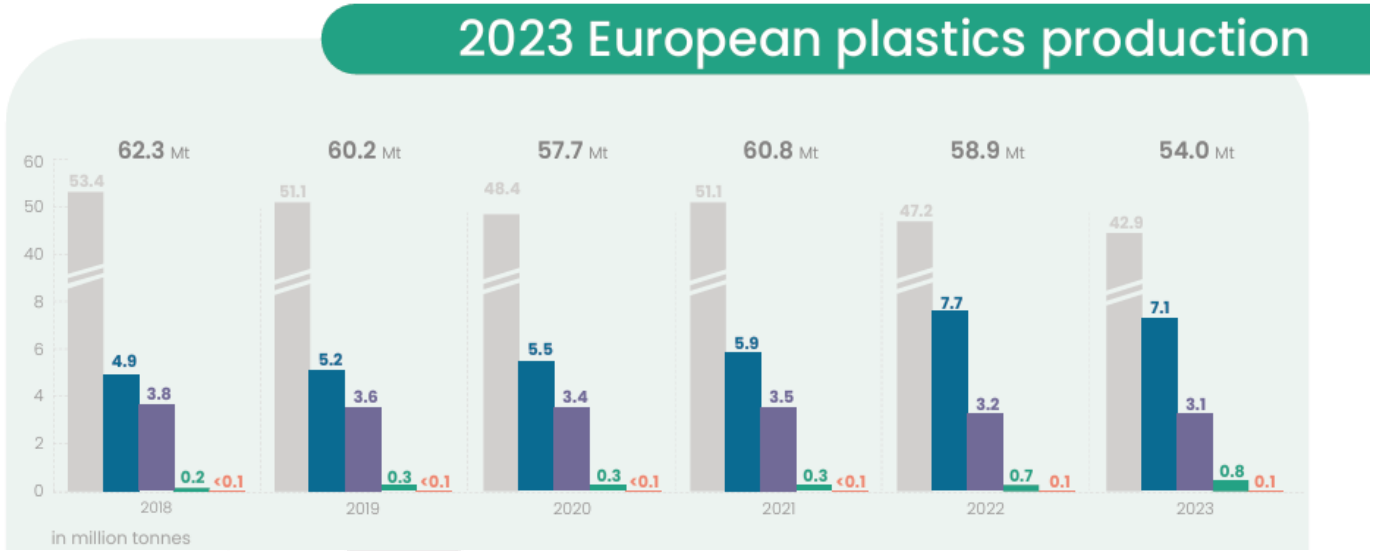




Source: Plastics Europe

ACR+

# CIRCULAR PLASTIC: FACTS AND FIGURES IN EUROPE

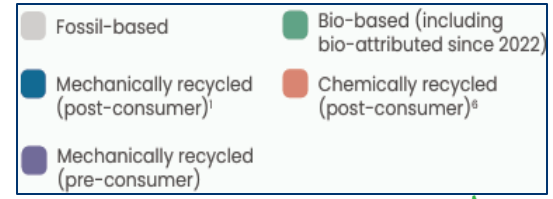



Source: Plastics Europe

In 2019 , plastics generated 1.8 billions tonnes of GHG emissions with 90 % coming from their production and conversion from fossil fuels. By 2060, emissions from the plastics lifecycle are set to more than double, reaching 4.3 billion tonnes of GHG emissions

About 22 millions tonnes of plastic found its way into soils, rivers and oceans in 2019 and plastic leakage is projected to double in 2060

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# PLASTIC AND CIRCULAR ECONOMY

## Circular Economy Goals:

The goals of a circular economy for plastics aim **to minimize waste and pollution** by keeping plastic in use for as long as possible, and then **recycling** it effectively. This involves **reducing unnecessary plastic use**, innovating towards reusable, recyclable, or compostable materials, and **ensuring all plastic items are reused, recycled, or composted.**

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# THE EU  PLASTIC CONCERN

EU plastic strategy (adopted in 2018)  objective:

- Transforming  the way plastic products are designed, produced, used and recycled in the EU.
- Protecting our environment and reduce marine litter, greenhouse gas emissions and our dependence on imported fossil fuels.
- Supporting more sustainable and safer consumption and production patterns for plastics.

    - **Making recycling profitable for business**
    - **Curbing plastic waste production**
    - **Driving innovation and investment**

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# EU LEGISLATION

- **SUP Directive**
- **Banning Single-Use Plastics:** From 2021, certain single-use plastic items like cutlery, straws, and food/beverage containers made of expanded polystyrene were restricted.
- **sets targets regarding recycled content and collection**. SUP beverage bottles which are manufactured from PET will have to contain at least 25% of recycled plastic from 2025 and 30% from 2030 onwards for all SUP beverage bottles (not limited to PET), calculated as an average for all such beverage bottles placed on the market on the territory of a Member State.
- EU Member States must ensure a **separate collection for recycling of 77% of the SUP bottles** placed on the market **by 2025** and **90%** of the SUP bottles placed on the market **by 2029.**

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# EU LEGISLATION

- **EPPWR**
- **Reducing Packaging Waste:**
- EU member states will have to meet goals of reducing plastic packaging waste of 5% by 2030, followed by a 10% reduction by 2035 and 15% by 2040.
- **Minimum Recycled Content:**
- By 2025 and 2030, The PPWR also sets targets regarding recycled content of the parts of packaging that are made of plastic (above 5% of the total packaging weight). Applicable by 1st January 2030 (or 3 years from the date of entry into force of the relevant implementing act, whichever is the latest), these targets are:
    - 30% for contact sensitive plastic packaging made from PET as a major component (50% from 2040),
    - 30% for SUP beverage bottles (65% from 2040), and
    - 35% for other plastic packaging (65% from 2040).
- **Restriction on certain plastics** (PFAS, etc)

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# EU LEGISLATION

- **ESPR**
- The Ecodesign for Sustainable Products Regulation (***ESPR***) entered into force on 18 July 2024. In the words of the European Commission, the ESPR is "*the cornerstone of the Commission's approach to more environmentally sustainable and circular products*". It sets out a framework for the establishment of ecodesign requirements (both information and performance requirements).
- Under the ESPR, delegated acts will impose requirements related to specific priority product groups regarding, for instance, product durability, reusability or reparability. Products will need to be accompanied by a Digital Product Passport (***DPP***), a digital identity card for products, components, and materials, which will store relevant information to support products' sustainability, promote their circularity and strengthen legal compliance.

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# EU LEGISLATION

- **Commission Regulation (EU) 2023/2055 - Restriction of microplastics intentionally added to products:**
  - ban on the sale of loose plastic glitter and microplastics intentionally added to products.
- **Contribution to the EU Budget:**
  - A contribution based on non-recycled plastic packaging waste was introduced as a new revenue source for the EU budget.
- **Plastic pellet losses:**
  - New rules aim to prevent the loss of plastic pellets during transportation and handling.
- **Waste shipment regulation:**
  - Ban to export plastics waste to non OECD countries by 2026

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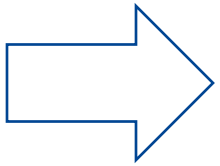
# THE PLASTIC RECYCLING SITUATION

Imported virgin and recycled plastics at a cheap price from non EU plastics waste and not from countries having the same circularity targets



Recyclates prices dropped by up to 50% (2023 numbers), putting in danger European plastic recyclers who invested huge amounts in plastics waste recycling facilities

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# WHAT'S NEXT?

The Circular economy Act  (adoption by 2026)

The waste framework directive revision (EPR on textile)

The WEEE directive revision

The European bioeconomy strategy

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# Thank you, and let's keep in touch!

**BUILD** synergies with other circular economy actors

**TAKE PART** in studies and international projects

**RECEIVE** regular up-to-date information on latest trends

**EXCHANGE** experiences and practices with your peers

**ENJOY** direct access to a network of experts

**INCREASE** your visibility

info@acrplus.org

www.acrplus.org

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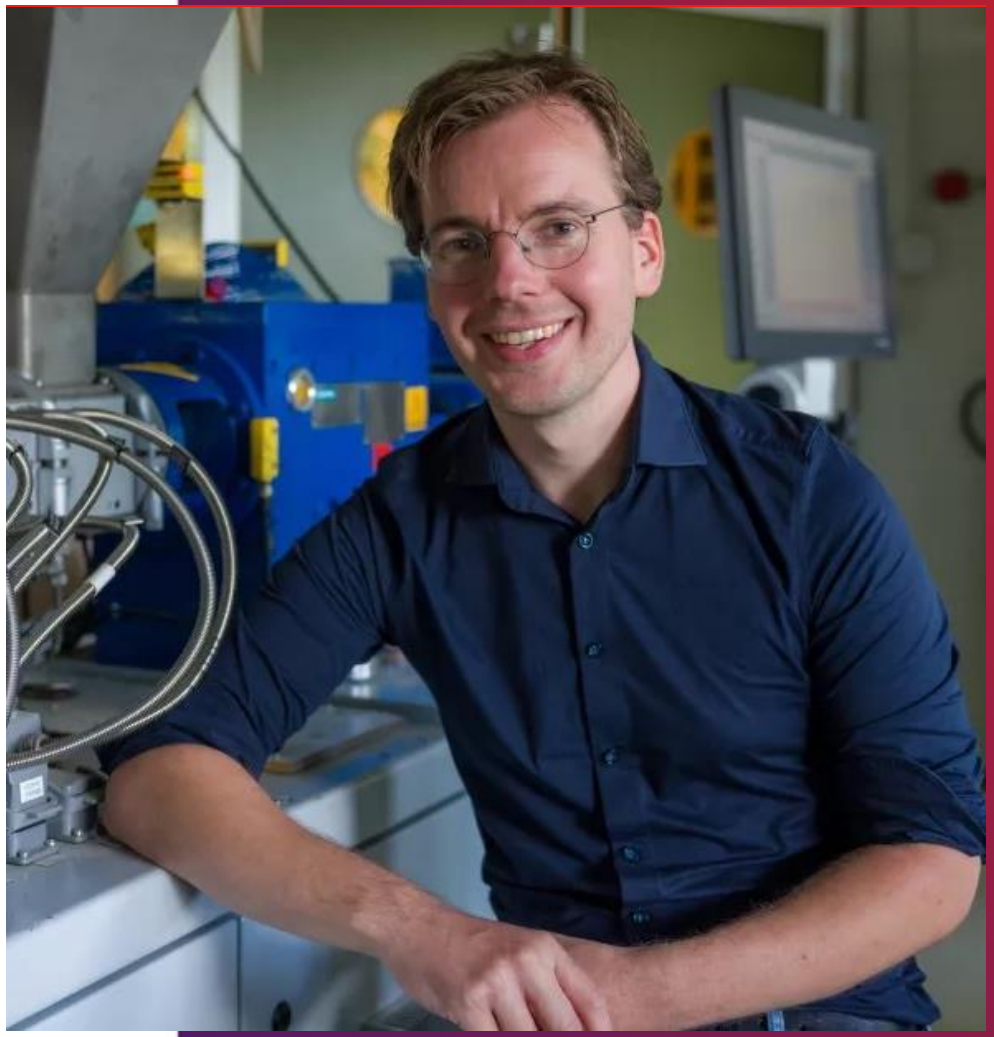
# Vincent Voet



NHL STENDEN

university of groningen

# Recent Advances in Circular Plastics Research

Research group Circular Plastics

Vincent Voet

12-06-2025

# Welcome @ NHL Stenden!

## NHL STENDEN COMMUNITY

**23,088** STUDENTS

**2,584** EMPLOYEES

**7** CAMPUSES: LEEUWARDEN, TERSCHELLING, GRONINGEN, ASSEN, EMMEN, MEPPEL, AMSTERDAM

## OUR EDUCATIONAL CONCEPT

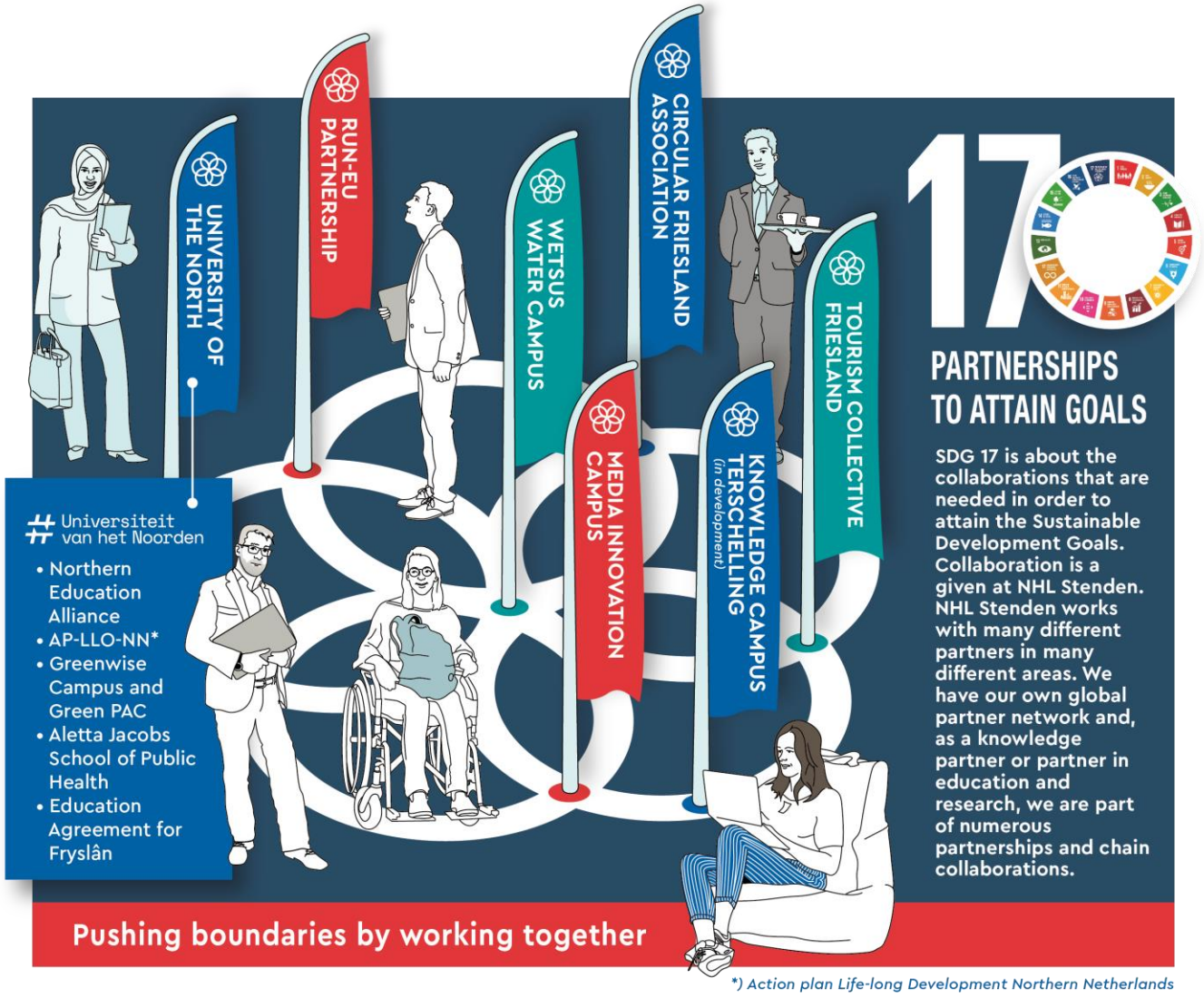
ALL FULL-TIME COURSES USE DBE

3,6

STUDENT SATISFACTION SCORE

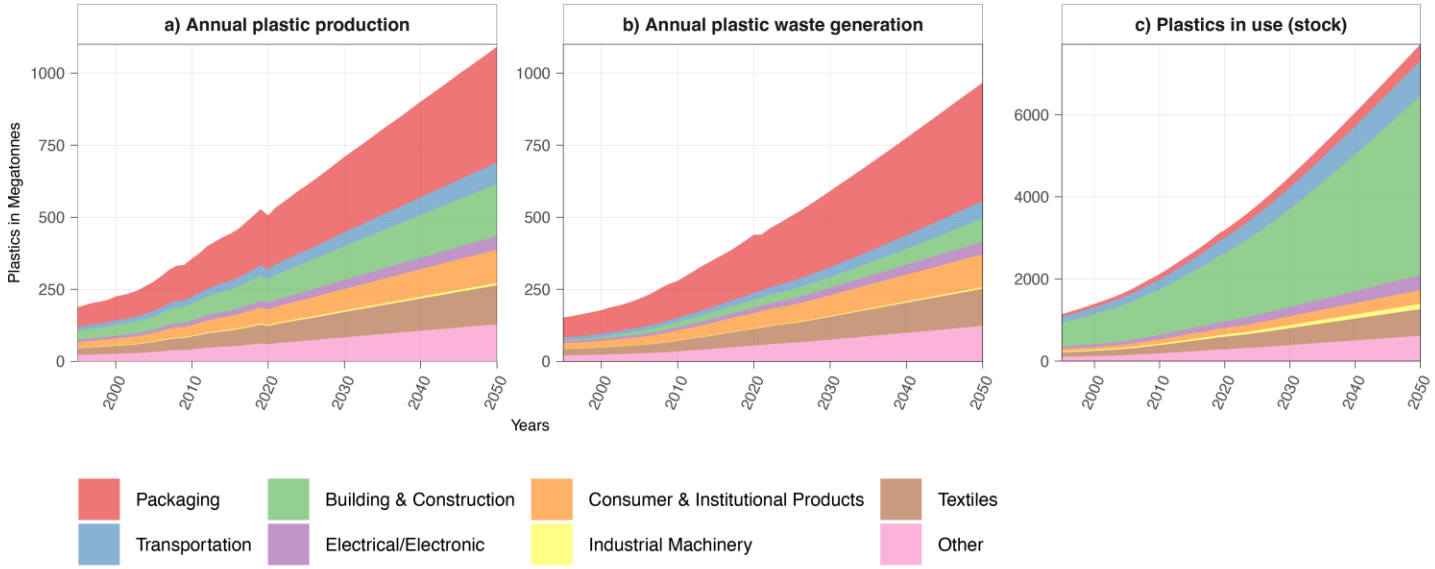
**DBE 1,077** EMPLOYEES HAVE COMPLETED DBE PROCESSES SINCE 2018

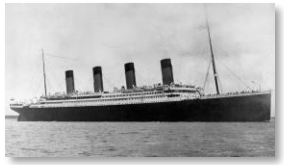
## RESEARCH PROFILE 'WELL-BEING IN THE REGION'




*) Action plan Life-long Development Northern Netherlands

# Planet *Earth* or Planet *Polymer*?



8000 x

2500 x

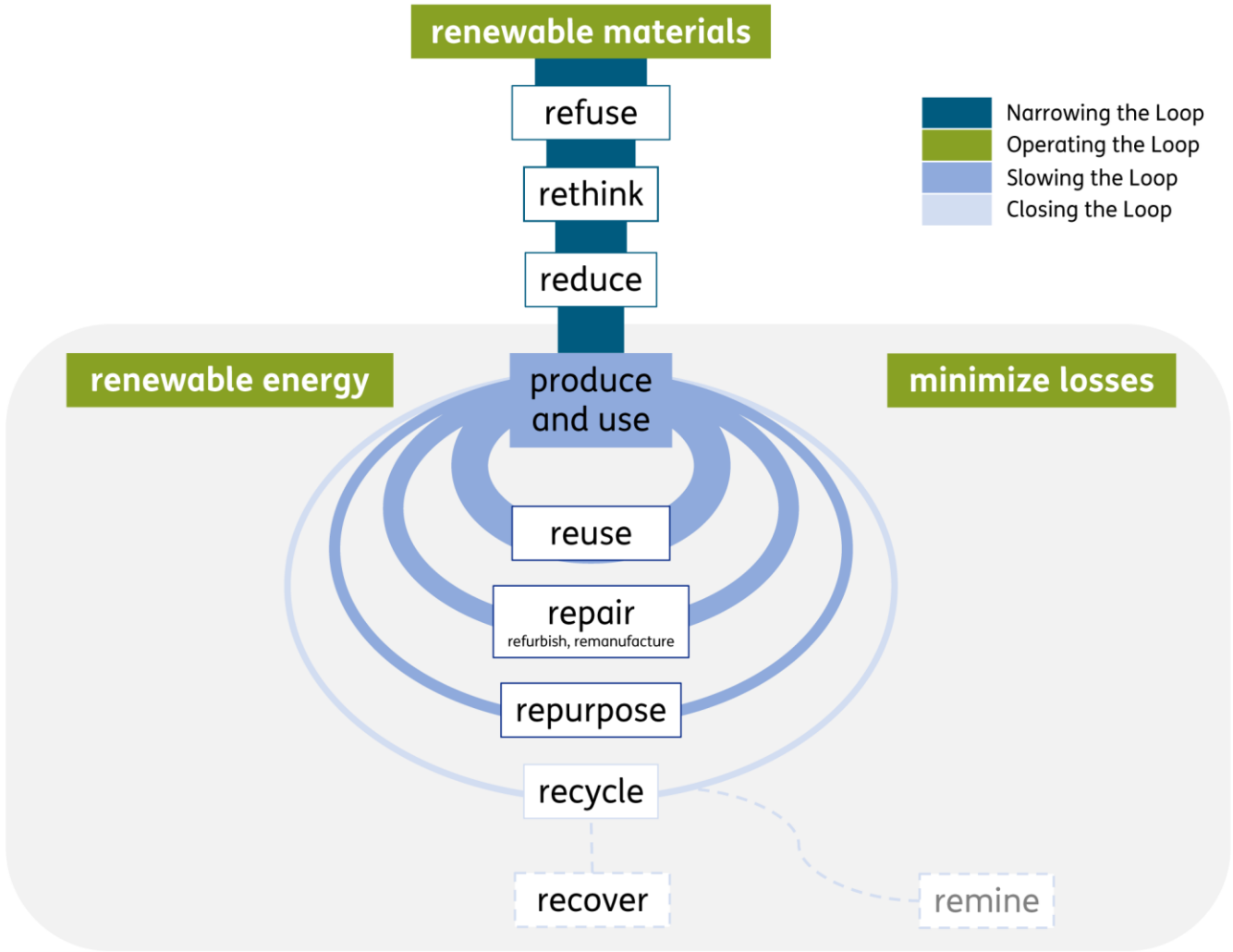
10 x


Plastics Europe. Plastics – the Facts, 2024.
TNO and Fraunhofer Umsicht. From #plasticfree to future-proof plastics. 2023.

# A Closed-Loop Economy: *Different R-strategies*

Research Group **Circular Plastics**

1. Circular Design
2. Polymer (re-)Processing
3. Renewable Polymers




TNO and Fraunhofer Umsicht. From #plasticfree to future-proof plastics. 2023.


***2024:***
*35 Researchers*
*86 Students*
*24 PPS Consortia*
*>100 Partners*

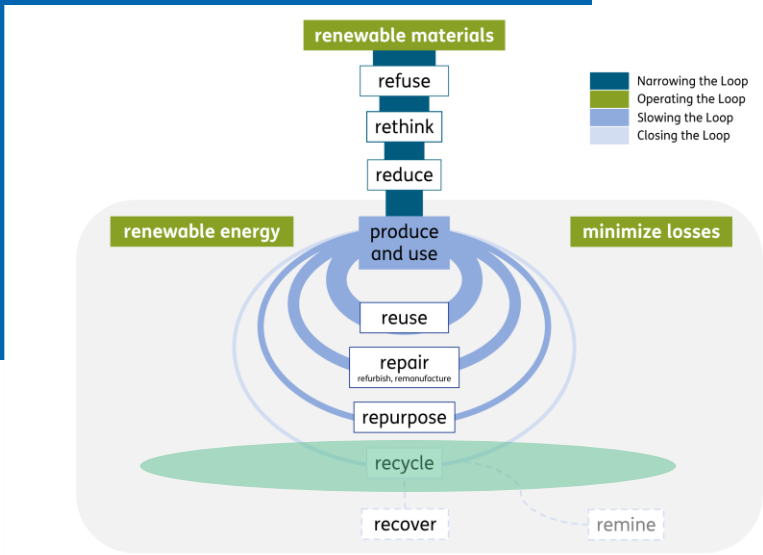
***"Sometimes you can't make it… on your own"***

HYBRIt
BIOPOLYMER AND RECYCLING INNOVATION

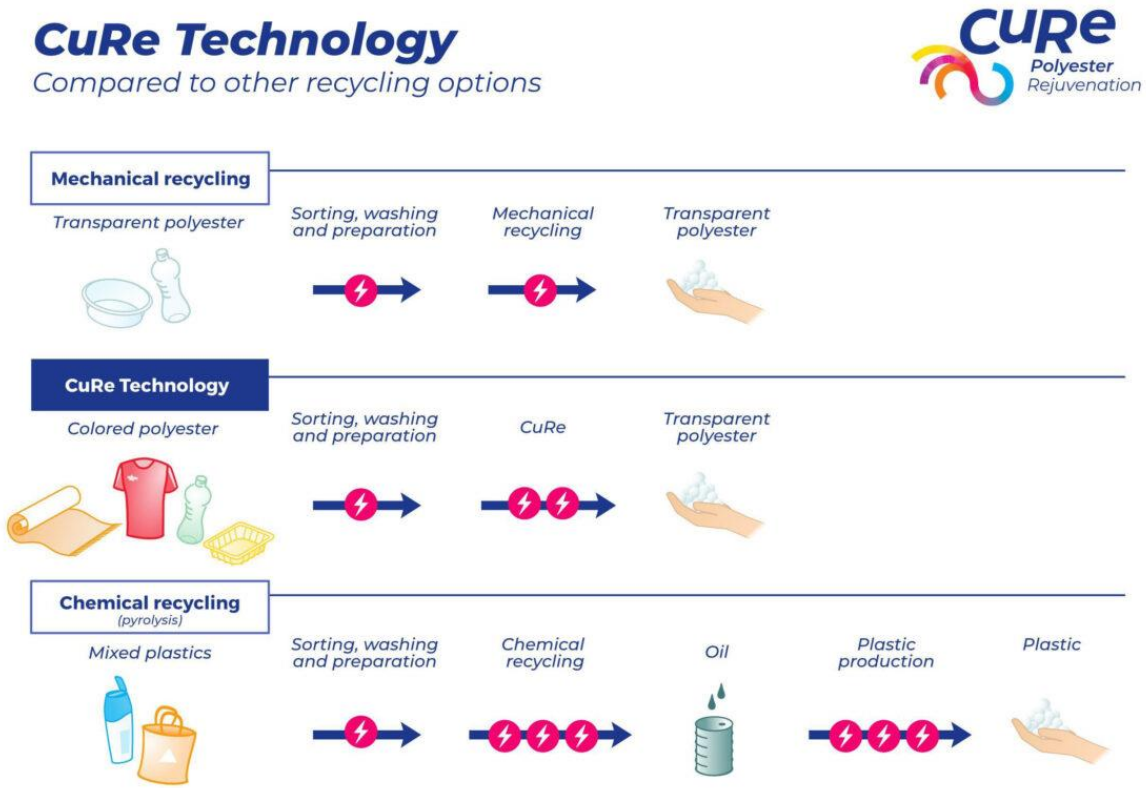

WANTED
DEAD OR ALIVE
BIOPOLYMERS
& PARTNERS IN CRIME
SENBIS POLYMER INNOVATIONS, PAQUES BIOMATERIALS
ARMED & VERY DANGEROUS
DEGRADING IN NATURE
$ 3.000.000
funded by SNN
WANTED
DEAD OR ALIVE
ENZYMES
& PARTNERS IN CRIME
CURE TECHNOLOGY, ARAPAHA
ARMED & VERY DANGEROUS
BREAKING ESTER BONDS
$ 100.000
funded by SIA
WANTED
DEAD OR ALIVE
VITRIMERS
& PARTNERS IN CRIME
MARLAN SOLID SURFACE, LIQCREATE
ARMED & VERY DANGEROUS
REARRANGING NETWORKS
$ 600.000
funded by NWO

# Monomer Recycling

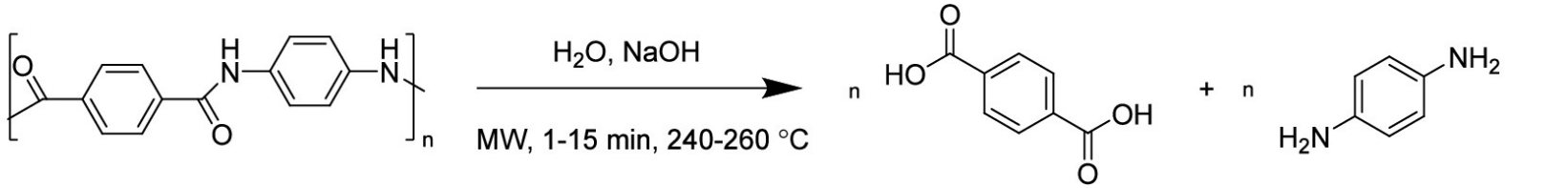
For complex polymers and polymer mixtures.



# Chemical Recycling *via* Depolymerization Routes



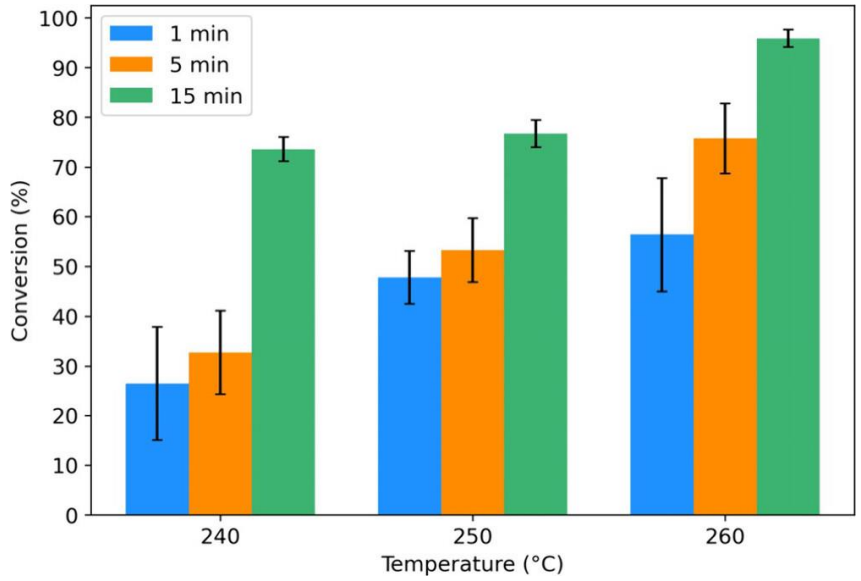
# Depolymerization of PPTA (Twaron®)




poly(*p*-phenylene terephthalamide) (PPTA)

terephthalic acid (TPA)

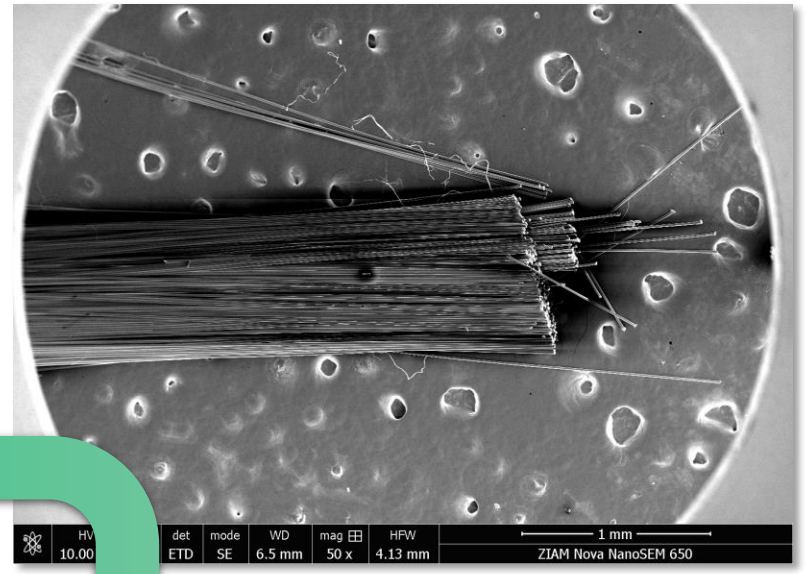
*p*-phenylene diamine (PPD)

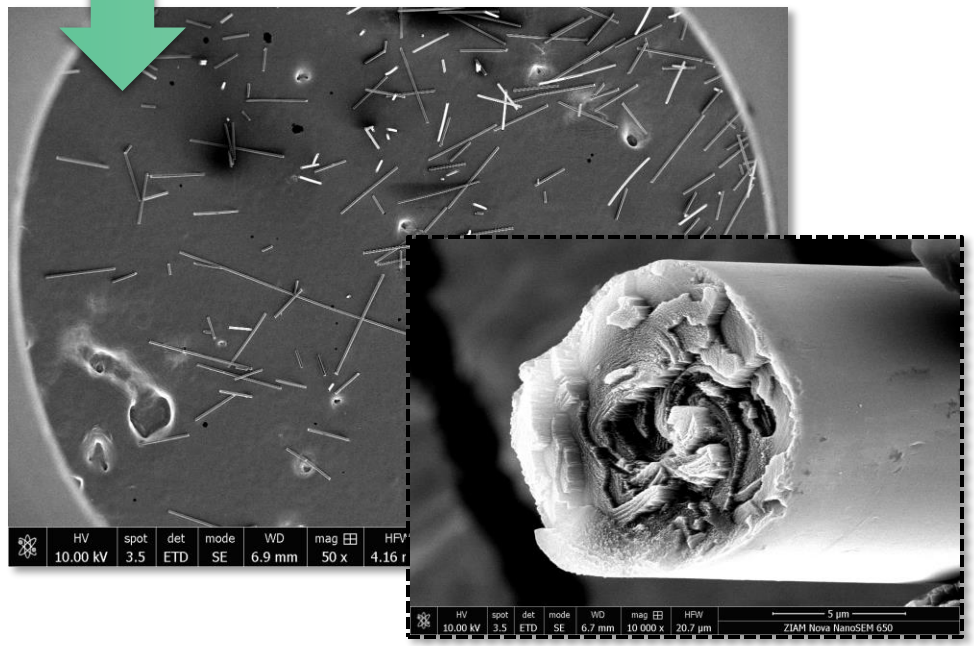



- **Rapid microwave-assisted** depolymerization
- **High conversion** (96%) and purity (99%)
- **Fastest depolymerzation** of PPTA reported

J. Am. Chem. Soc. 2025, 147, 9, 7191–7195.

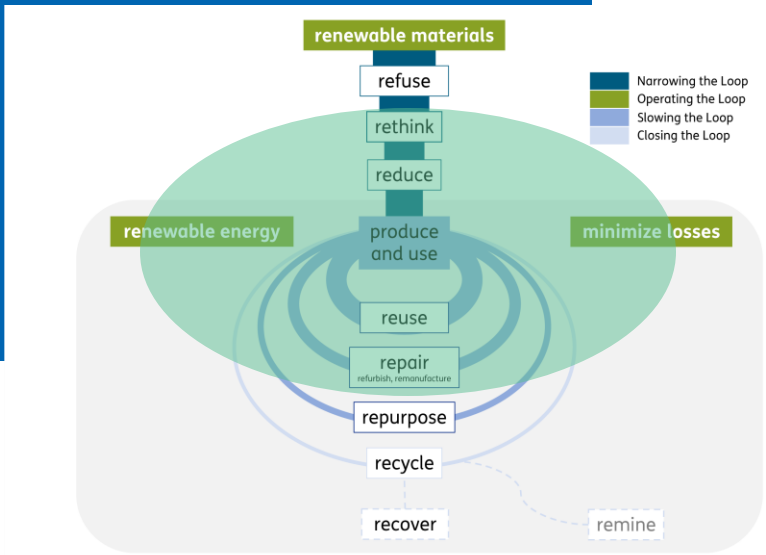
# Mechanism under Investigation…

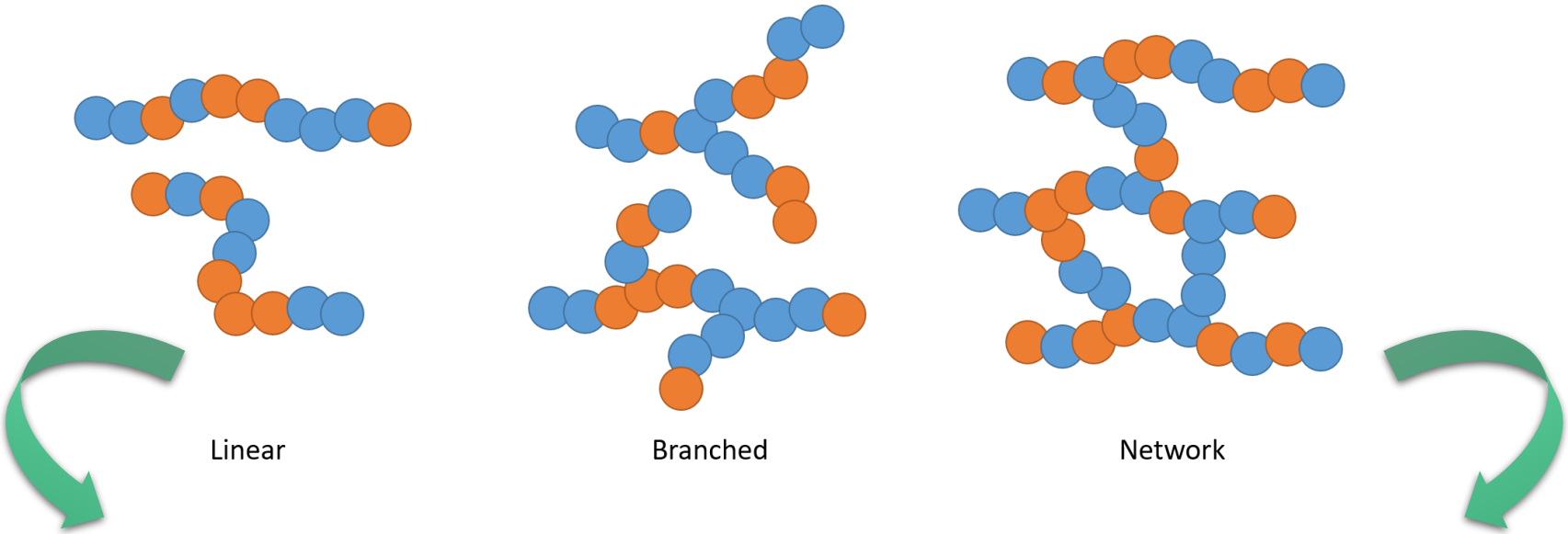



# Vitrimers

A novel class of reprocessable (network) polymers.



# (Molecular) Architecture is Essential

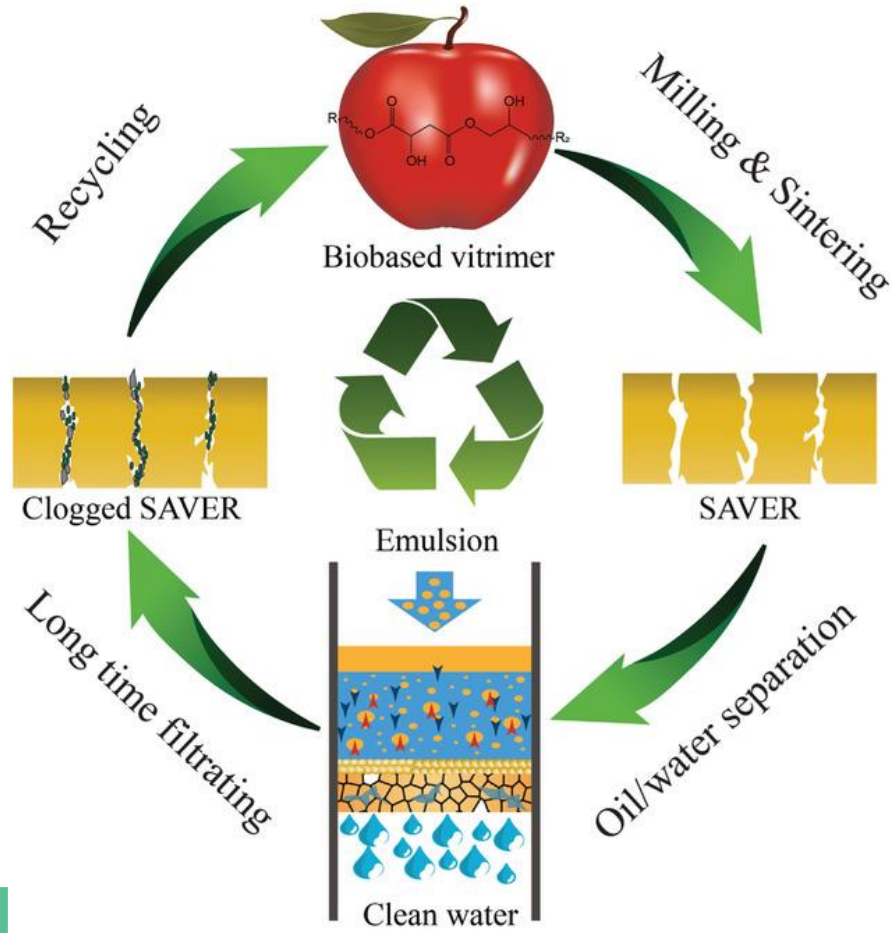



*Thermoplastics*

***Vitrimers***

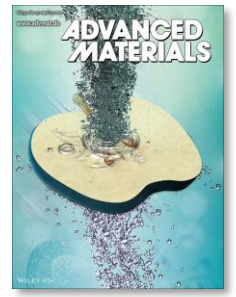
*Thermosets*

# Covalent Adaptable Networks: Vitrimers



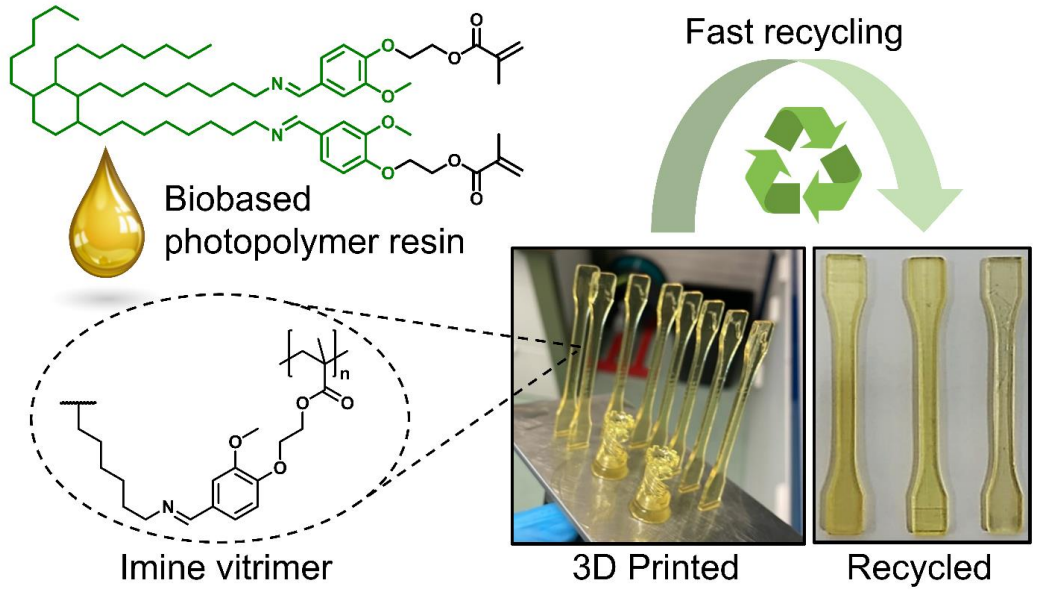


- Dynamic covalent chemistry via **bond exchange reactions**
- Vitrimers can be **used**, **recycled** and **reused**




Adv. Mater. 2021, 33, 2008460

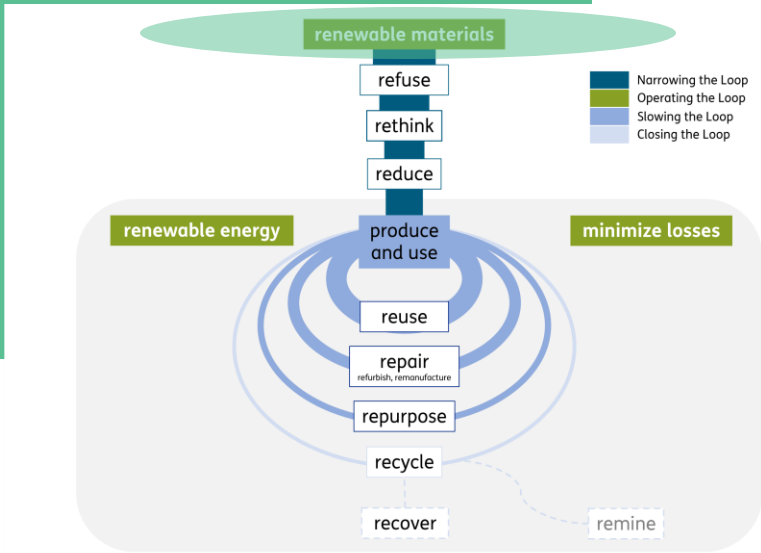
# From Printer Inks to Solid Surface Composites



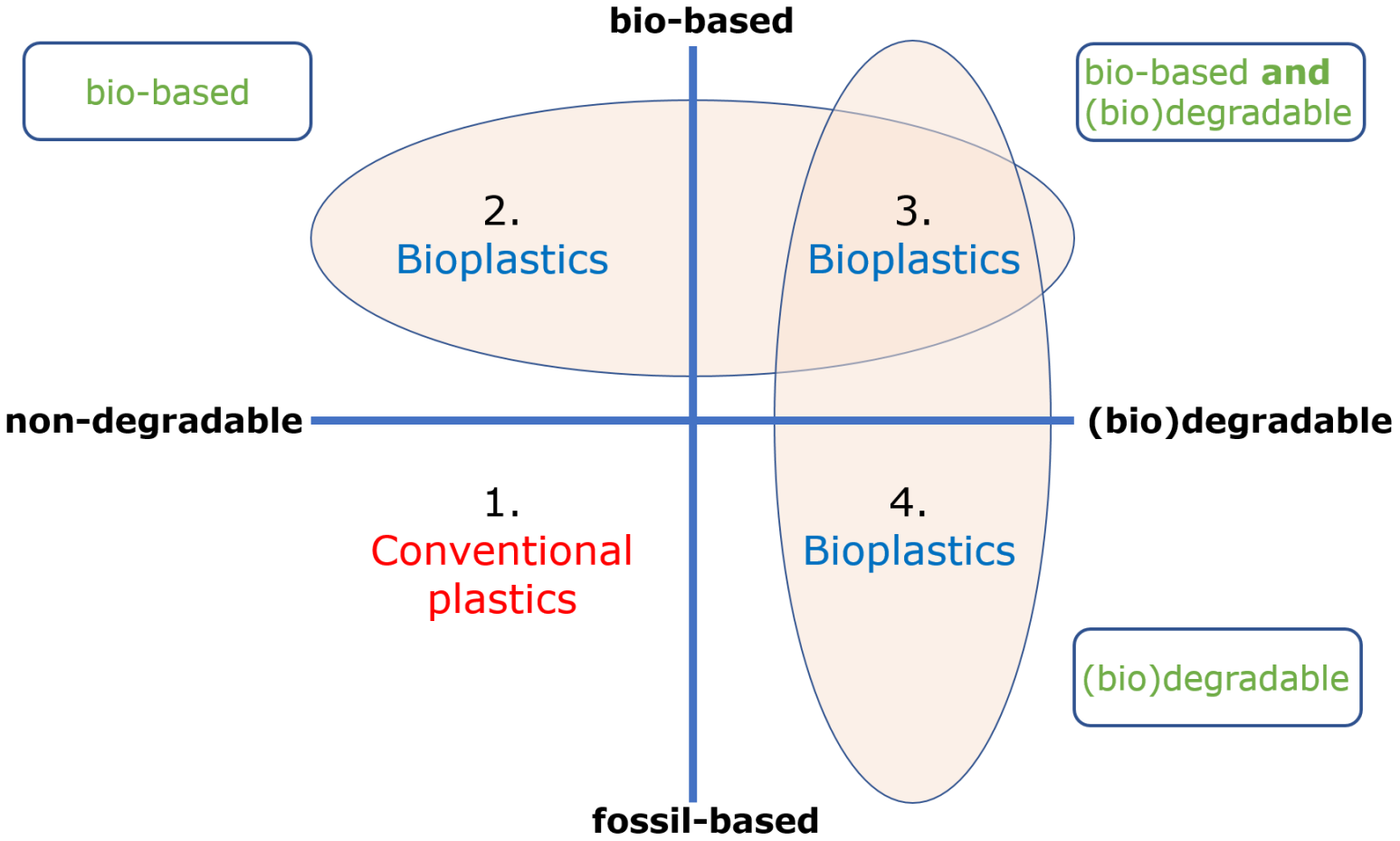

Macromol. Mater. Eng. 2024, 309, 2400036.
ACS Appl. Mater. Interfaces 2023, 15, 22, 27110


# Biopolymers

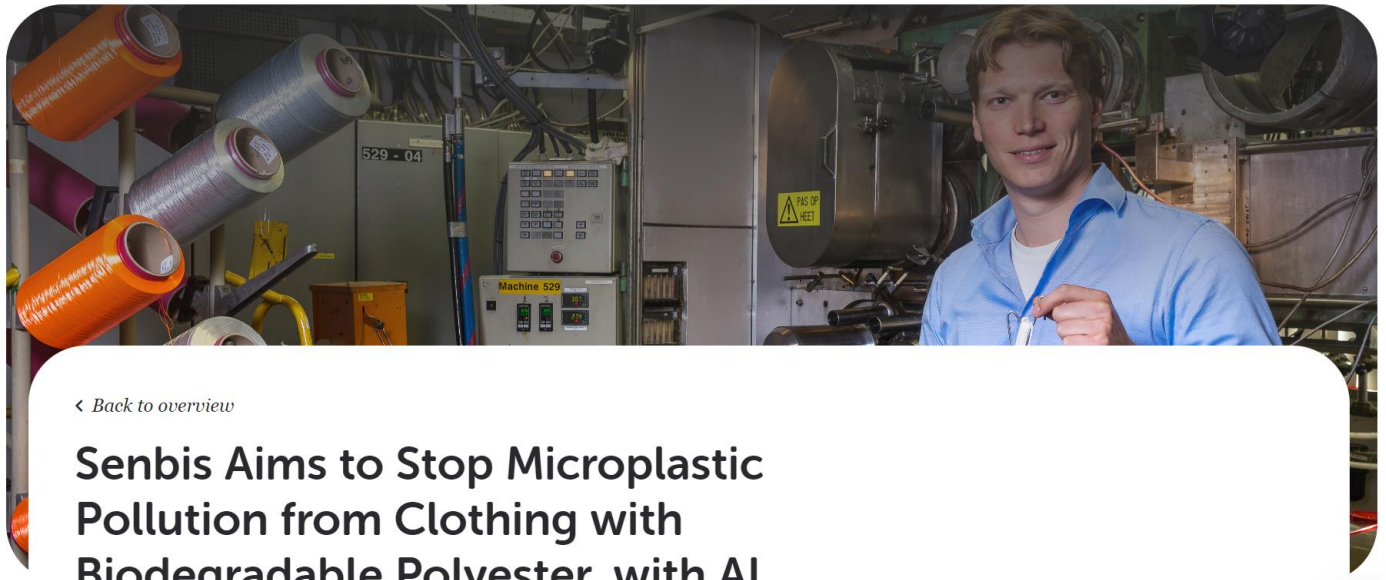
Biobased and/or biodegradable, inspired by nature.



# Bioplastics: a lot of Confusion…

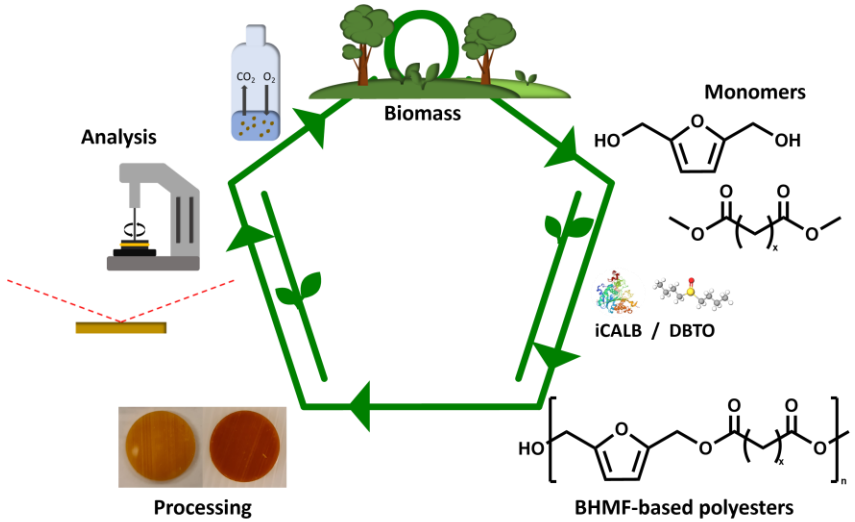


# Alternatives for Polyester Fabrics



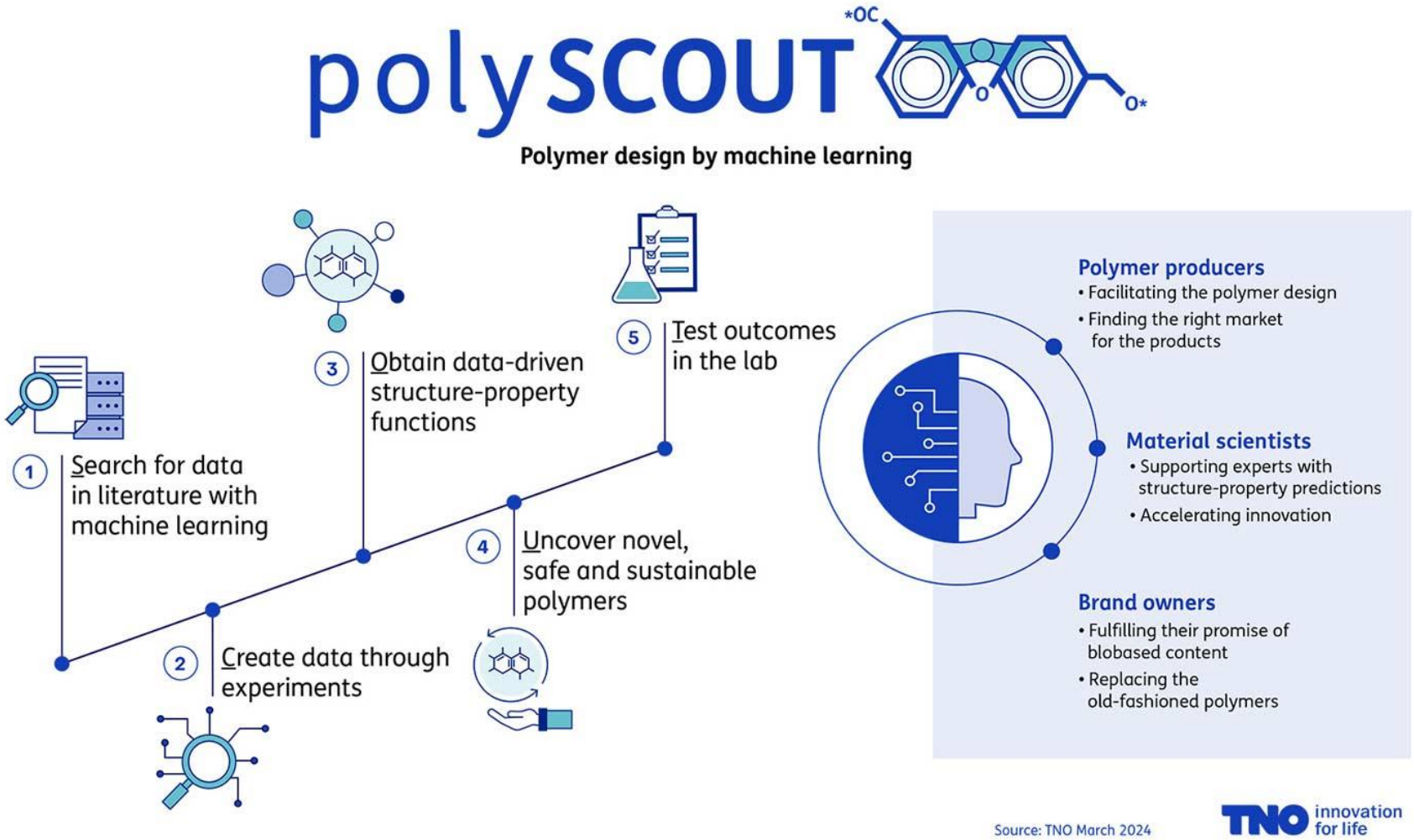

‹ *Back to overview*

## Senbis Aims to Stop Microplastic Pollution from Clothing with Biodegradable Polyester, with AI Assistance

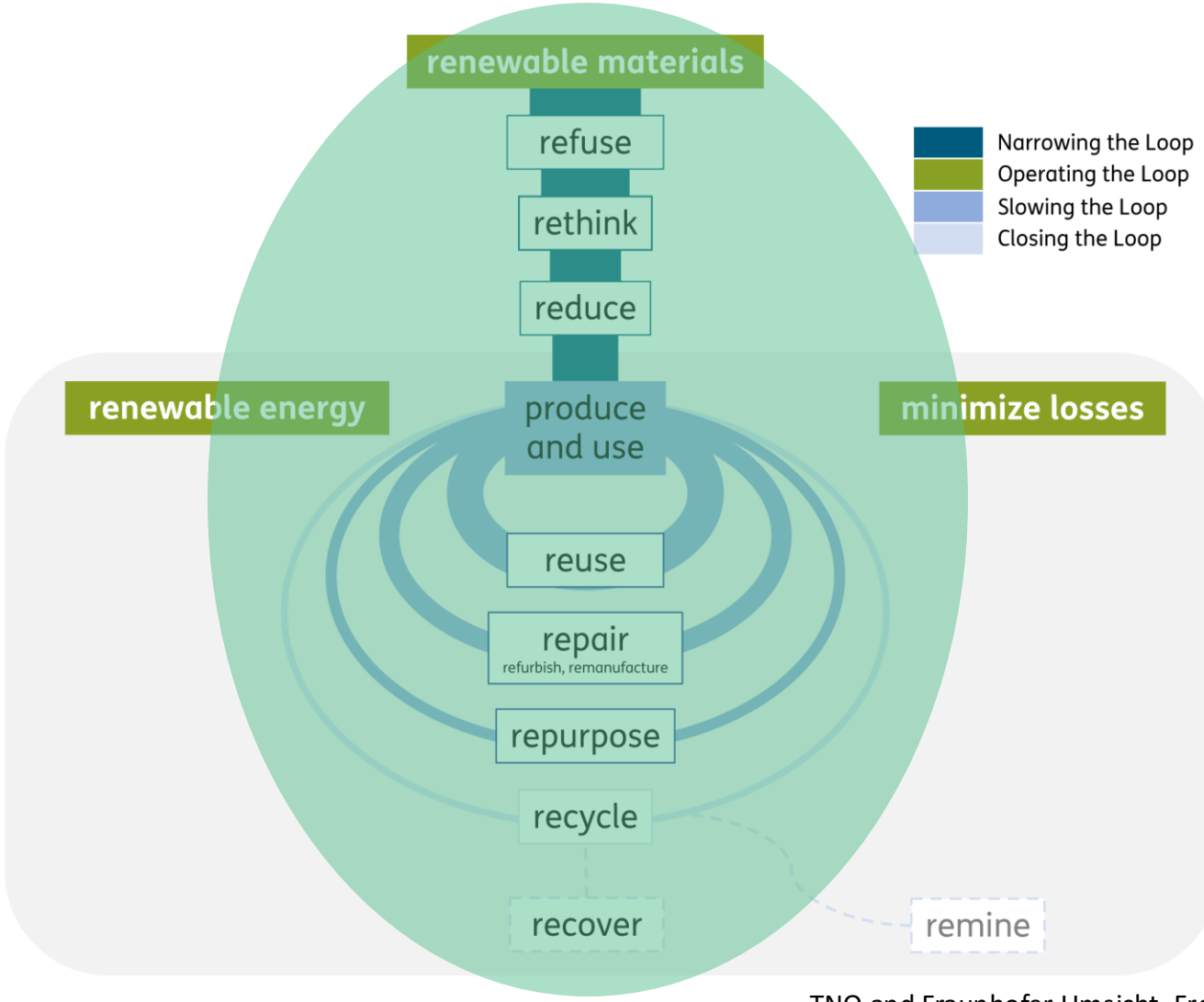



ACS Omega 2023, 8, 10, 8991–9003.
Green Chem., 2024,26, 8744-8757.

# Polymer Design Predicted by A.I.?



# A Closed-Loop Economy: *The Bigger Picture*




TNO and Fraunhofer Umsicht. From #plasticfree to future-proof plastics. 2023.

# Circularity is a Team Sport


**NHL Stenden University**
Corinne van Noordenne
Kylian Janssen
Jarno Guit
Ties van der Veen
Tobias van der Most
Rudy Folkersma

**Groningen University**
Chongnan Ye
Corniek Post
Joël Benninga
Valentino Fantozzi
Katja Loos



Netherlands Enterprise Agency

NHL STENDEN

university of groningen

**Thank you for your attention!**

*vincent.voet@nhlstenden.com*

NHL STENDEN

# International Bachelor's Degree | 3 Years

- Hands-on with greener technologies
- Develops professional skills through design-based education
- Extra Support & Friendly Environment

**Start: September 2025**
**Taught in English**
**Location: Emmen, the Netherlands**

# Green Chemistry

Transforming Today for a Greener Future

FOR MORE INFORMATION


+31 633 048 282
green.chemistry@nhlstenden.com
https://www.nhlstenden.com/en/courses/green-chemistry

# Circulair Friesland Association

# Q&A

Circulair Friesland


circularsummit fryslân2025

# Break

## Coffee and Lunch

# Working Session

Divide over 2 Tables

- Biobased Plastics
- Reuse of Plastics

Getting to know each other

Biggest Challenges for collaboration

Opportunities for collaboration

Project Development

# Matching Form

- Projectidea / Topic of Request
- What are you looking for?
- What can you offer?
- What is the first step you will take after this session?

# Plenary Wrap - Up


circularsummit fryslân2025

## 14.40 - 15.00
# Closing of CSF25 (A0.63)

## 15.00 - 17.00
EWWR 2024 Award Show