

Achieving competitive biobased value chains.

Circular Biobased Delta:

Marcel van Berkel

VANGUARD: Shaping bio-based value chains through cross-regional cooperation Université Libre de Bruxelles 18 May 2022

Content

- Scene-set
- Circular Biobased Delta
- Feedstock Transition
- CO2 emission reduction
- Plastic Circularity





Scene-set

The Climate Change Mitigation Star: A Sixfold Challenge

RENEWABLE ENERGY from solar, wind and others

DECARBONISATION OF ENERGY & TRANSPORT

via electrification and green hydrogen

RENEWABLE FUELS

where decarbonisation is not possible





Source: nova-Institute.eu



RENEWABLE CARBON

from biomass, CO₂ and recycling for chemicals and derived materials





CIRCULAR ECONOMY

and efficiency







Circular Biobased Delta

Vision and Mission and the Circular Biobased Delta 10year plan

- Vision
 - drive transition with stakeholders to circular biobased economy in the Delta region
- Mission
 - accelerate biobased routes and circular solutions by creating new value chains
- Goal in 2030
 - reduce 10 Megatons CO2-eq per year and double the circularity to 50% average
- Strategy
 - develop project portfolio with stakeholders and roadmap for CO2-reduction by CE Delft
- Monitoring
 - Impact, timing, investment, feedstock demand, closing the loop (%)



Green ChemistryBioplasticsBio-aromatics

Lnemic Pyr

- Gasification
- Depolymerisation

10-jarenplan 2020-2030 Stichting Circular Biobased Delta

Mei 2020

Openbare versie van rapport

Biofeedstock

- Sugar Delta
- Biorefinery
- Chaplin

4 Themes

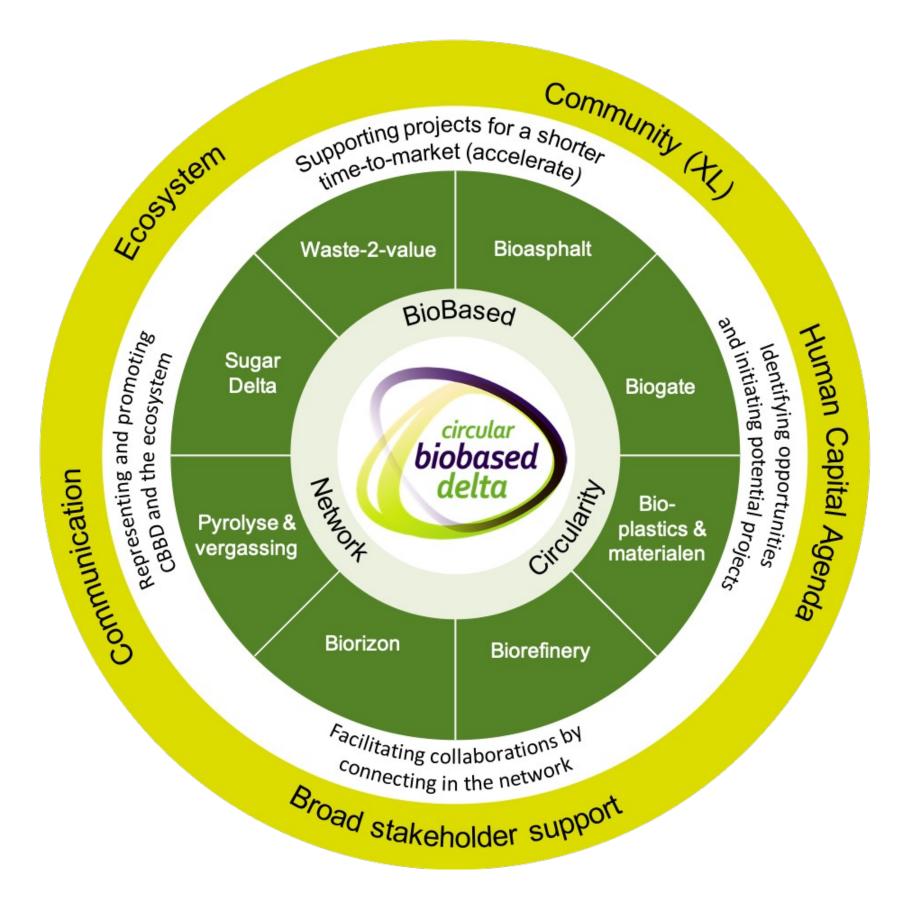
Chemical Recycling

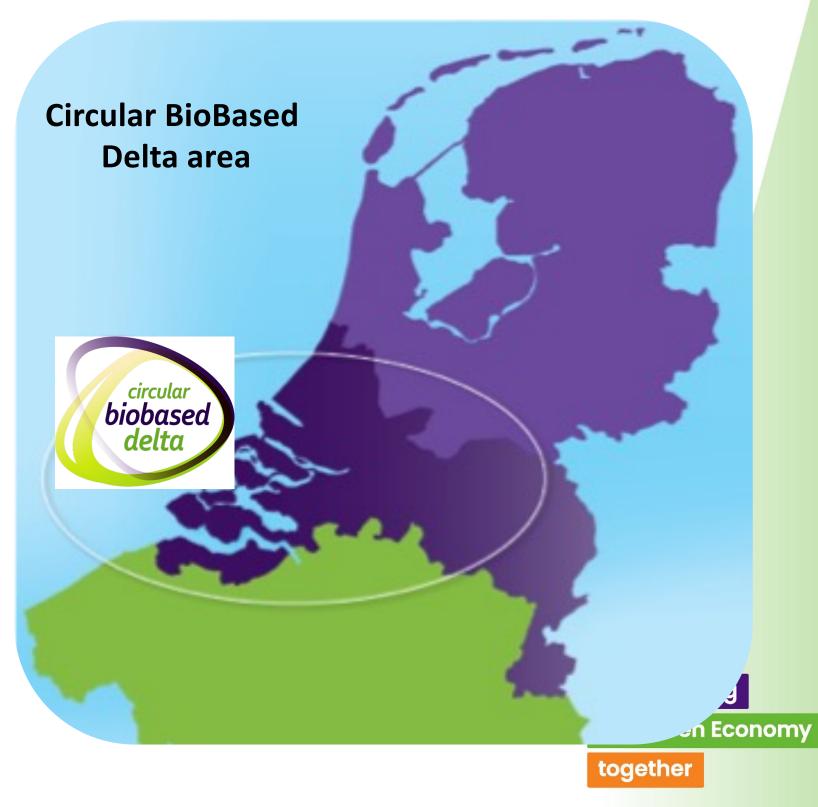
Pyrolysis

Waste2Value

- CCU
- Agro Waste
- Mixed Waste

Mission: To increase the economic value of carbohydrates and reduce CO2 emissions in the Biobased Delta

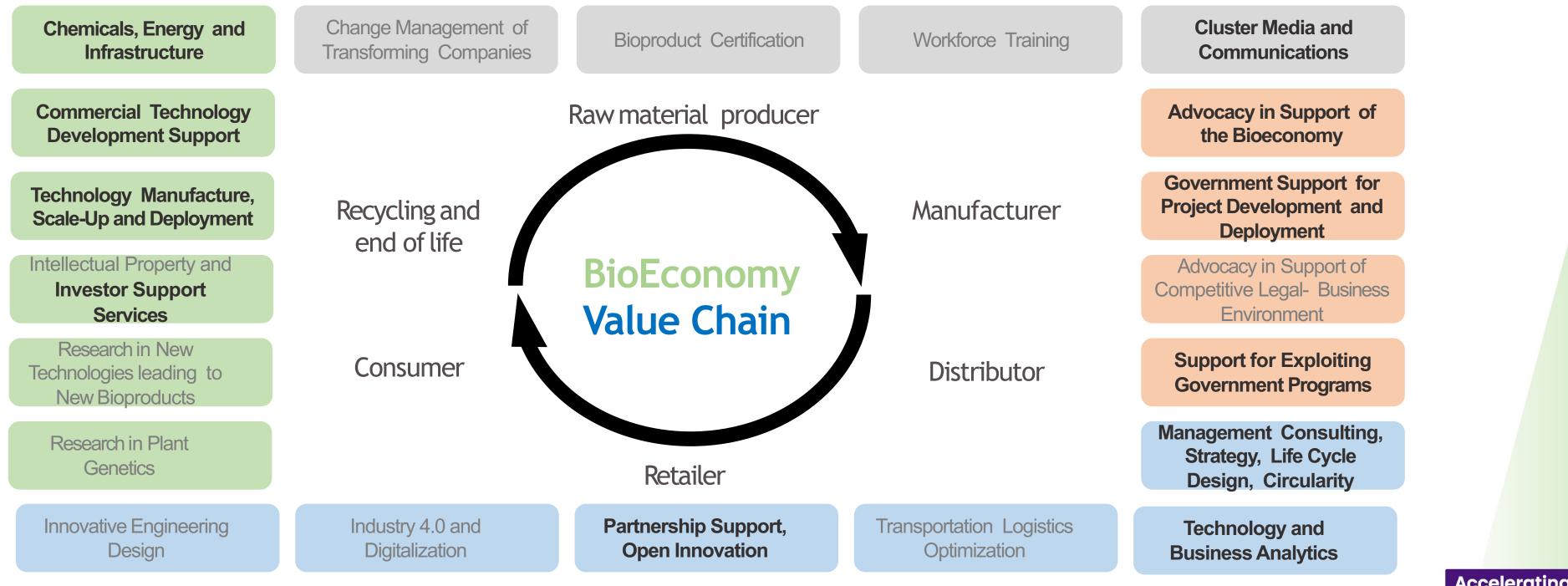




delta

Bioeconomy clusters achieve competitive biobased value chains by offering multidisciplinary services.

ATTRIBUTES OF SUCCESSFUL CLUSTERS*



Services provided by Circular Biobased Delta

*Study Leading bioeconomy clusters Univ Montreal_December_2021



Services outsourced





Planet B.io Delft

Yes! Delft Incubator



Green Chemistry Campus (COCI)



Bioprocess Pilot Facility (BPF)



Bio Base Europe Pilot Plant

APPLICATIECENTRA & OPEN LABS





Natuurvezel Applicatiecentrum (NAC)

Kleuren Applicatiecentrum (KLAC)



Biopolymeer Applicatiecentrum (BAC)



Biobased Innovations Garden Rusthoeve (AIKC)



KENNIS & ONDERWIJSINSTELLINGEN





HZ University of applied sciences Centre of Expertise **Biobased Economy**



Economy



Curio Biobased Economy



Technische Universiteit TU Delft



ZEEHAVENS



Port of Rotterdam



Port of Moerdijk



North Sea Ports

INNOVATIEVE INDUSTRIEPARKEN



Nieuw Prinsenland



Biopark Terneuzen



Port of Moerdijk



SABIC, Bergen op Zoom





Plant One Rotterdam

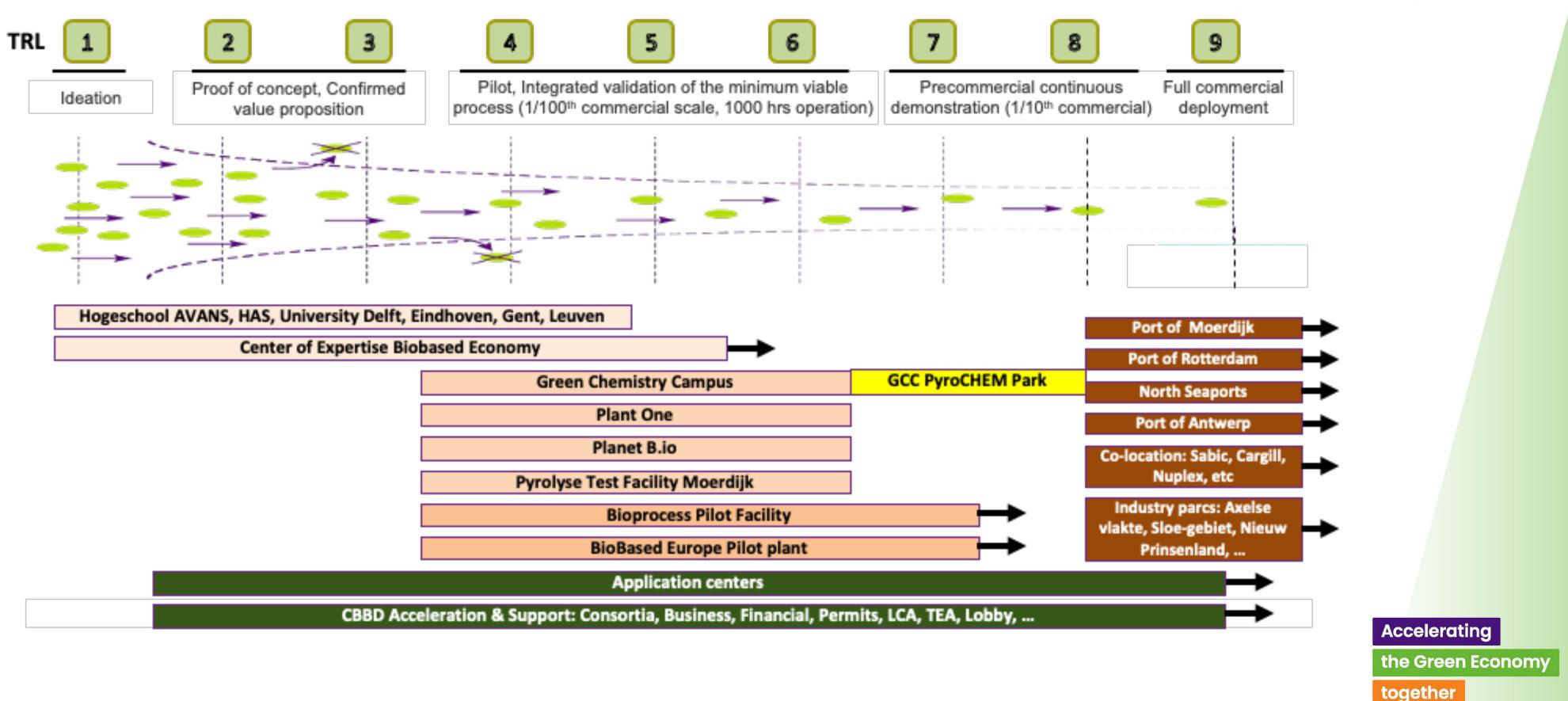


Green Chemistry Innovation Lab



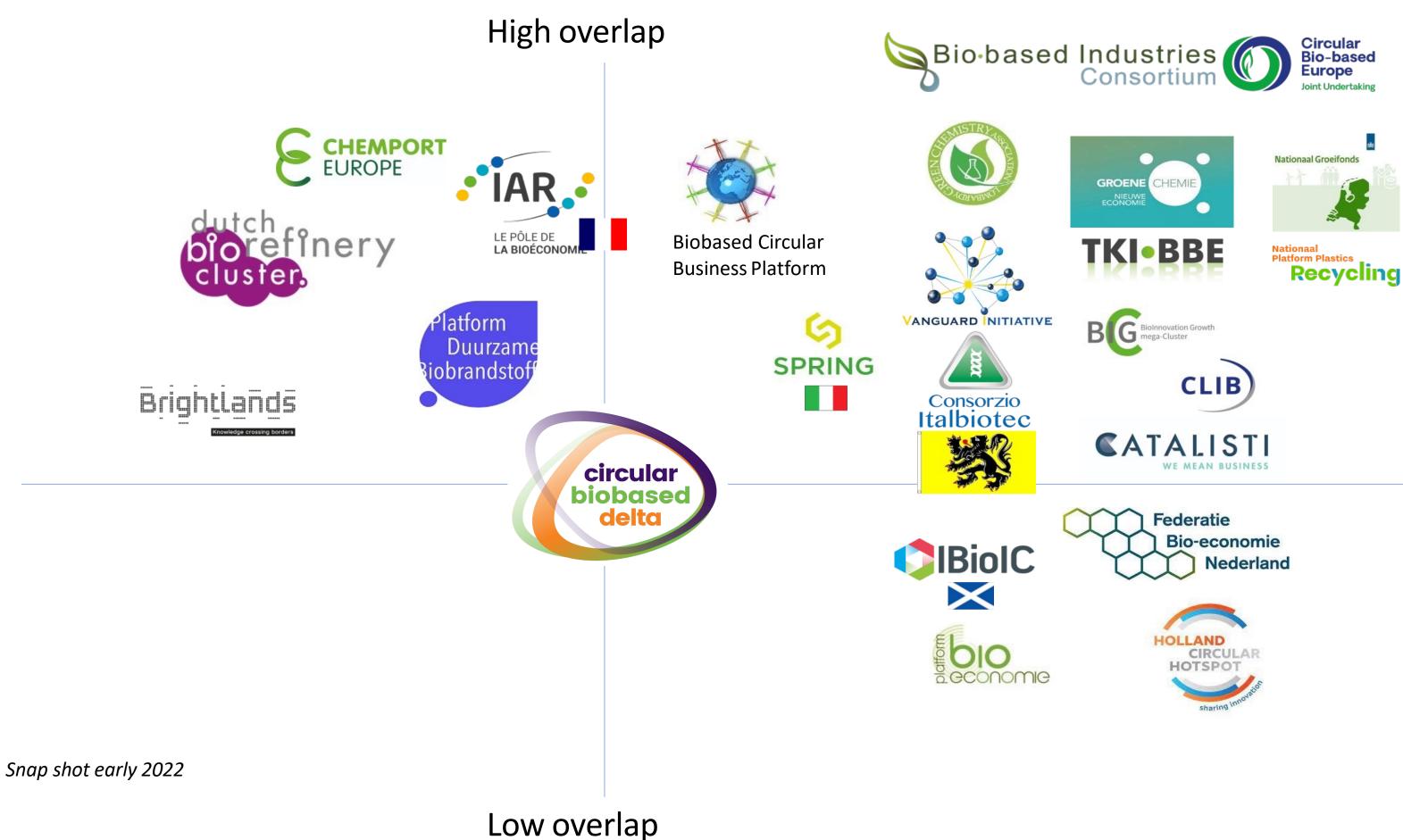
Greenport Westholland

A truly Eco-system for the development of the Circular BioEconomy





(Inter)national positioning CBBD: cross border connections accelerate SMEs innovation



Competition



Collaboration

We represent a consortium of 12 SME's in the value chain of biopolymers & materials looking for (EU-subsidy) projects

- Vacuum extrusion sugar beet & corn pretreatment (Betaprocess). 1.
- 2. Biorefinery using steam-explosion technology.
- 3D biobased and 100% biodegradable and biobased polymers. 3.
- Natural fibers based materials and (thermoplast) composites. 7.
- Sustainable biobased 'green' and non-toxic printing inks and paper coatings. 8.
- Injection and injection stretch blow molding, as well as extrusion blow molding. 9.
- 10. Vacuum forming and thermoforming. Maximum dimension is 3x2x1m.
- 11. Large scale (4x2x1.5m) CEAD CFAM 3D-printer and milling robot.
- 12. Pyrolysis technology and production of green hydrogen.

















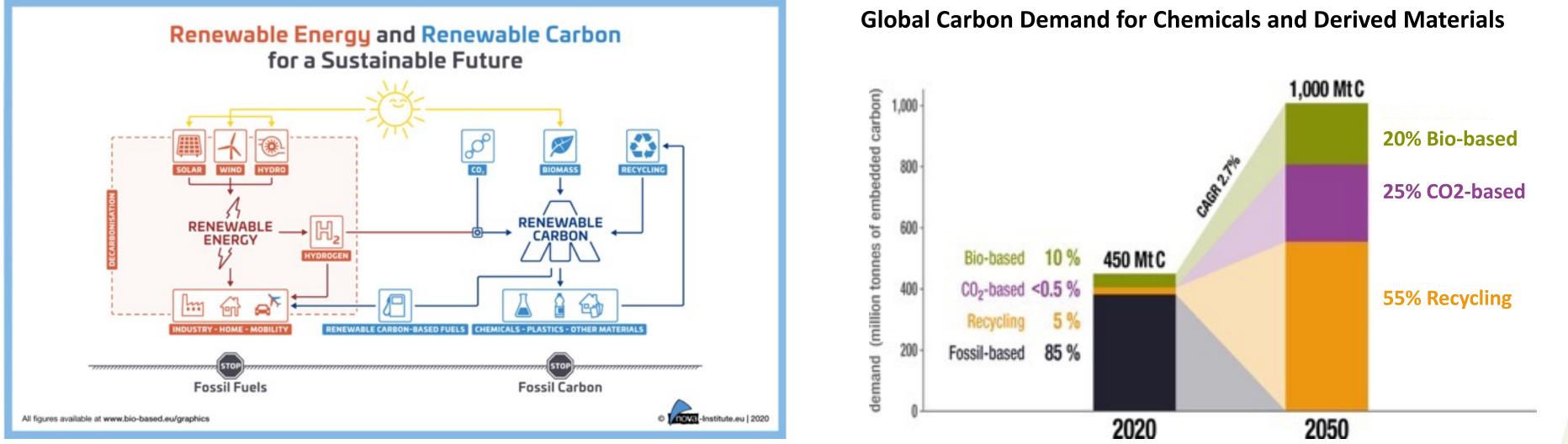






Feedstock Transition

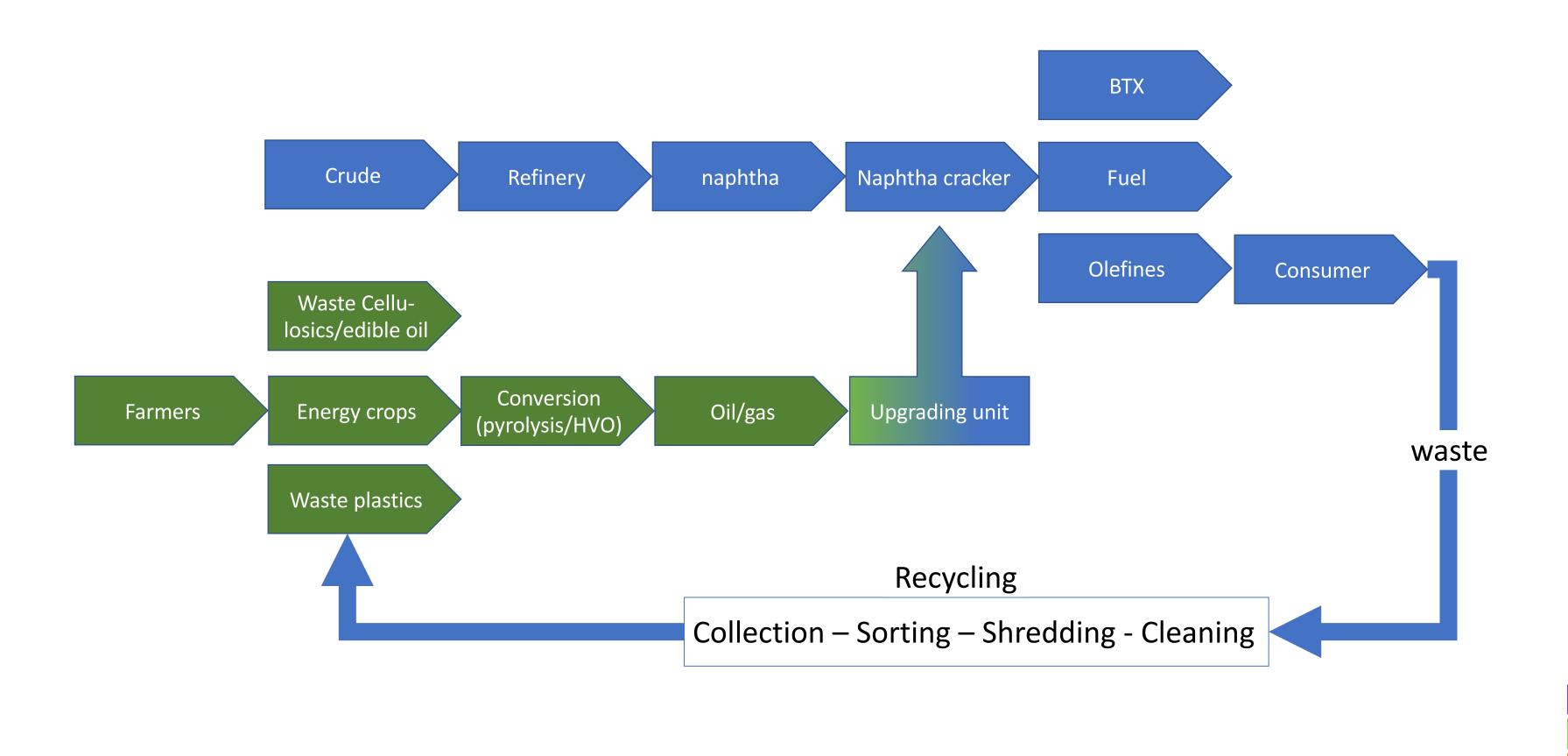
Chemical and plastic industries need alternative carbon sources







Infrastructure for the feedstock transition to replace fossil based naphtha





HVO Biorefineries in The Netherlands

- Neste
- Shell
- UPM

500.000 tons/a 850.000 tons/a 500.000 tons/a



Shell to build 820,000 t/yr biorefinery

15 March 2021



By BioRefineries Blog - February 05, 2021

Versión en Español

carbon footprint in the road transport and aviation, as well as replace fossil raw materials with renewable Press release: "UPM's growth plans in biofuels progress to the next stage". 28/01/2021.



wher 2021 Shell will build a biorefinery with production capacity of 820,000 t/yr in dam, the Netherlands, it said today. The facility will be on the in aduction is expected to start in 2024.

ated vegetable

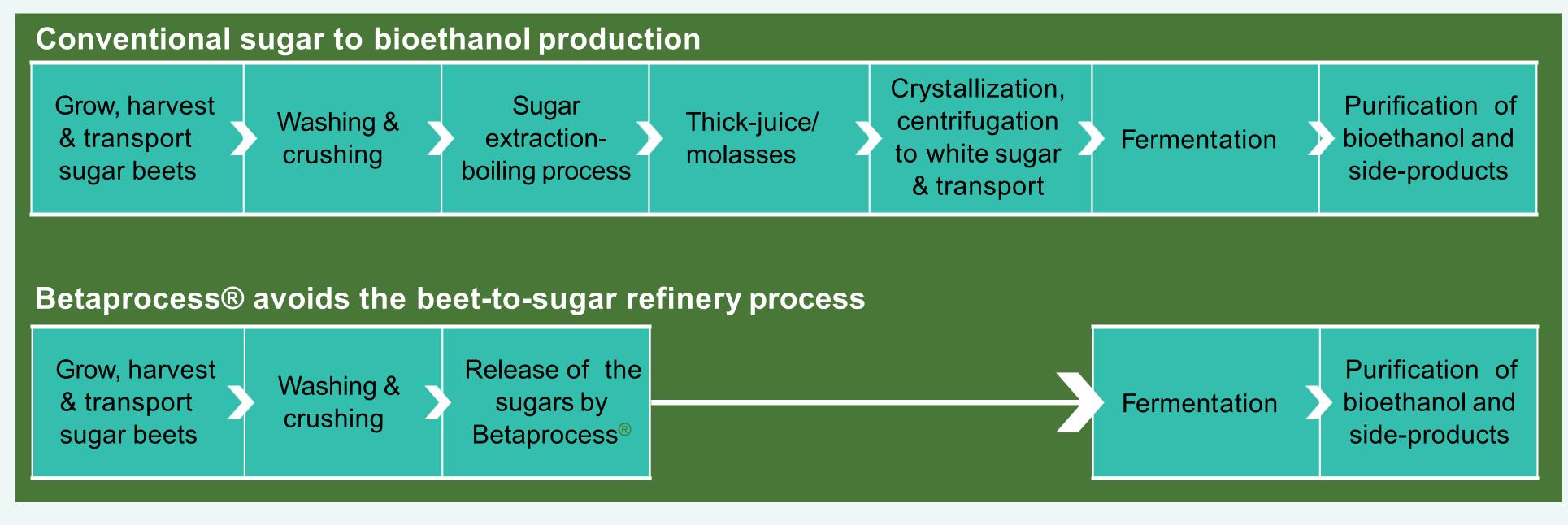
Neste selects Rotterdam as a location for its possible next world scale renewable products refinen/ Published in Releases and news under Renewable solutions

UPM starts the basic engineering phase of an advanced biorefinery

UPM moves forward with biofuels growth plans and starts the basic engineering phase of a next genera annual capacity of 500 ktons of high-quality renewable fuels including sustainable aviation fuel (SAF



The disruptive technology avoids the beet-to-sugar refinery process

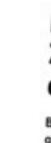


Main advantage of the new technology is that it avoids the beet-to-sugar refinery process. The beet-to-ethanol process is thereby reduced by two production steps.

Activities in the region on chemical recycling

- CBBD report 2020 "Pyrolysis of woody biomass".
- OP Zuid project "Pyrolysis living lab" 2016 - 2021
- React EU project "Pyrochempark".
- Shell invests in pyrolysis technology Blue Alp and contract with Pryme
- Neste and Ravago plan chemical recycling plant in Vlissingen
- National Growth Fund Sustainable Materials
- CBBD "Chemical Recycling Network" launched









Commerciële pyrolyse-initiatieven in onze Delta-regio.

Dit nieuwe bedrijf in Bergen op Zoom zet huishoudelijk afval om in een grondstof voor kunststof

ZOOM - Het Israëlische bedrijf UBO M--od aan de Conradweg in P-

Neste and Alterra in Chemical Recycling Collaboration wn a minority stake in Alterna Energy as the two collaborate to develop and

Recycling-fabriek Neste en Ravago voor plastic afval in Vlissingen

Neste en Ravago gaan een joint venture oprichten woor de t

SHELL AND BLUEALP TO BUILD TWO PYROLYSIS-BASED RECYCLED-FEEDSTOCK PLANTS IN THE NETHERLANDS

D NEWSWIRES

Pryme to Supply Shell Chemical Plants With Plastic-Derived Pyrolysis Oil



STIMULUS

Materialeninnovatie als hart van de verduurzaming

Accelerating

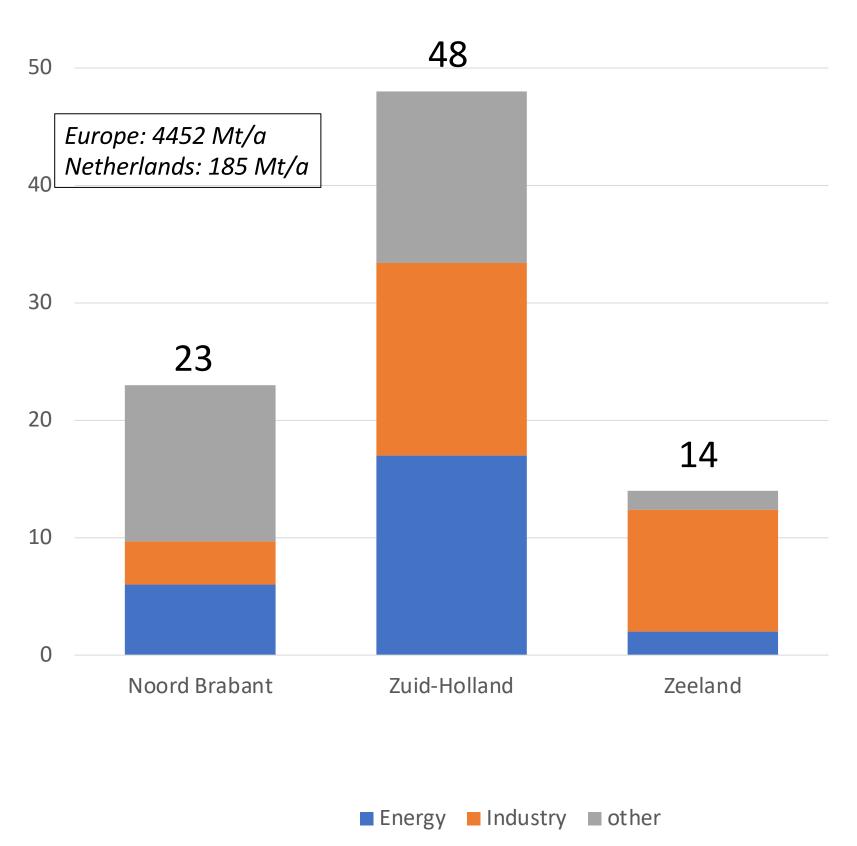
the Green Economy together



CO₂ emission reduction

A target of 55 % reduction CO2 emissions in 2030 and 95% in 2050

 CO_2 emission in the Biobased Delta (85 Mt/a)



Solutions to reduce CO2 emission: Key technologies: solar/wind energy, agriculture, bio-refinery, green chemistry, fermentation, pyrolysis, natural fibres

- Circular BioEconomy eco-system (Biobased Delta)
- Triple Helix: Industry/SME, Government, Academia
- International partners
- Financial support

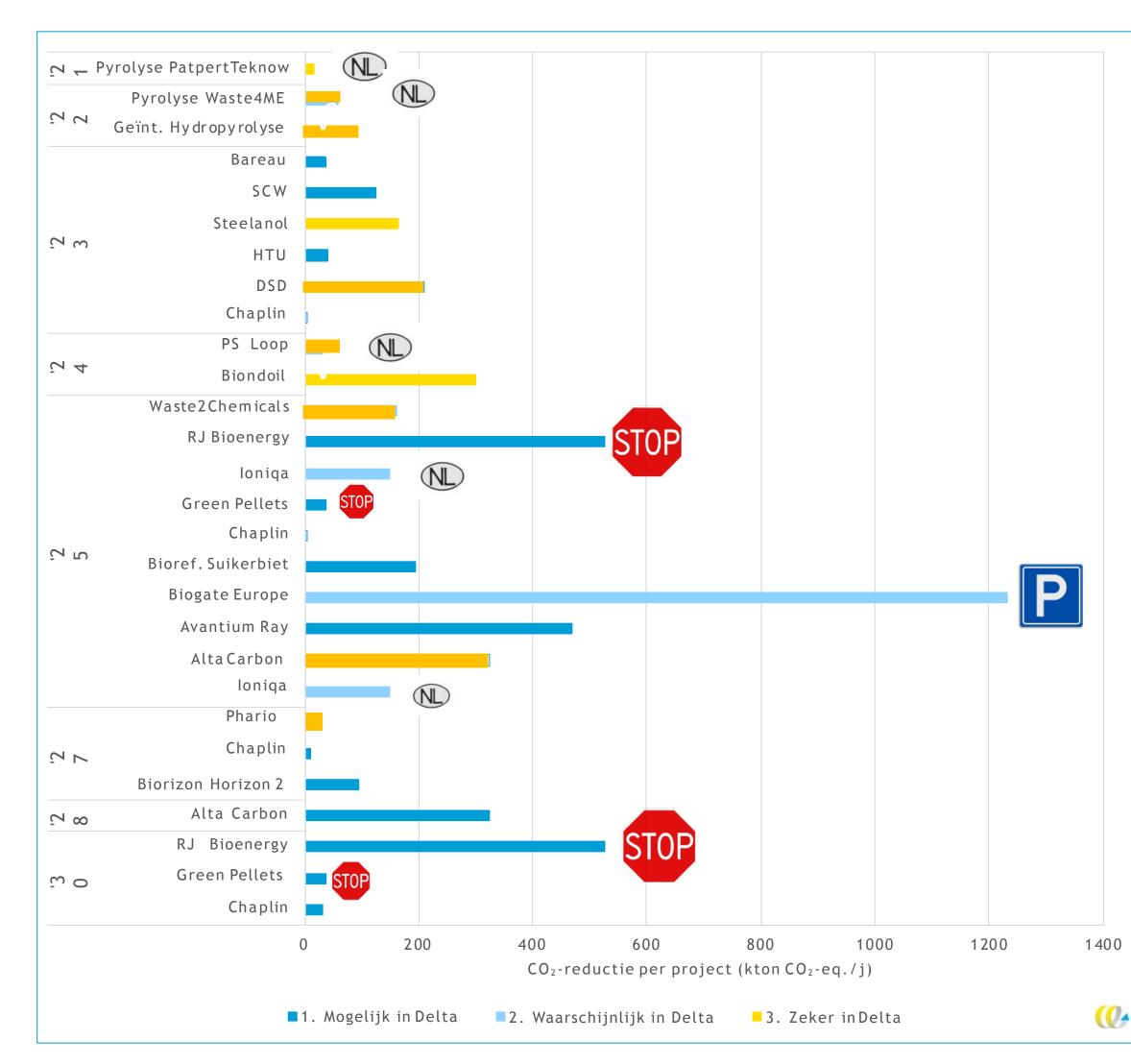


• Key Success Factors

Accelerating

the Green Economy together

Roadmap CO2 reduction Circular Biobased Delta, per end 2021





Government of the Netherlands



Innovative projects given additional €1.35 billion boost due to funding from National Growth Fund

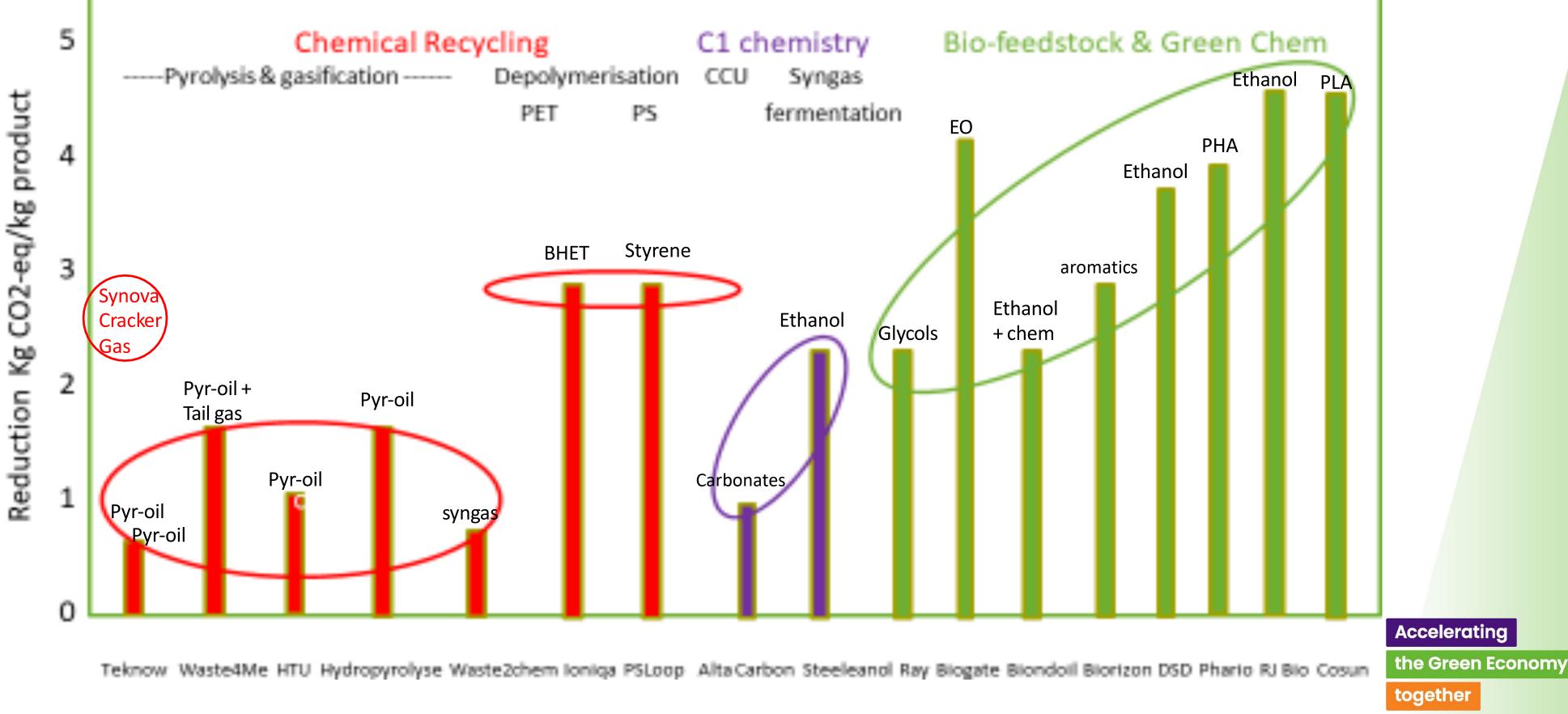
Number of projects continue with possible boost from National Growth Fund

- ABC Growth Fund request
- Duurzame Materialen NL NGF
- Biomass discussion in NL has impact
- Biondoil to Antwerp Next Gen District
- RJ Bioenergy stopped
- Bioethanol als chemische bouwsteen?
- Laatste heeft fit in de USA



How effective are the various routes in terms of CO2-reductie?

Values on the basis vof product comparison vs fossil route (CBBD Roadmap CE Delft)





Examples of CBBD programs & projects







Plastic Circularity

Many different companies/technologies and growing in gasification, pyrolysis & carbonization

Zonpyrenasunpine nany blueal pteck company 27 company 44 company 46 gran pany 46 gran pany 46 gran purecycle pryme shy mpany 22 company 45 company 46 gran purecycle pryme shy otech ny 30 ensyl plastice nergy company 47 company 36 gran y 46 gran purecycle pryme shy ompany 28 sunpine carbios company 47 company 36 gran y 46 gran purecycle pryme shy ompany 28 sunpine carbios company 47 company 43 anellotech e company 39 company 37 gran with a shell biorizon pyrena company 41 y 43 anellotech company 41 hydrocarbon with a blue alptech jeplan company 19 company 18 company 45 apk company 26 biobty company38 rcompany4 Company14 company36 rightmakr repsolCompany18 company27 company4 company18 company27

Winners?



Criteria used for Technology Evaluation and Economic Analysis

In particular, we look at the following criteria:

Key Criteria Economic Analysis:

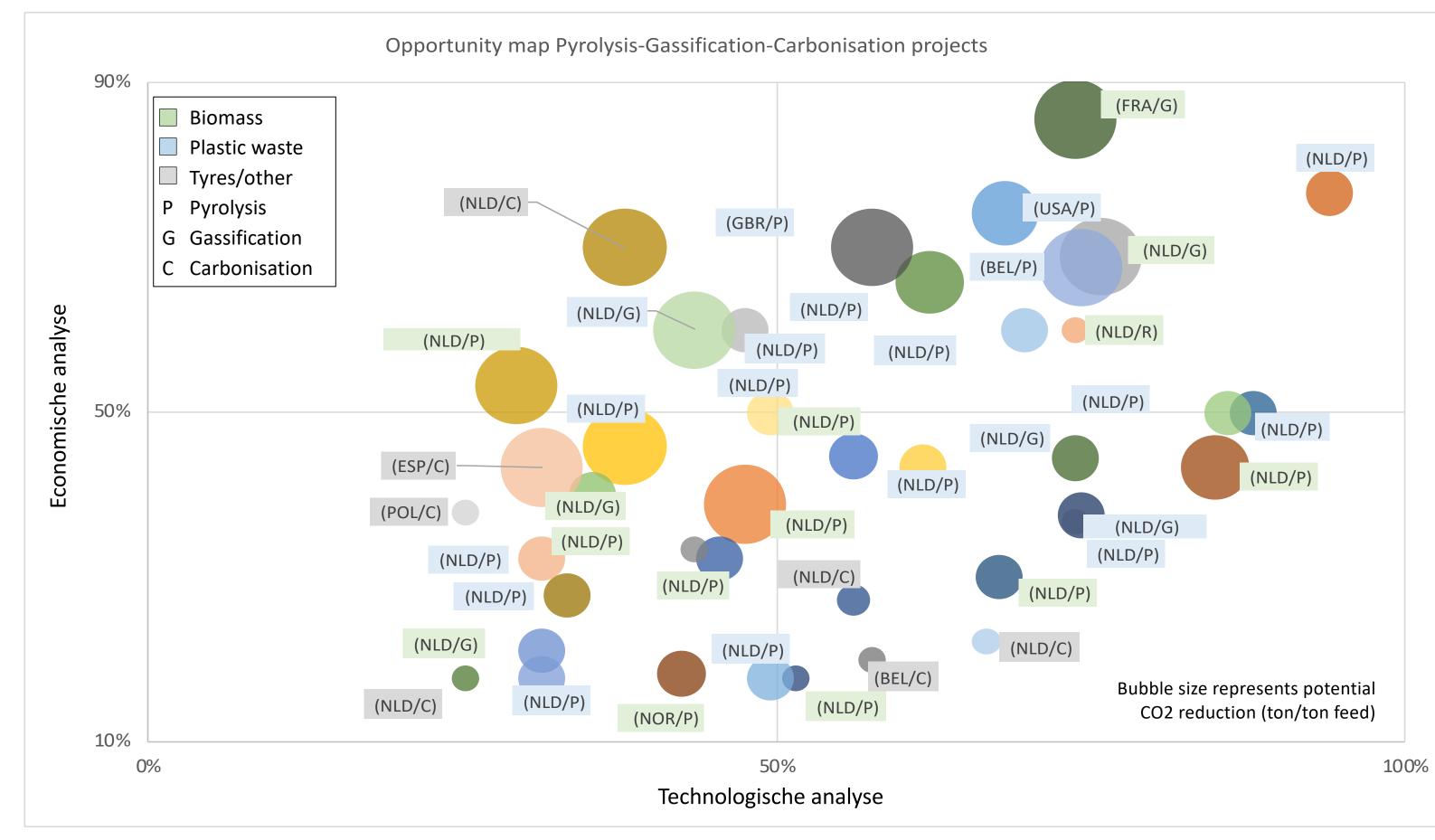
- CO2 reduction (ton/ton feed) 1.
- Yield (marketable product/feed) 2.
- Consortium strength for market pull 3.
- 4. Dependence on gate-fee
- 5. IRR

Key Criteria Technology Evaluation.

- Complexity of the technology (e.g., number of process steps, temperature, pressure) 1.
- TRL level 2.
- 3. Availability of the right raw materials
- Scalability (maximum size per single unit for commercial plant) 4.
- 5. Required investment (CAPEX €/kg feed).



CBBD has characterized more than 50 companies/ technologies.







Dank voor uw aandacht

www.circularbiobaseddelta.nl



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