PLAST – EN EMBALLASJEVINNER!

Morgendagens plastløsninger for mat

7. Februar 2018

Dr. Siw Fredriksen, Advisor

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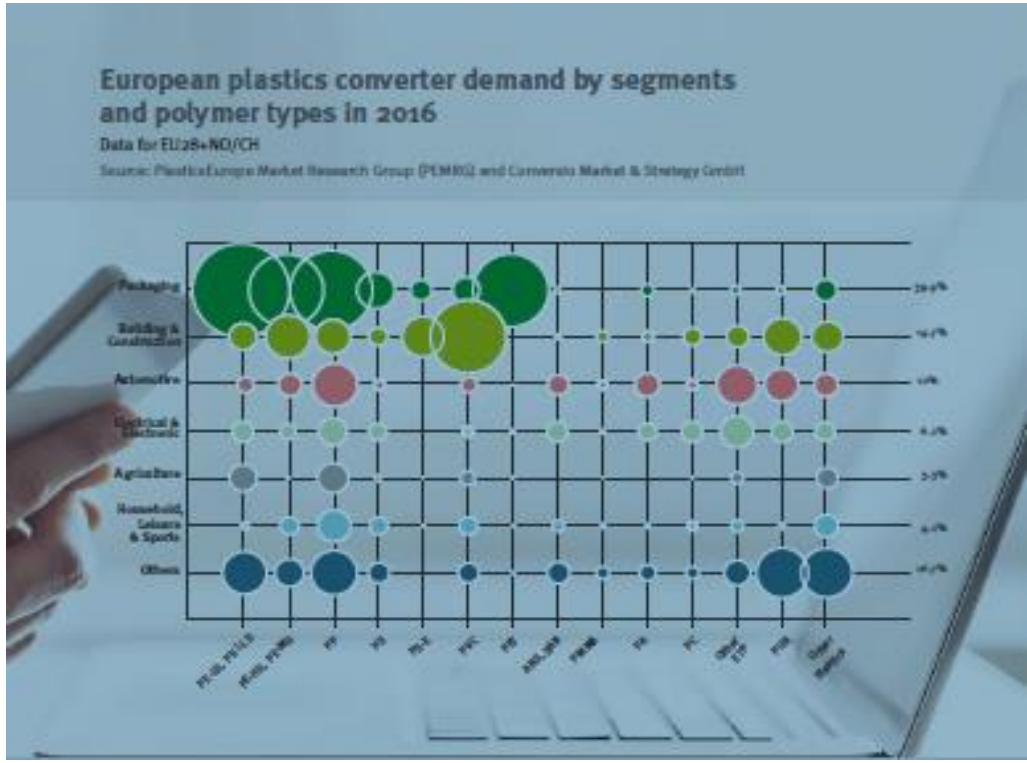
A Global market leader for Industrial R&D services in Polymers
- by exploring opportunities and discover Sustainable Solutions

PLASTICS – THE MATERIAL FOR THE 21ST CENTURY

- Plastics are an integral part of our daily life

  - and will continue to be so
    - competitive cost/performance
    - light weight
    - strong
    - protects food and reduces food waste
    - saves water and energy
- Plastics has numerous application opportunities
- Packaging is the largest market segment for plastics
- PE, PP and PET are the main polymers in packaging









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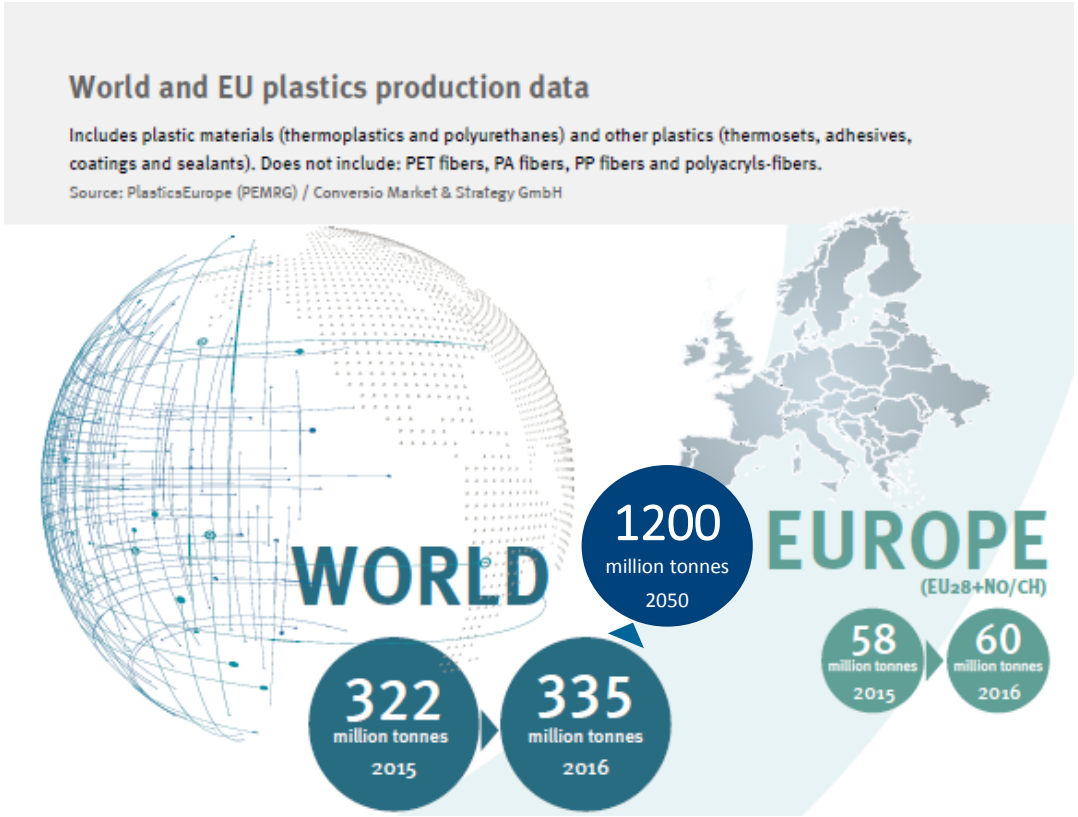
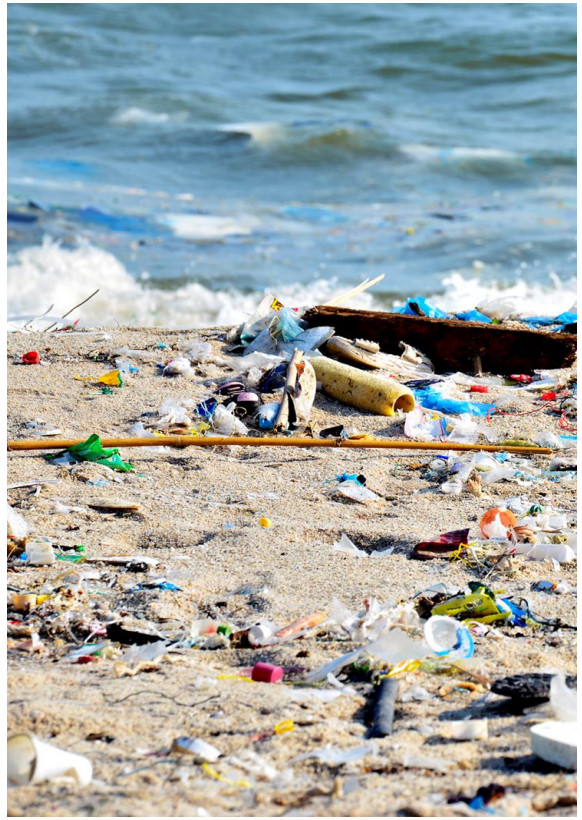
PLASTICS VOLUMES AND PLASTIC WASTE - CHALLENGES





- Plastics production - fourfold increase 2014 – 2050
- Increase in oil use from 5 % to 20 %

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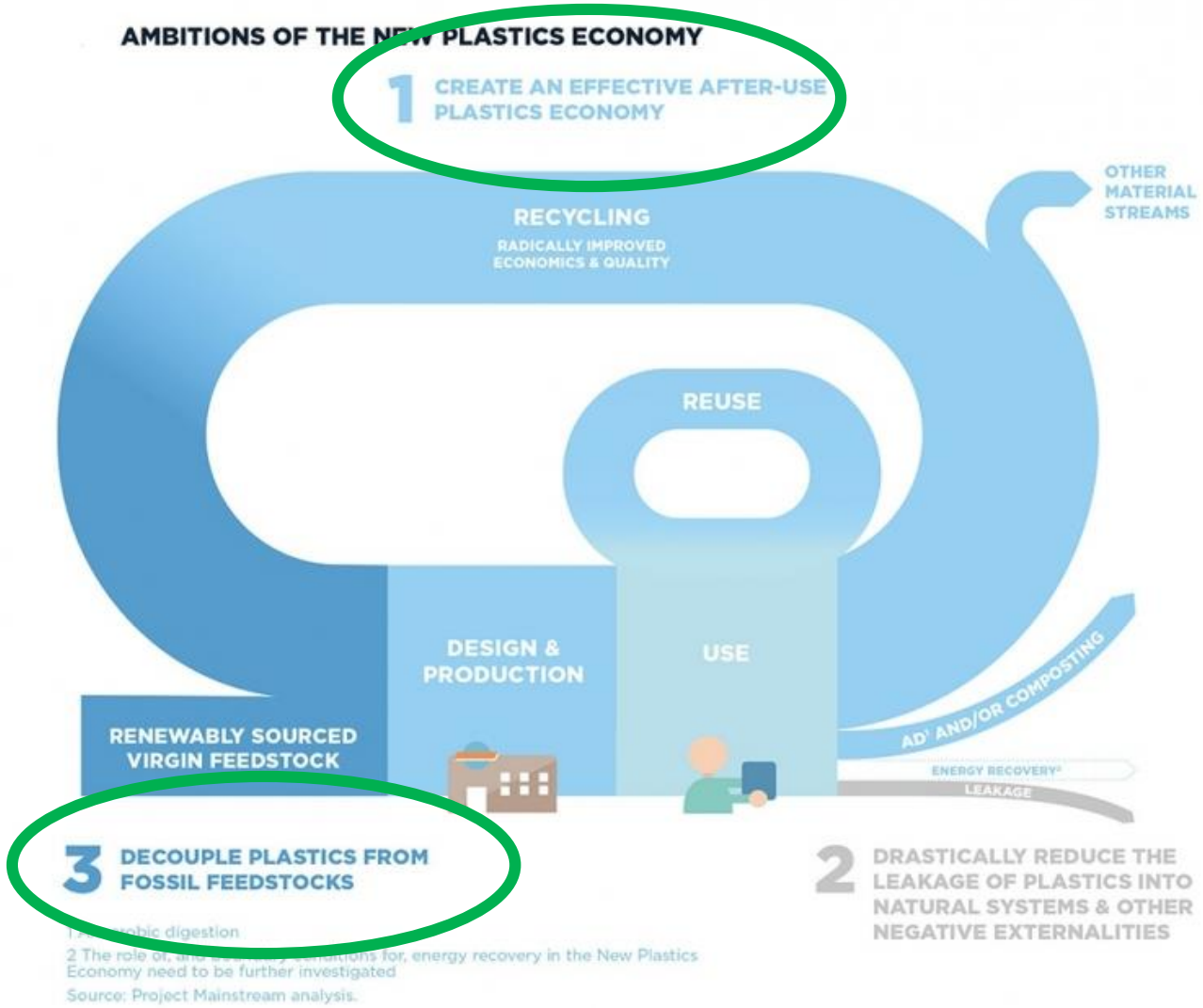
THE NEED FOR A NEW AND CIRCULAR PLASTICS ECONOMY



Source: The Ellen MacArthur Foundation (2016)

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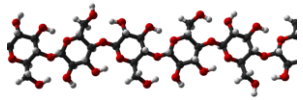
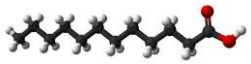
WHAT ARE THE NEW FEEDSTOCKS FOR FUTURE PLASTICS?

Generation 1
Carbohydrates
(sugar, starch), oil crops



Available & already there
Competing with food & feed

Generation 2

Cellulose, lignin



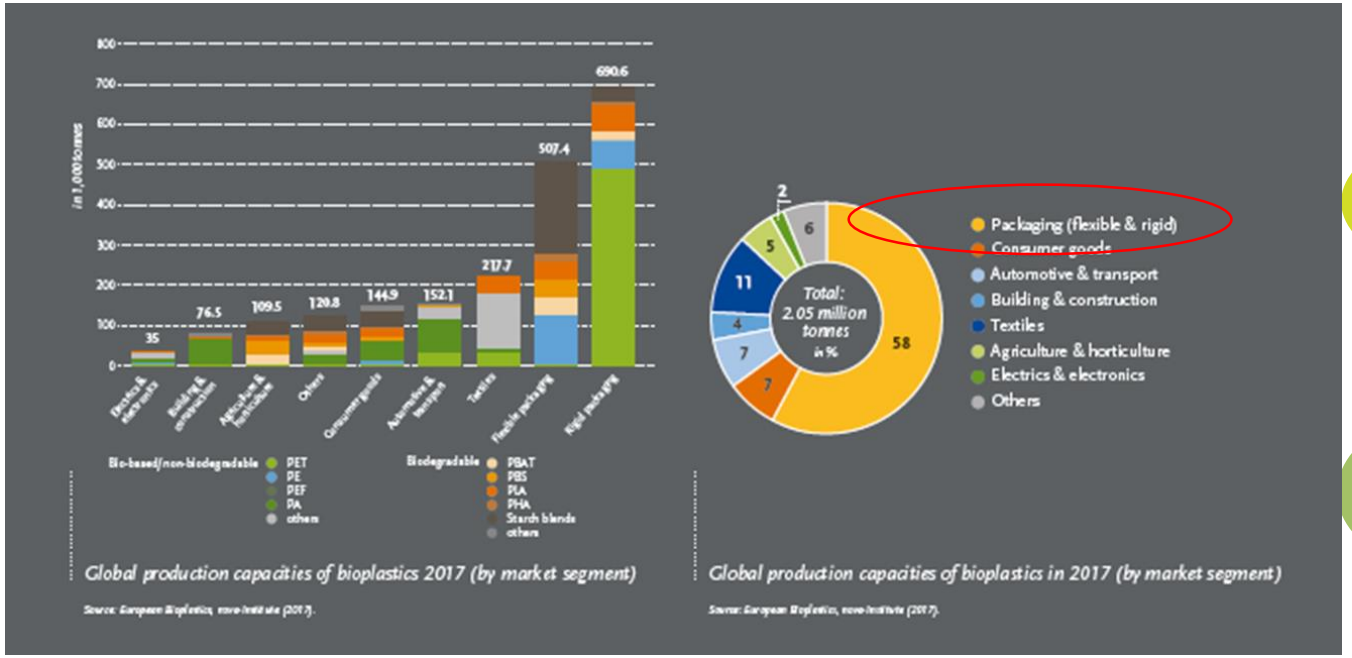
Available but more difficult
Not competing with food & feed

Generation next
CO_2, methane (GHG's)
Algae



Newcomers
More or less available
May/may not compete with food & feed

RENEWABLY SOURCED POLYMERS – WELL, BUT WHICH?



http://docs.european-bioplastics.org/publications/EUBP_Facts_and_figures.pdf

PE, PET

Black to green carbon («same, same»)

PEF

PLA, PHA

Green carbon only (+ «new stuff only»)

- Packaging is the largest market segment for biobased polymers
- Modest volume growth now expected (20 %/5 years); PET dominates

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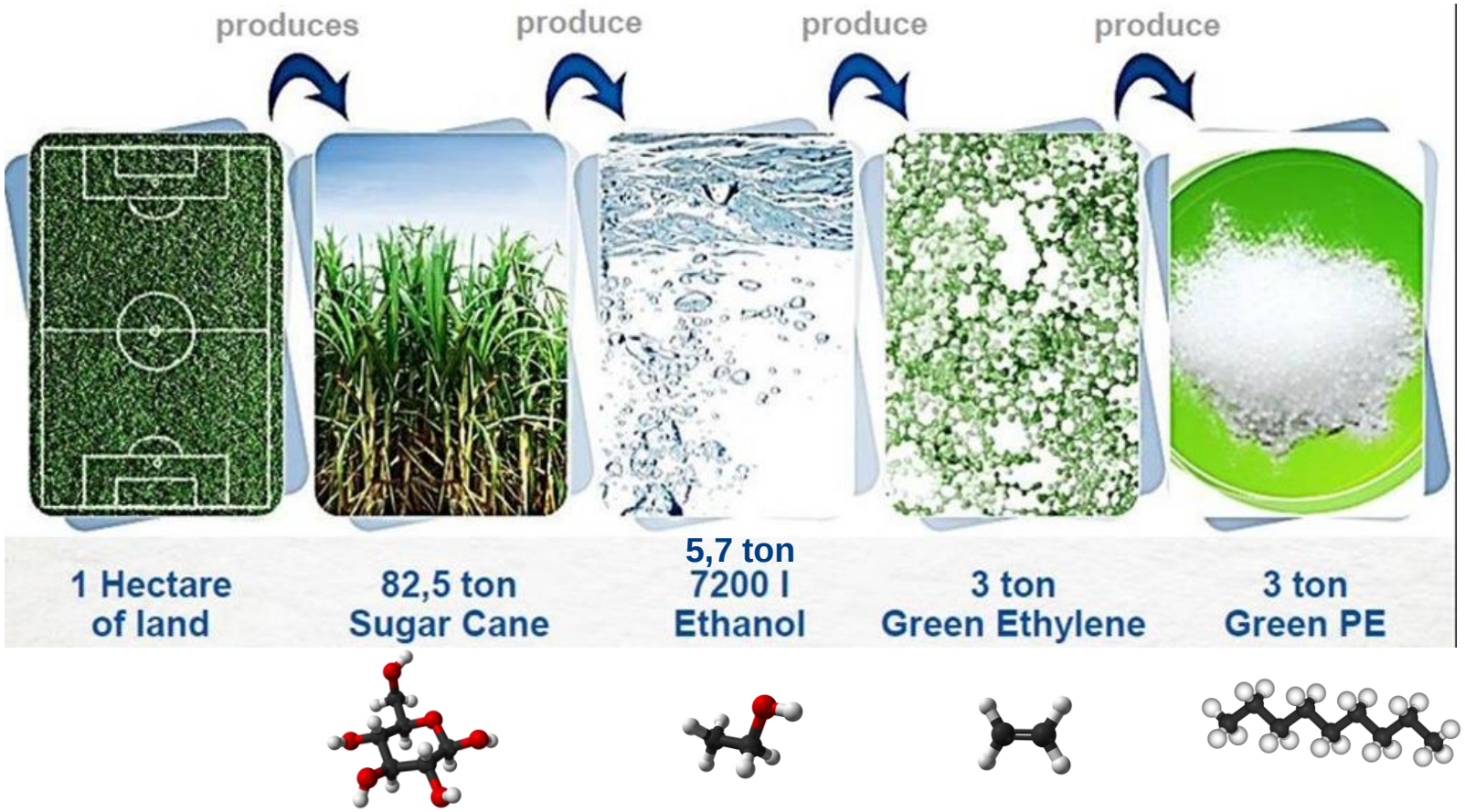
Green Polyethylene from sugar cane – Braskem



I'm green™ Plastic
Renewable source
Carbon reduction

Source: downloaded from https://polymerinnovationblog.com/bio-polyethylene-drop-in-replacement/

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PET – WELL DEVELOPED RECYCLING SCHEME

(Polyethylene terephthalate) PET

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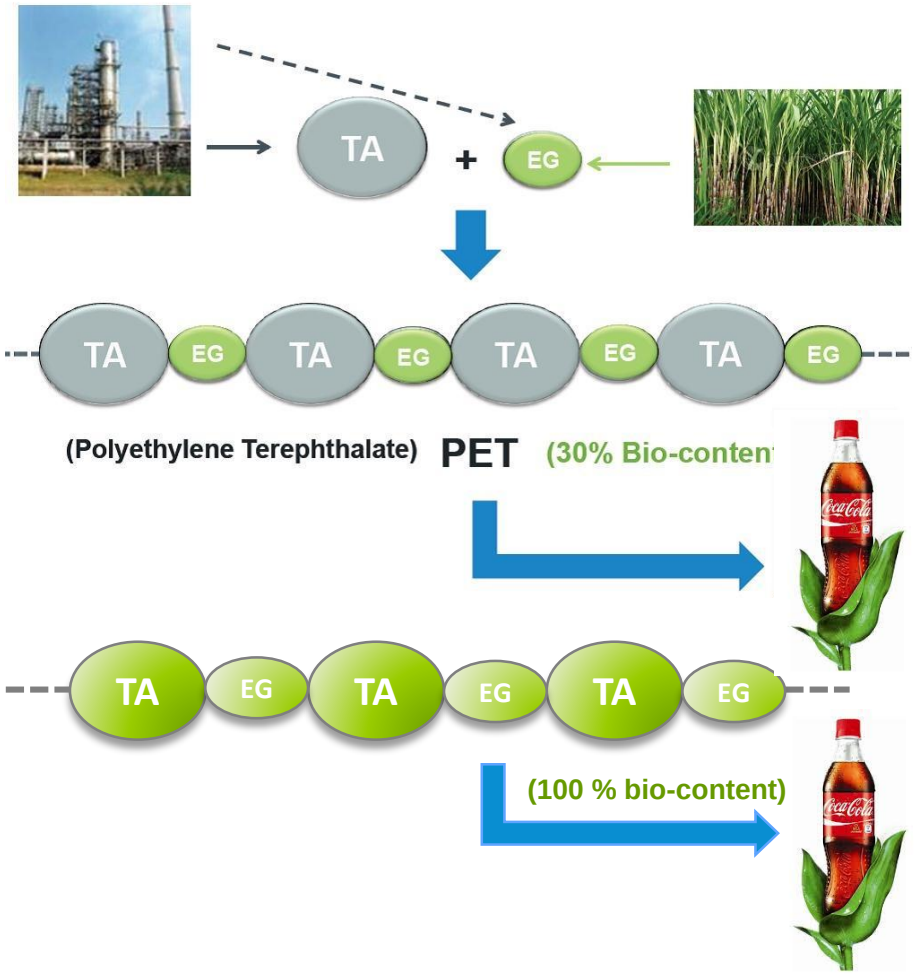
PET – BIOBASED PET IS A DROP-IN SOLUTION



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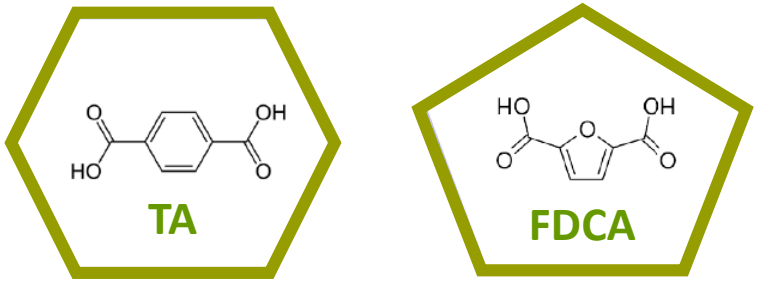
BIOBASED PEF – A NEW VALUE CHAIN IS REQUIRED



PET **PEF**

(Polyethylene furanoate)

https://www.avantium.com/press-releases/synvina-press-release/

http://www.virent.com/news/virent-bioformpx-paraxylene-used-for-worlds-first-pet-plastic-bottle-made-entirely-from-plant-based-material/

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PLA* – «NATURALLY BORN BIO» - FROM PLANT SUGAR

Improved PLA performance opens up high added value markets

TOTAL | Corbion

DANONE

*PLA (Poly Lactic Acid)

https://www.total-corbion.com/about-pla/pla-lifecycle/

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NORNER CONVERTS CO_2 TO POLYMERS

10 years experience in making polymers and polyols from CO_2 in Norner's lab

Application opportunities demonstrated: 40 % CO_2 in polymer – replacing oil!

The next step: Small scale pilot 2018/2019

The Research Council of Norway

9 INDUSTRY, INNOVATION AND INFRASTRUCTURE

11 SUSTAINABLE CITIES AND COMMUNITIES

12 RESPONSIBLE CONSUMPTION AND PRODUCTION

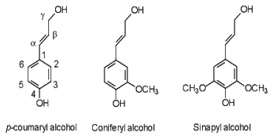
13 CLIMATE ACTION

17 PARTNERSHIPS FOR THE GOALS

NORNER – DEVELOPMENT OF BIO-BASED POLYMERS AND MATERIALS

ERA IB

The Research Council of Norway



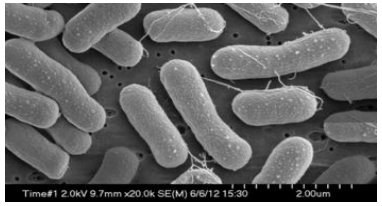
Chemicals

Materials
(cellulose, lignin)

Biobased composites

Biobased polymers

The Research Council of Norway



Polymer made by bacteria

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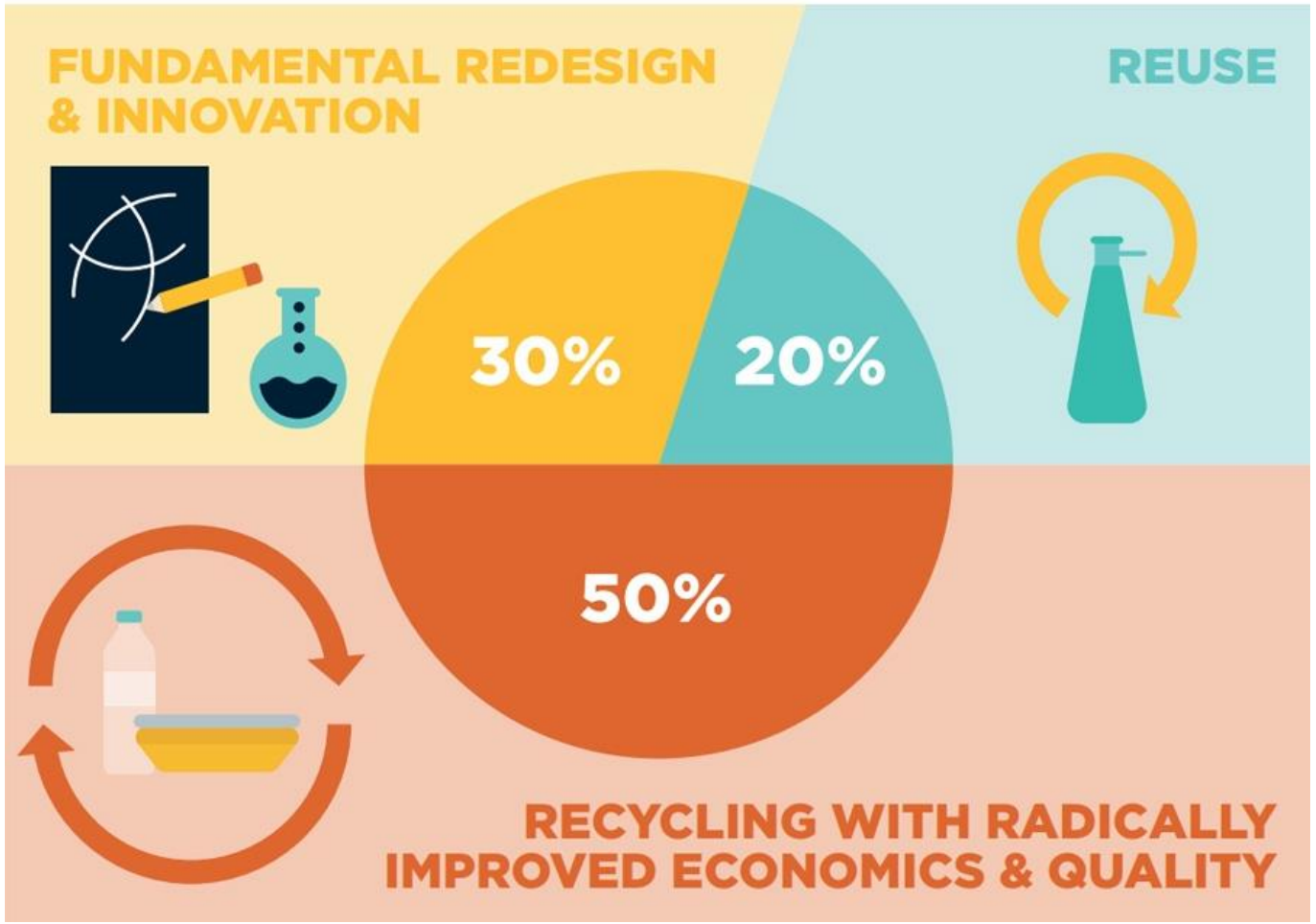
We need to solve the «circular challenge» for plastics of today

Three distinct transitions strategies to accelerate the shift towards the New Plastics Economy
(share of plastic-packaging market by weight)



Source: The Ellen MacArthur Foundation (2017)

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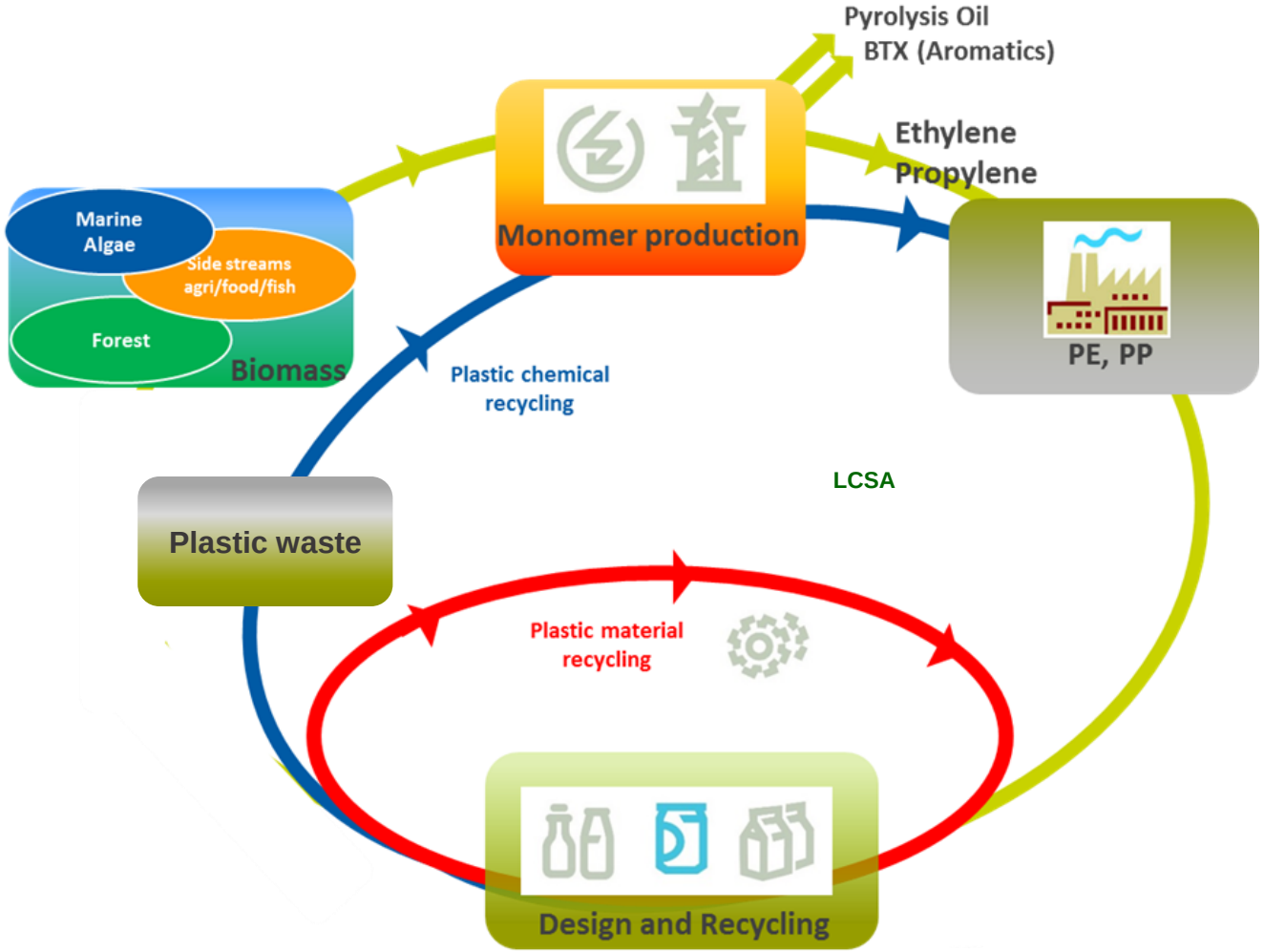
FUTUREPACK – FUTURE PLASTICS PACKAGING IN THE CIRCULAR ECONOMY

The FuturePack project will develop
"a comprehensive knowledge platform
for the Norwegian production of
sustainable packaging materials
from *Norwegian biomass* and *polymer waste* resources
in accordance with the principles of *circular economy"*

- 5 Norwegian RTO's
- 10 Norwegian industry partners
- The Research Council of Norway
- International IAB
- Duration: 4 years

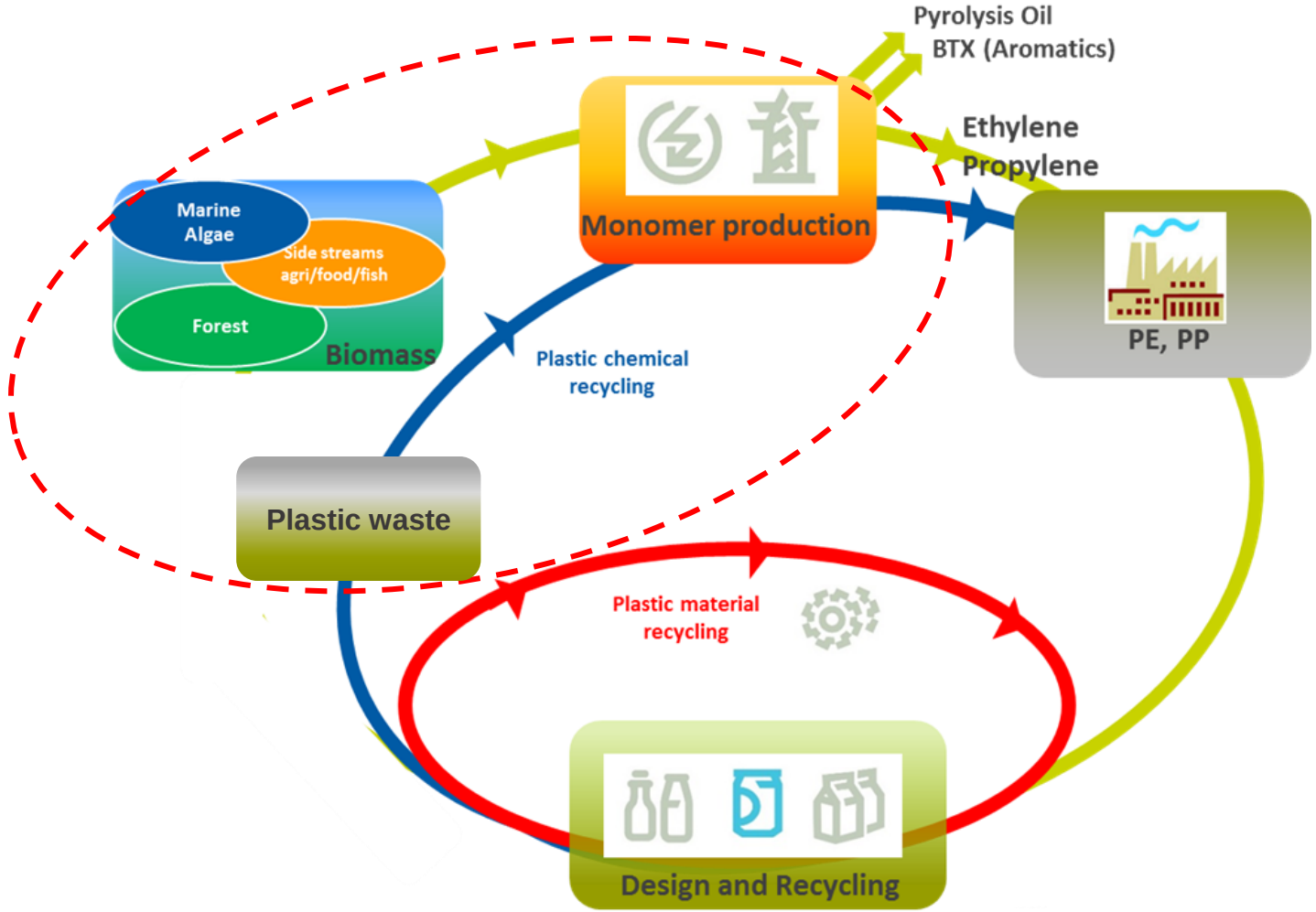


FUTUREPACK – MONOMERS FROM BIOMASS AND PLASTICS WASTE

Conversion to monomers by pyrolysis

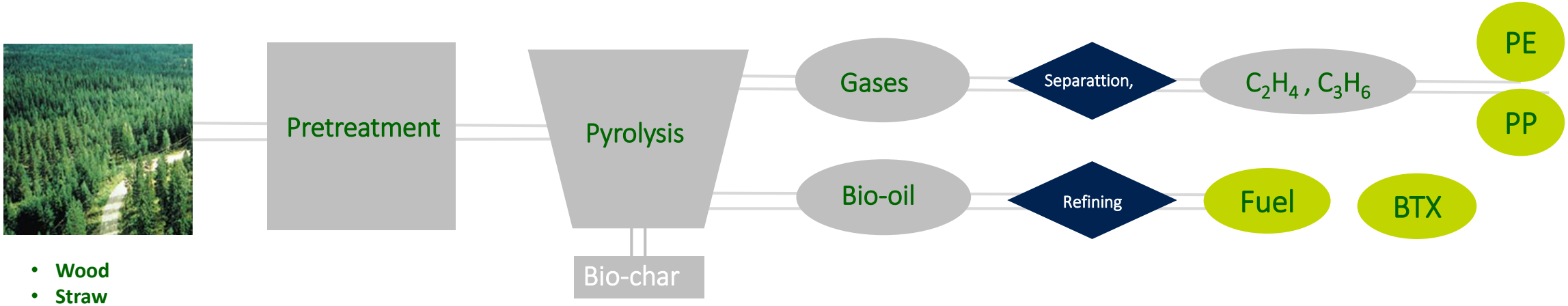
ethylene – for PE

propylene – for PP



FUTUREPACK - PE AND PP FROM BIOMASS?

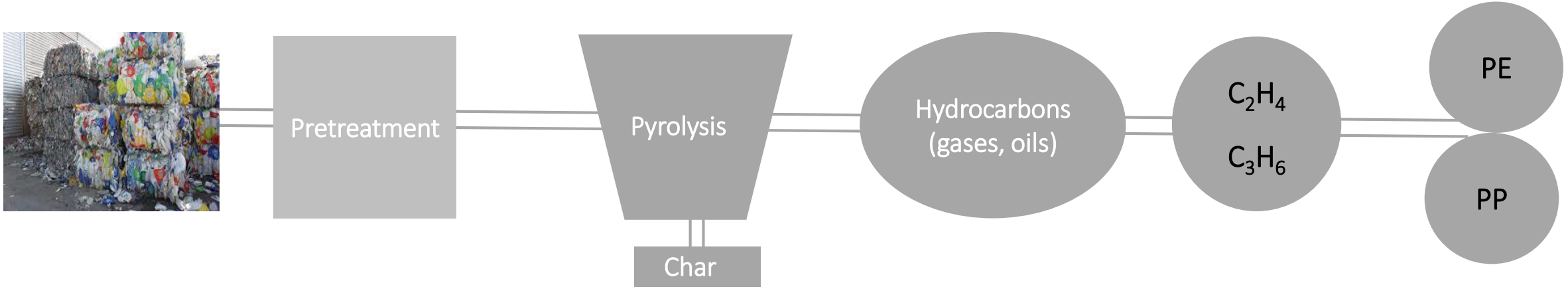
- Novel approach: Advanced thermochemical (pyrolysis) process for ethylene and propylene
  - Pyrolysis: High temperature, no oxygen
- High hopes: Bio-based virgin PE and PP



- **Wood**
- **Straw**
- **Algae??**

FUTUREPACK - PE AND PP FROM WASTE PLASTICS?

- New: Chemical recycling of waste plastics to ethylene and propylene (pyrolysis)
  - Pyrolysis: High temperature, no oxygen
- High expectations: «Laminate fix» - make virgin PE and PP



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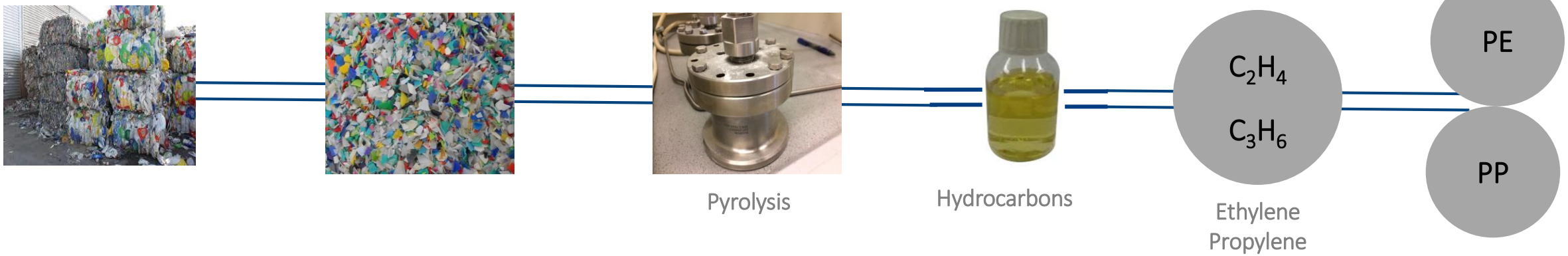
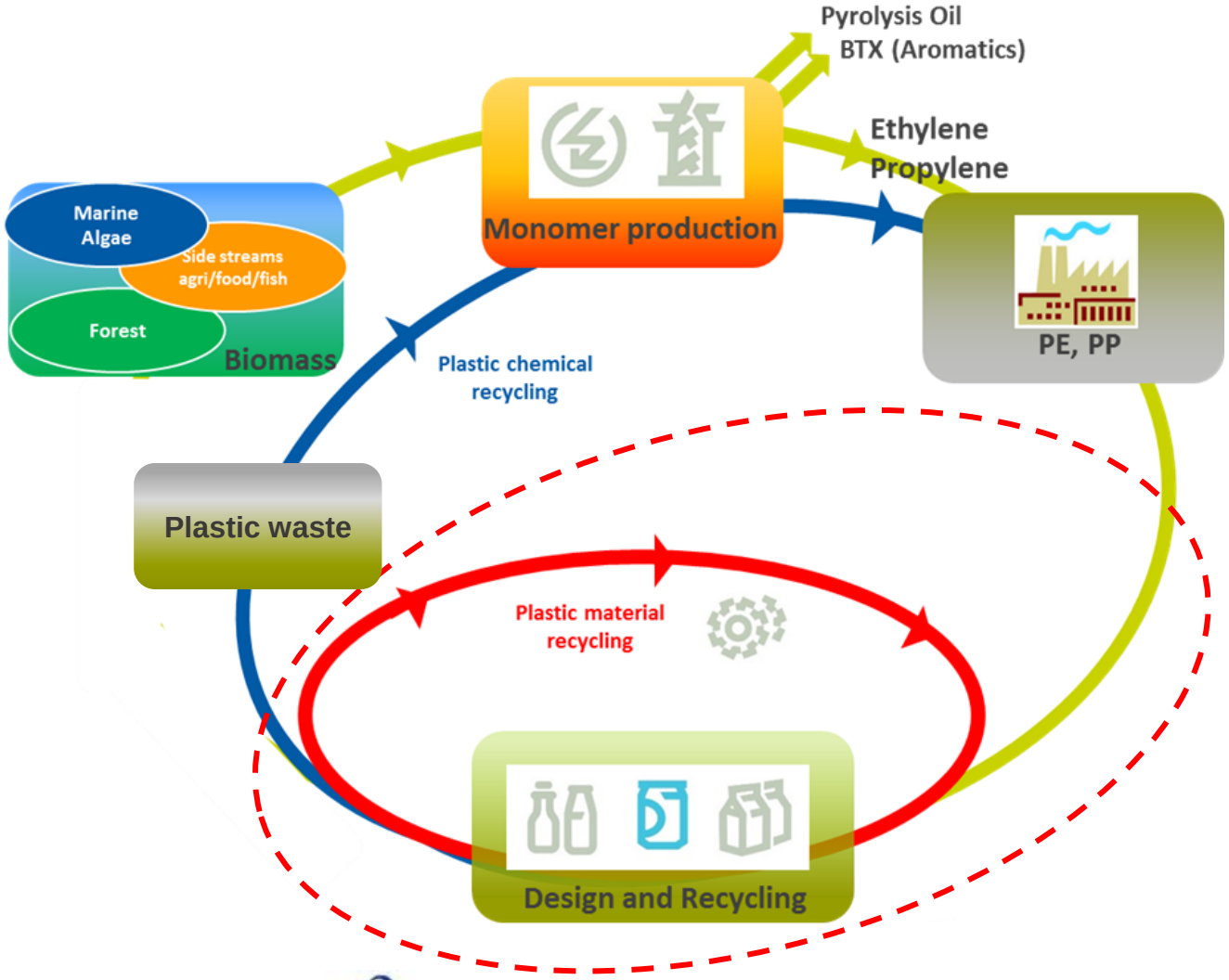


FUTUREPACK – PACKAGING DESIGN FOR RECYCLING

- *Use of recycled plastics in packaging*
- *Packaging design for recycling*



Recycled Plastics – retain performance

Collect & Sort + **Solve challenges** = **Material quality**

Virgin PE, PP

PCW «BINC»
- Sort, single stream

PCW
- Sort, broad

- Colours
- Migration/chemicals
- Labels
- Taste
- Odour
- Adhesives
- Inks
- Washing (cold/hot)
- Content residues/emptying

- Polymer properties
- Polymer performance
- Product consistency

Documentation

- ✓ Effect of improved sorting
- ✓ Effect of washing
- ✓ Effect of re-extrusion/processing
- ✓ Migration/Chemicals
- ✓ Quality of recyclate

Development

Innovation

- ➢ Design for recycling
- ➢ Novel additivation packages
- ➢ Novel inks & adhesives
- ➢ Compatibilisers
- ➢ Material enhancers

DESIGN FOR RECYCLING – NO MORE MULTILAYERS!?

1) *Multimaterials for non-barrier applications –*
replace with monomaterial laminates

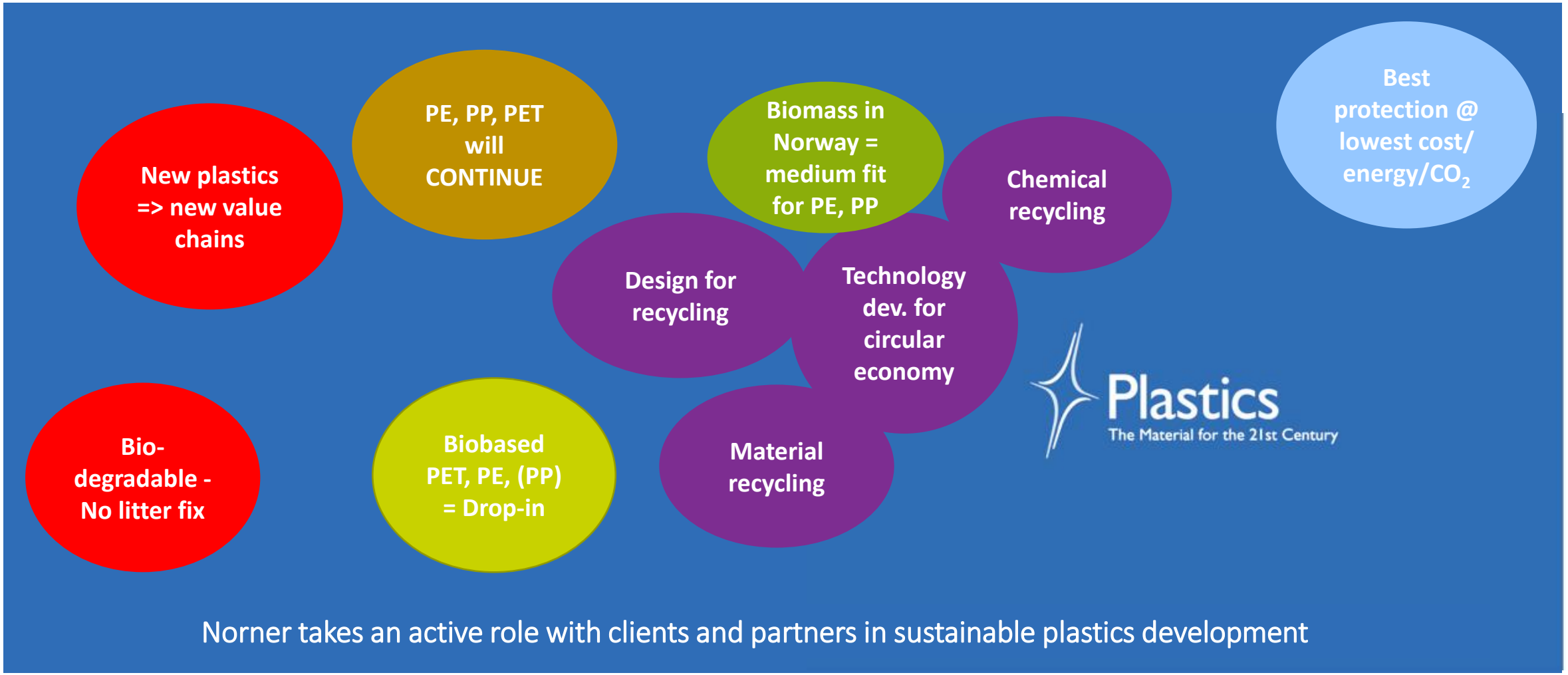
- Case: Substitute PET/PE or PP/PE laminates with PE/PE or PP/PP
- Evaluate: Material composition, properties and packaging
- Innovation: Lamination technology (PE vs. PUR glue)

First case studies

2) *Multimaterials with gas barrier for long shelf life -*
replace current solutions with recyclable solutions

- Case: Substitute PE/PA laminates with PE/PE, opt. w/EVOH
- Evaluate: Shelf life and storage conditions
- Innovation: Active packaging for shelf life extension

PLASTICS – PACKAGING MATERIAL FOR THE FUTURE



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Norner powers up for the future

FuturePack

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