

From Linear to Circular

Opportunities & challenges for the chemical industry

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GC3 Chair of the Board



Agenda

- Intro / about me
- Linear vs Circular
- Wat maakt het zo moeilijk?
- Circulaire pioniers in Nederland
 - FoamPlant, BioBTX, PeelPioneers

Achtergrond



AkzoNobel



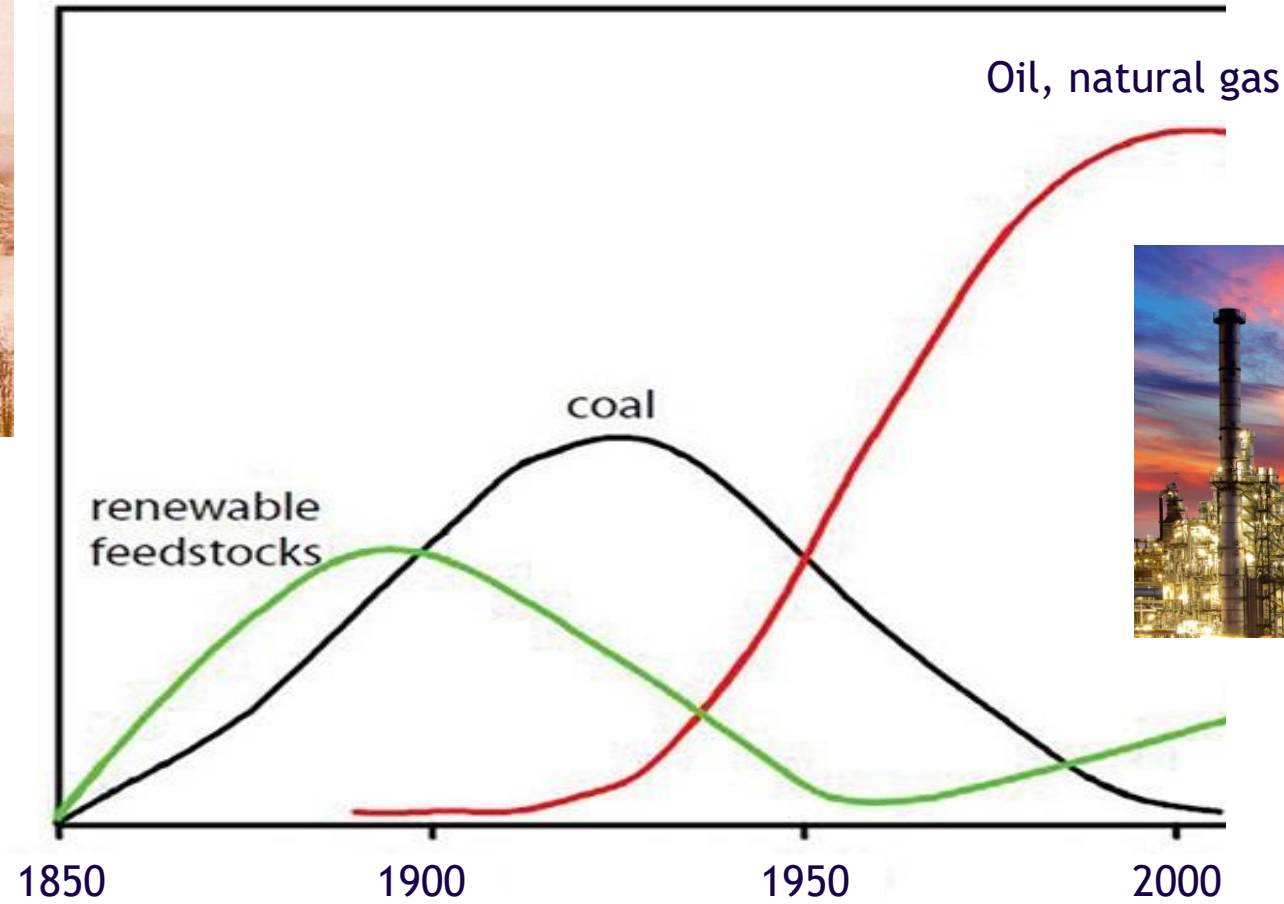
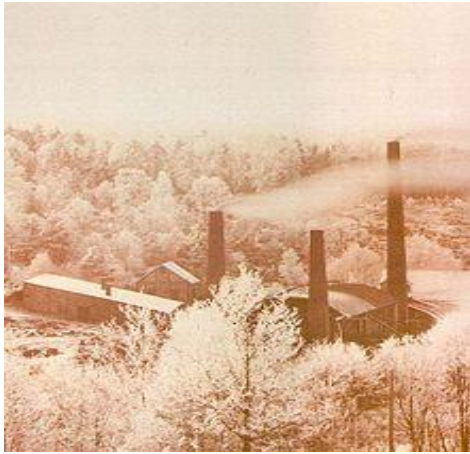
One word:



- The Graduate, 1967



A great future!

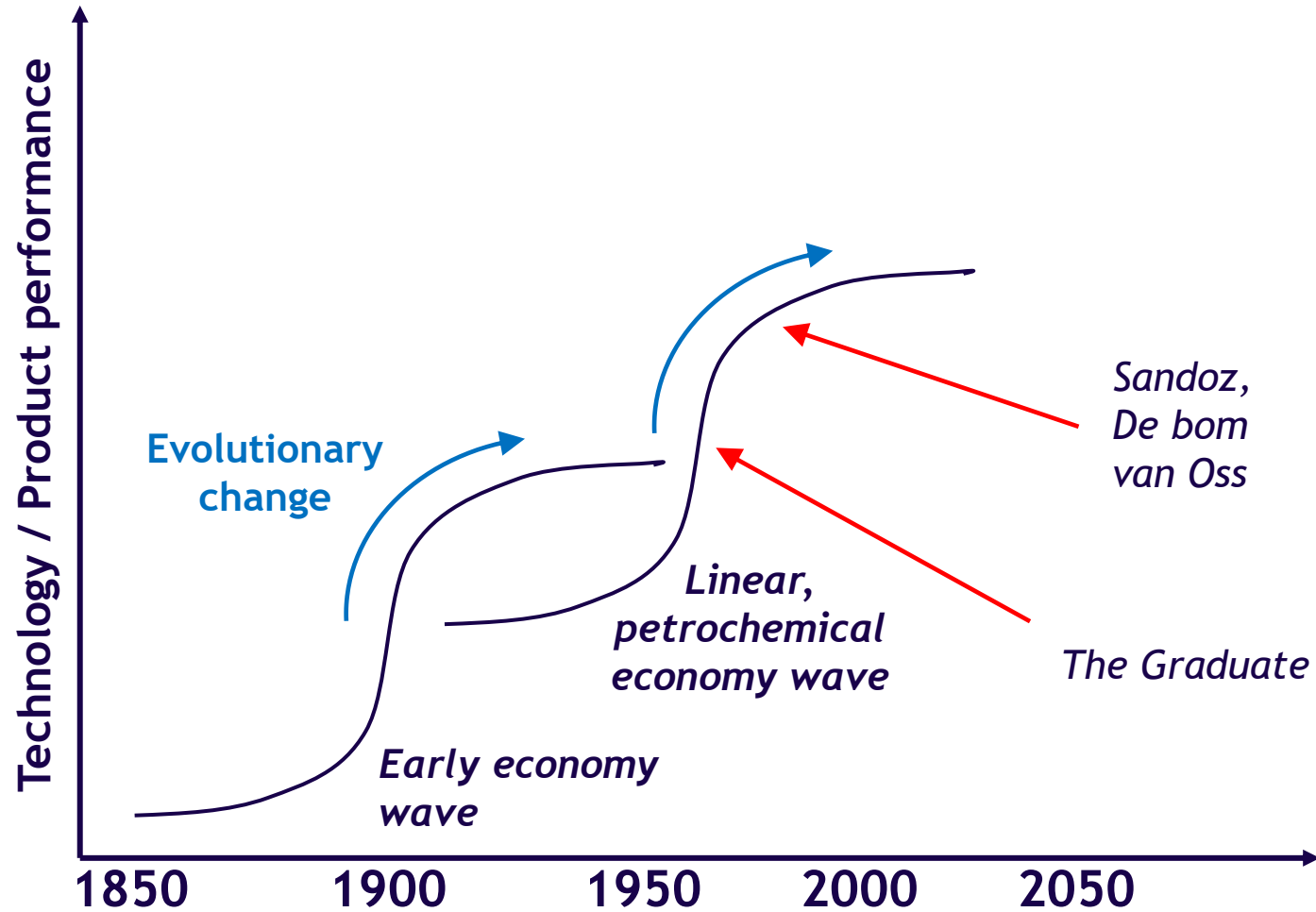


But ...

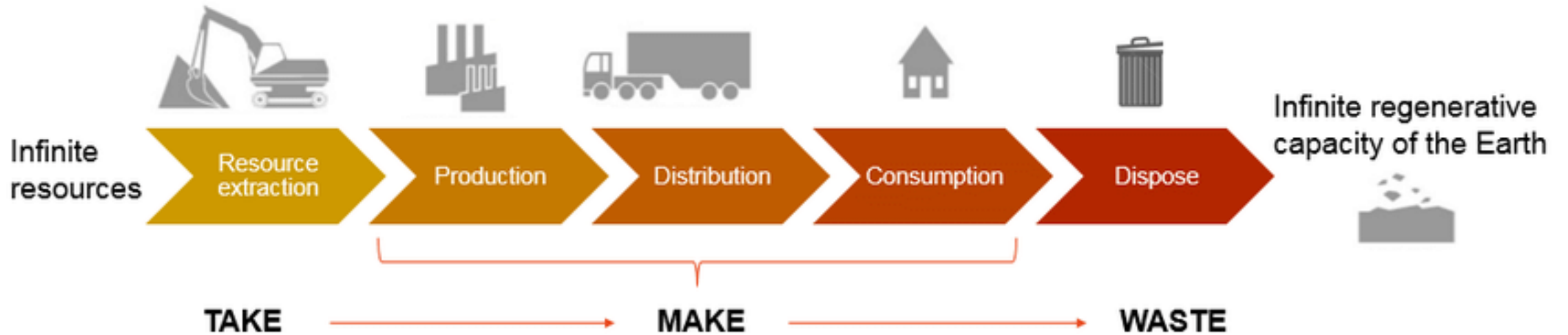
- Chemical Pollution / Harmful chemicals
- Climate change
- Plastic waste



What is happening?



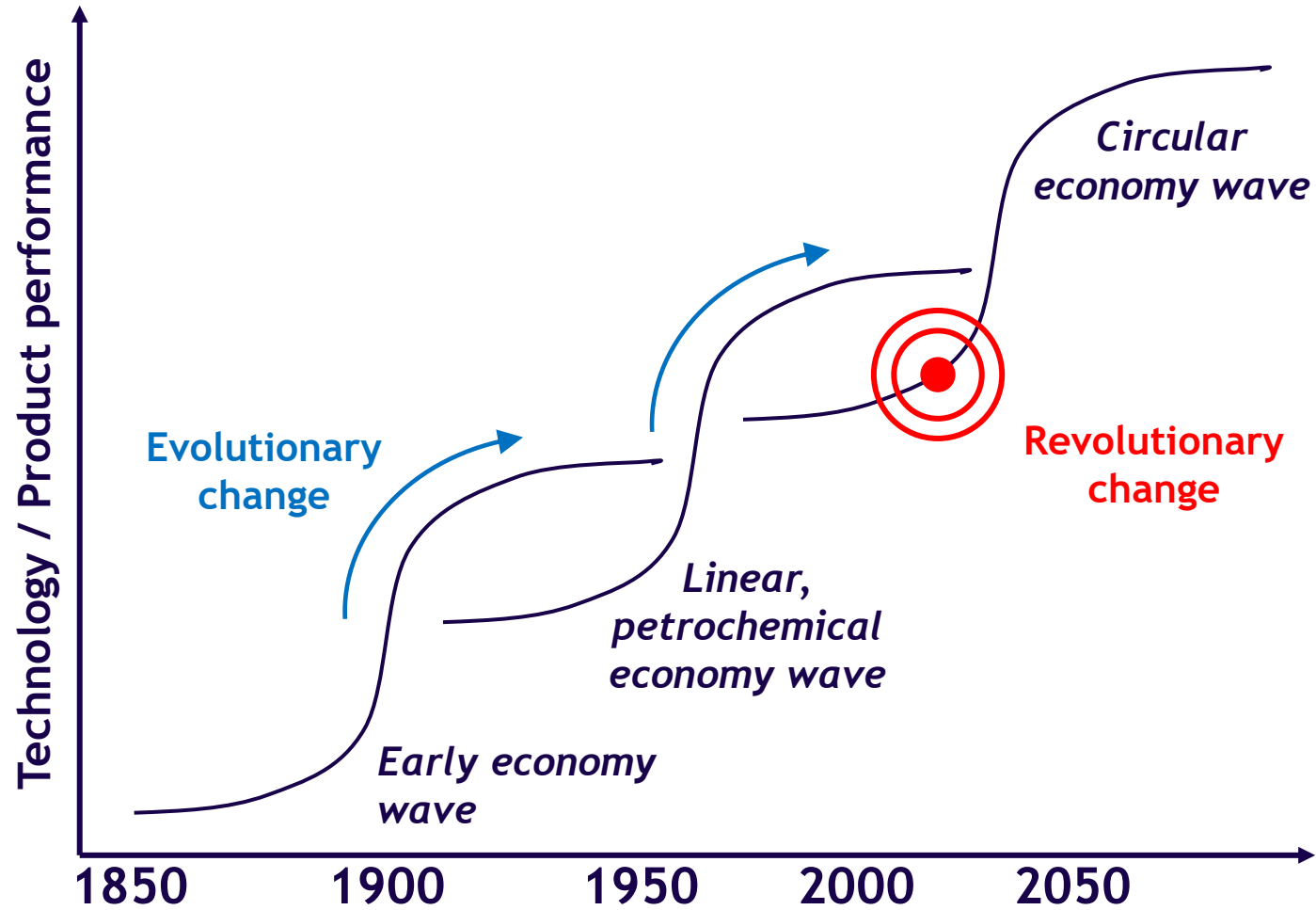
Take – Make - Waste



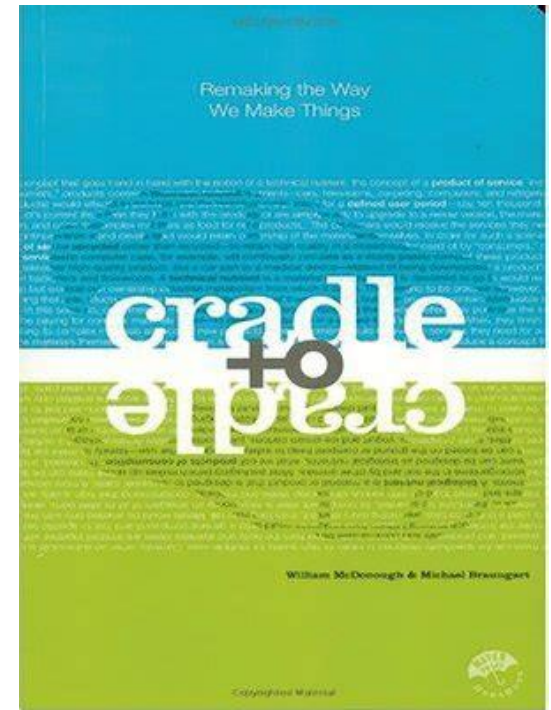
Finite resources!

Finite regenerative capacity!

What is happening?

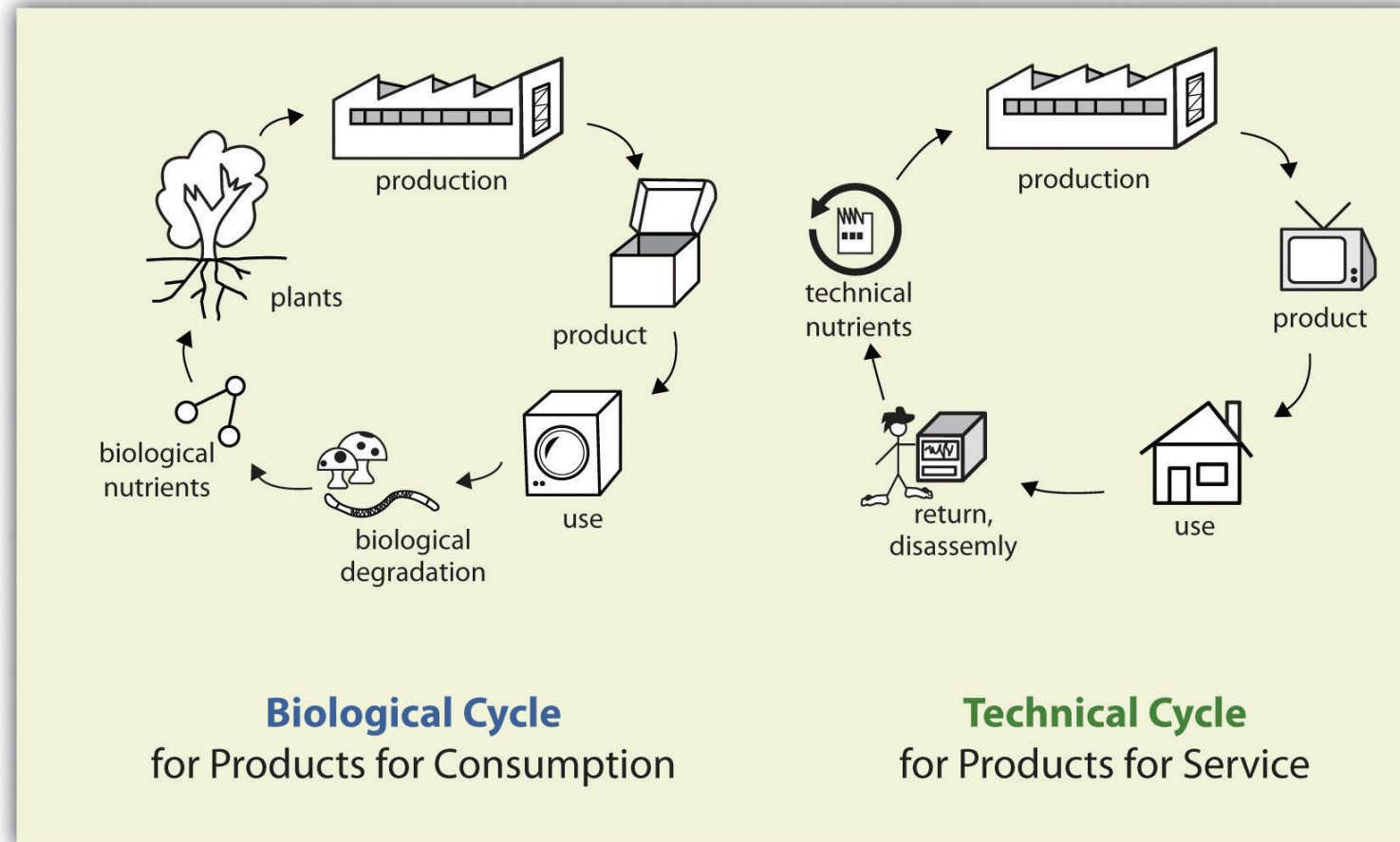


Circular



McDonough & Braungart

Cradle-to-cradle thinking: 2 cycles

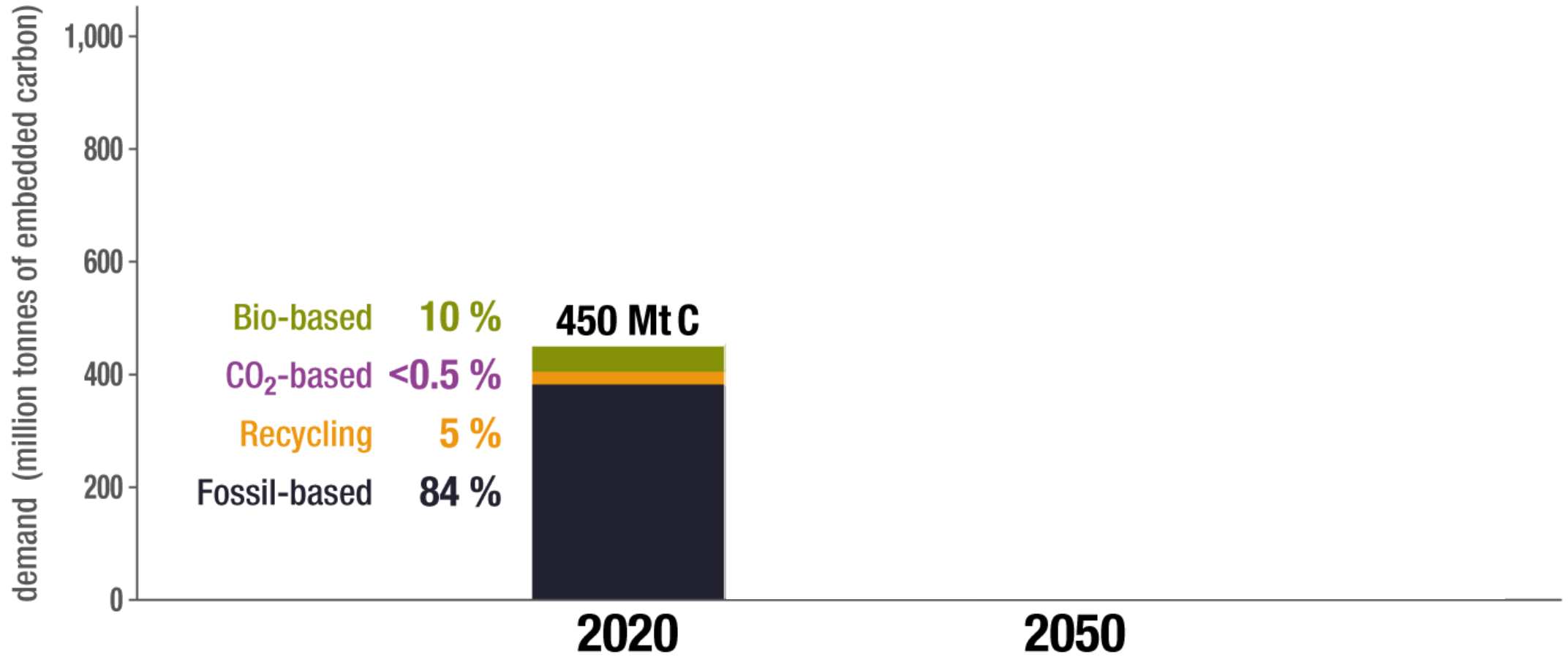


New feedstocks



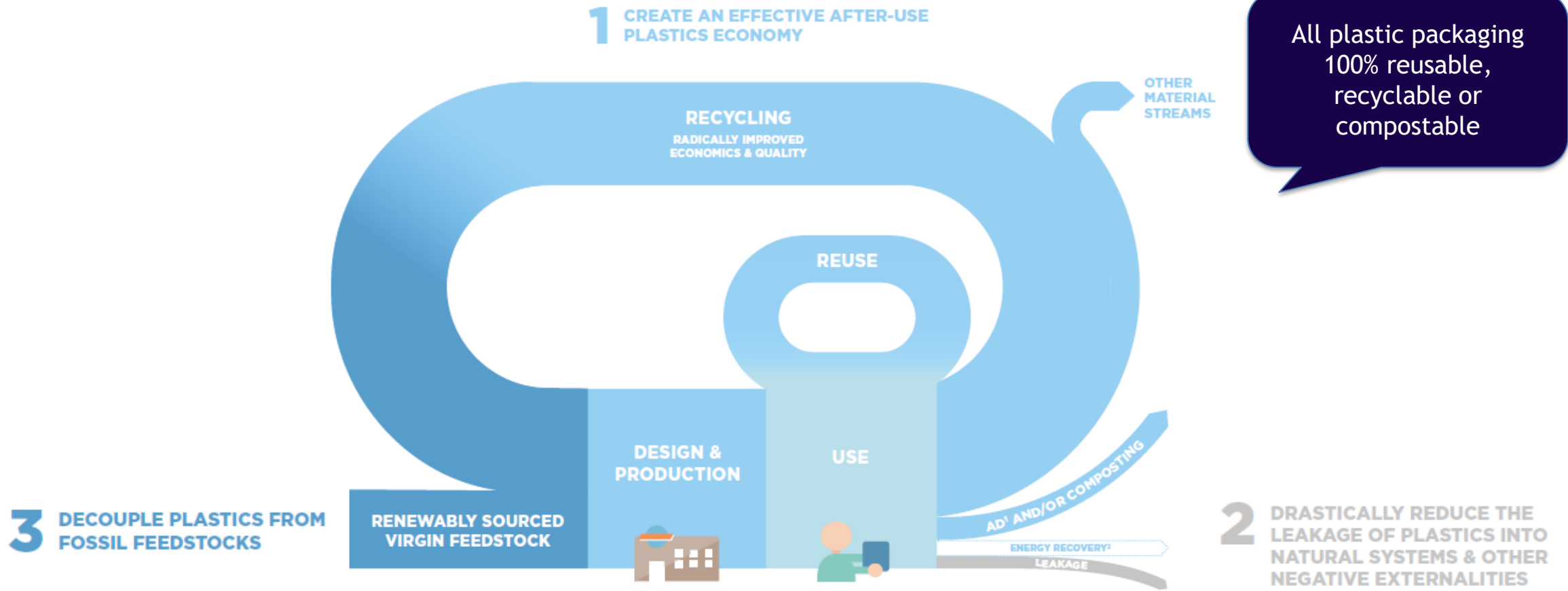
Source: Nova Institut 2022

New feedstocks



Source: Nova Institut 2022

Circular plastics




Source: Ellen MacArthur Foundation

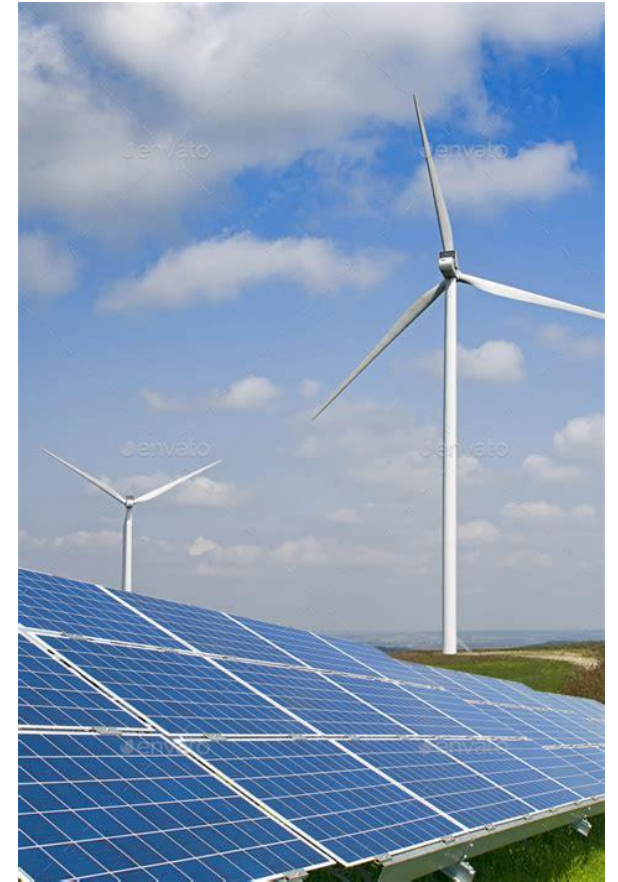
Toxic free environment



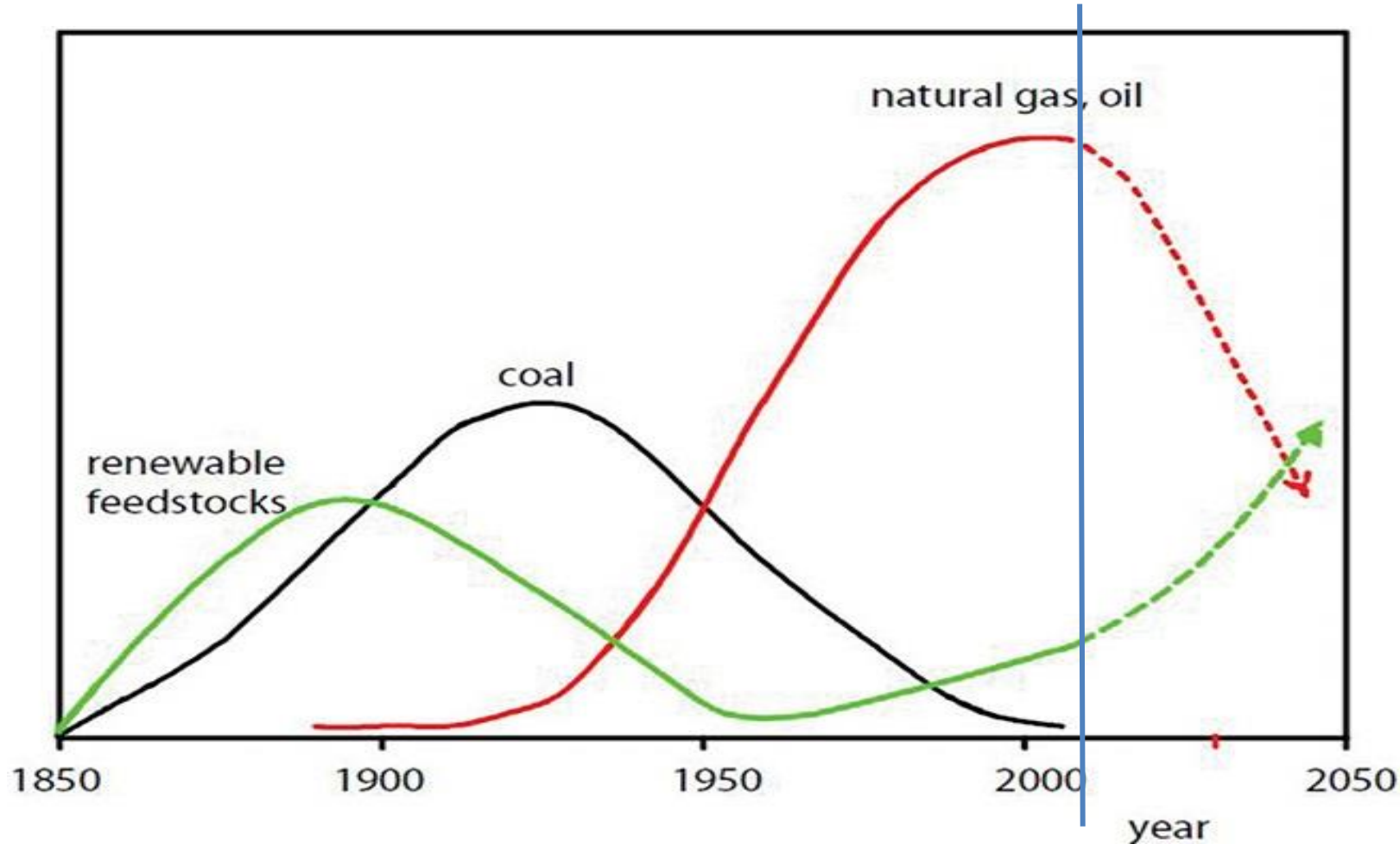
Geen stoffen in het milieu die toxisch en/of persistent zijn

A tall agenda ...

- Transition from fossil fuels to renewables (defossilization, not decarbonization):
 - Biomass
 - Recycling
 - $\text{CO}_2 \rightarrow$ Depends on green energy, H_2 
- Develop new molecules using the principles of green chemistry and engineering
- Reimagine product design, delivery, and consumption patterns in cooperation with supply chain partners, and closing the loop

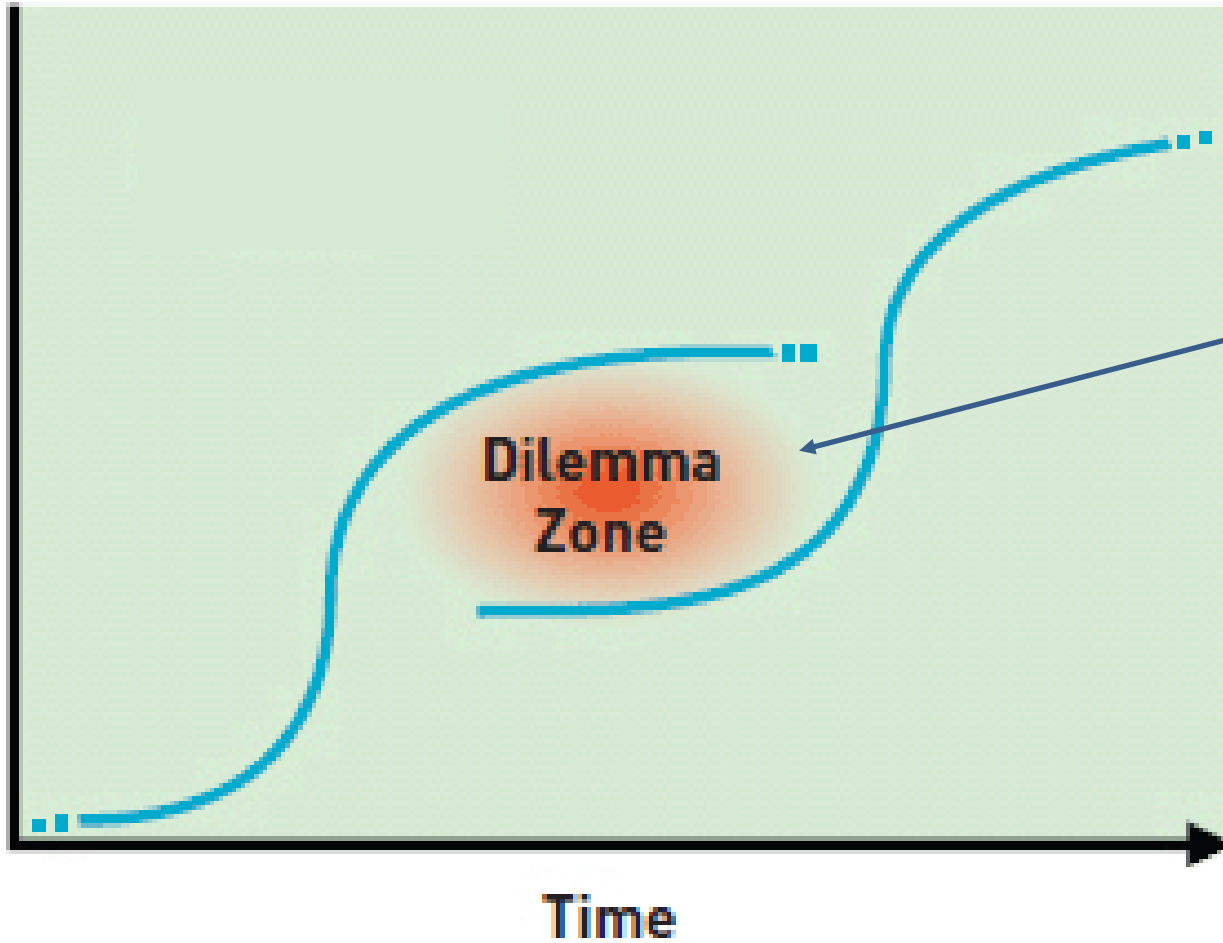


Back to the future



- The chemical industry can make anything out of everything, even CO₂
- Defossilization, not decarbonization

But why is it so hard?



What to do?
Who moves first?

Hoping to get the best of both worlds

Corporates

- Moving from lab to production
- Safety and operational excellence
- Global footprint



Start-ups & Scale-ups

- Innovative ideas
- Fresh perspectives
- Passion and energy



3 NL startups who are creating the future

- PeelPioneers – circular ingredients
- FoamPlant – circular foams
- BioBTX – circular aromatics



PROBLEM

In Europe we destroy potential resources.

- More than 5.000.000 tons of citrus peel are wasted by companies in Europe annually.
- Most of the peel is incinerated or landfilled, causing CO2 emissions and destroying resources in the peel.



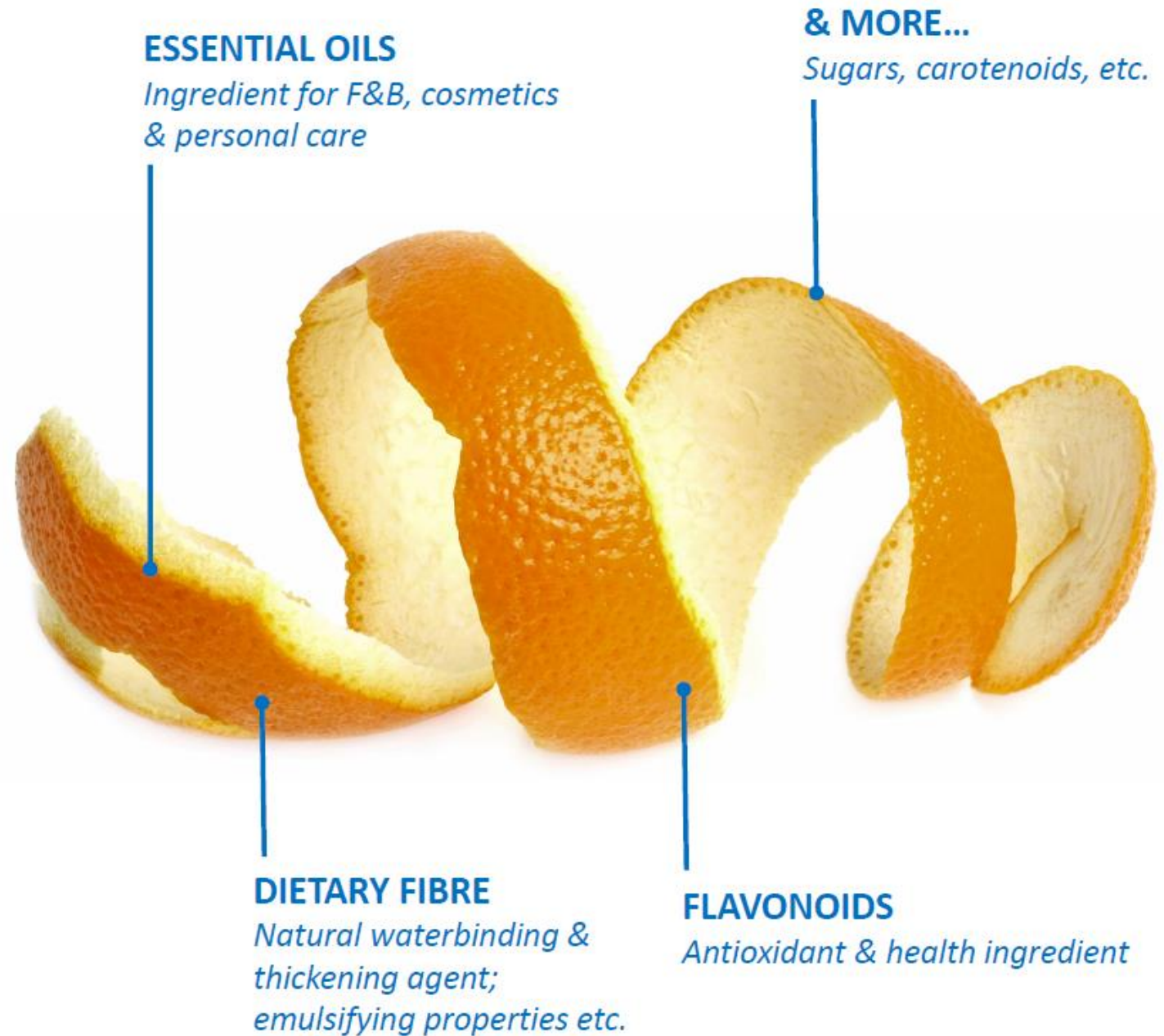
PeelPioneers



SOLUTION

PeelPioneers offers a more sustainable and cheaper solution for orange peel recycling.

- We turn orange peel into valuable ingredients for food & cosmetics applications.
- Our products are used as functional ingredients to provide functional & sensoric properties in our consumers (food) products.



ESSENTIAL OILS

*Ingredient for F&B, cosmetics
& personal care*

& MORE...

Sugars, carotenoids, etc.

DIETARY FIBRE

*Natural waterbinding &
thickening agent;
emulsifying properties etc.*

FLAVONOIDS

Antioxidant & health ingredient

Product portfolio



COLD PRESSED OIL

A 100% natural oil
Obtained without chemicals
Multi-usable ingredient



FIVE FOLD OIL

Concentrated orange flavor
Natural flavoring agent
Usable in food and non-food



D-LIMONENE

Essential oil
Strong degreasing substance
Applicable in the cleaning industry



FINIX CITRUS FIBER

Dietary fiber that fulfills
technical functions
White coloured powder
Contains no orange scent or taste
Widely applicable in food products



CANDIED ORANGE

Candied orange cubes
Applicable in the bakery industry
Tastes, smells and looks like orange

Biorefining!

Fiber applications



**PLANT BASED FOOD
& MEAT**



BEVERAGES



BAKERY PRODUCTS



FROZEN FOODS



**DRESSINGS, SOUPS
AND SAUCES**



FRUIT PREPARATIONS



CONFECTIONARY



**DAIRY & HEALTH
PRODUCTS**

Circular foam?

- 60% of the volume of waste plastics is foam
- Polyurethane foam is problematic:
 - Fossil based / high carbon footprint
 - Persistent / not compostable/biodegradable
 - Barely recyclable
 - Requires additives to become flame retarded

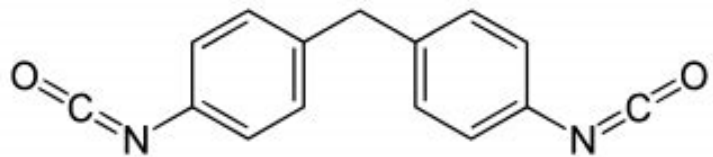
foamplant
innovators in circular foam



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Hoe?

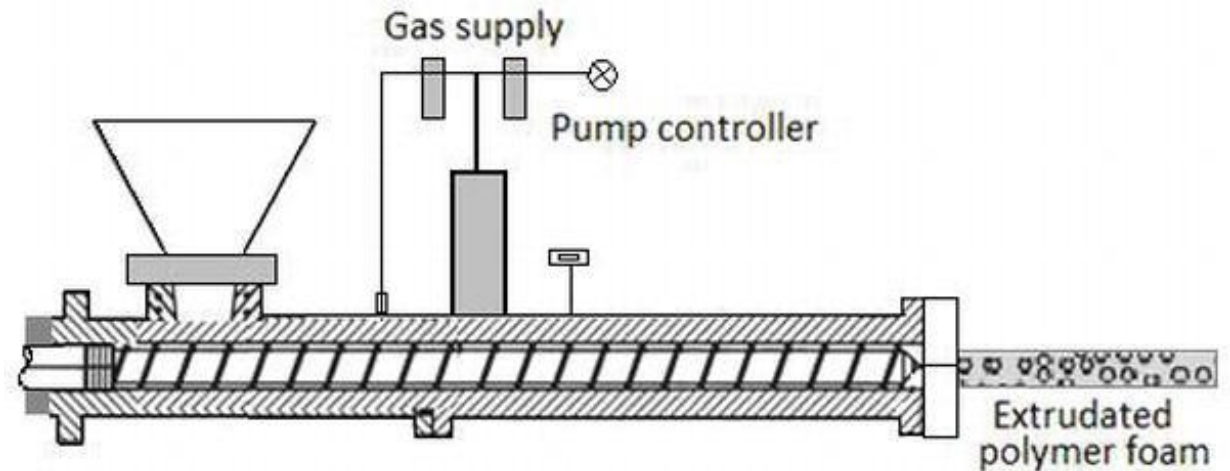
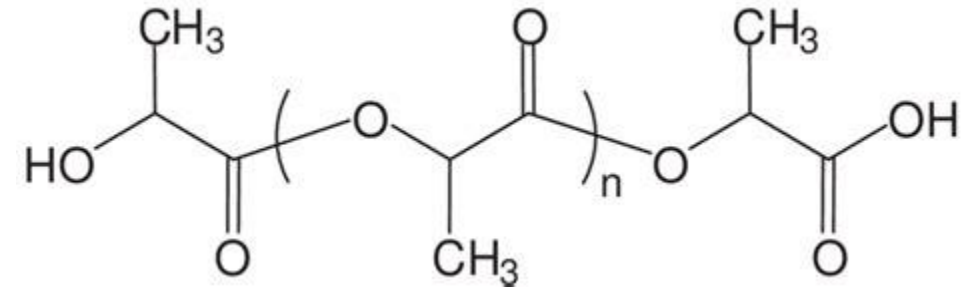
- Biobased polyesters zoals PLA en PBS*
- Geen isocyanaten!

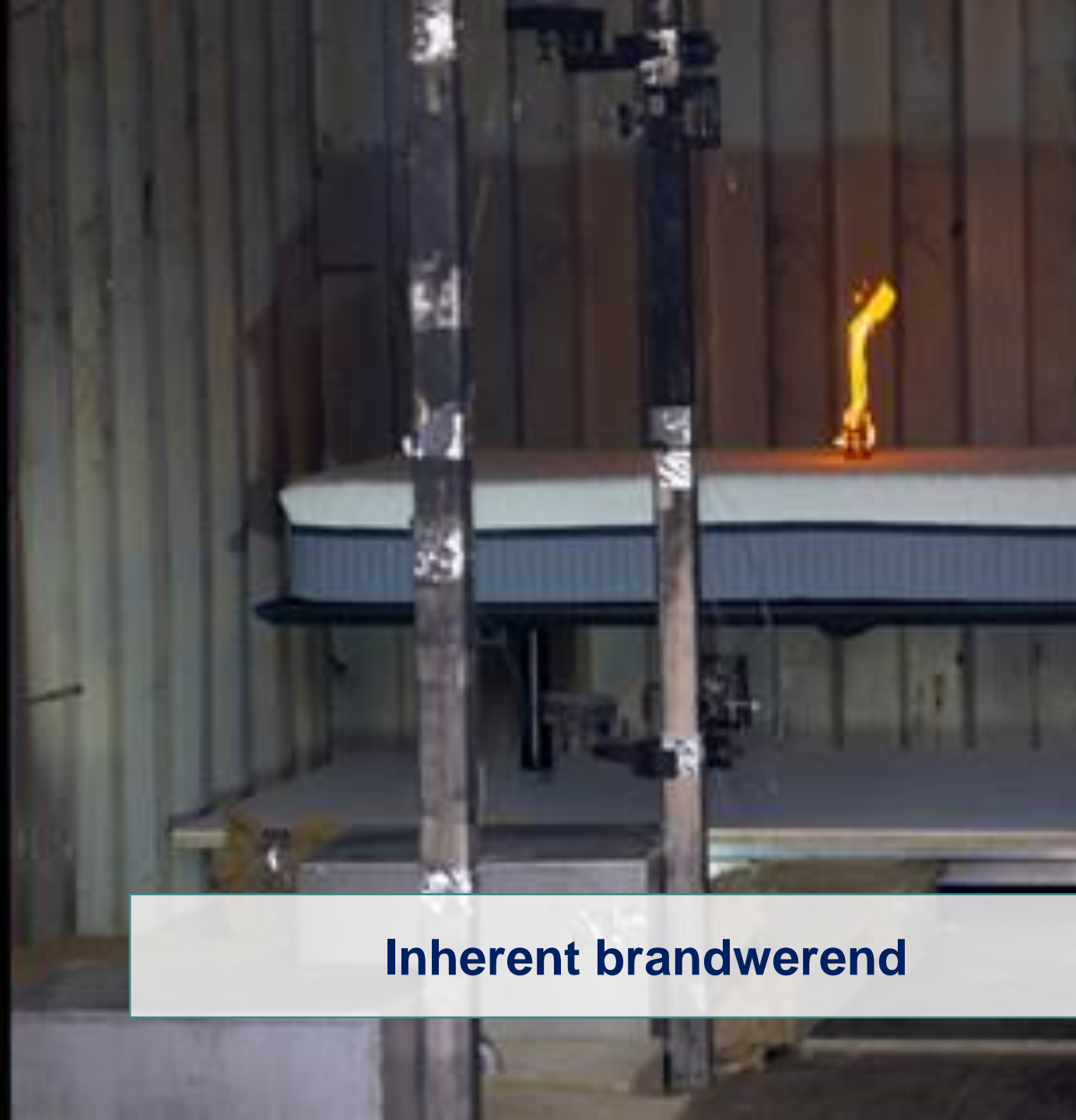


- Polymeer extrusie, zoals voor polystyreen

*PolyLactic Acid / PolyButylene Succinate, made from sugars

foamplant
innovators in circular foam





Inherent brandwerend

Opportunity

- Huge market with no obvious “green” alternative
- Low Capex in manufacturing
- High safety, no isocyanates
- Biobased feedstock
- Lower carbon footprint
- Recyclable, compostable
- Inherently flame retarded – No FR needed

foamplant
innovators in circular foam

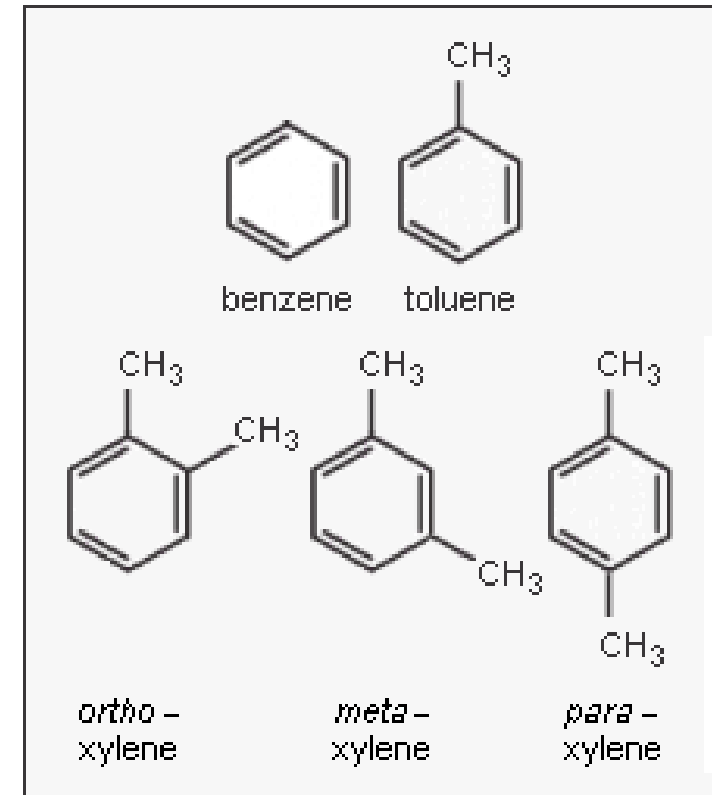
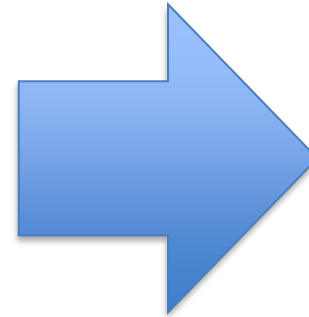


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BioBTX: Recycled Aromatics



Hoe?

1. Pyrolysis to produce volatile aliphatics and aromatics (and py gas)
2. Catalyzed conversion into aromatics
 - Using the py gas to power the unit



Opportunity!



Business proposition

- Huge market of >\$200 Bn, commodities used in countless chemical products
- Almost uniquely made by oil refineries, very hard to replace

Product sustainability benefits

- Circular product, and lower carbon footprint than from oil
- Can be made from biomass → biorefinery
- Can be made from (hard to recycle) plastic waste
- Defossilization ...

One word: Circular

- Het Stenen Tijdperk is niet geeindigd door een tekort aan stenen
- Het Olie tijdperk eindigt niet vanwege een tekort aan olie ...



One word: Circular

- Circulair is gewoon beter
 - Afval, biomassa, CO₂/H₂/hernieuwbare energie
- De chemische industrie kan alles maken uit elke grondstof
 - We zijn niet veroordeeld tot fossiele grondstoffen en Chemicals of Concern
- De mensen die jullie nu onderwijzen, gaan de wereld van 2050 inrichten – circulair!



Thank you



GC3 is a unique community of ~100 members, including:

