



BASF
We create chemistry

TPU made from rubber & further sustainable loops @ BASF

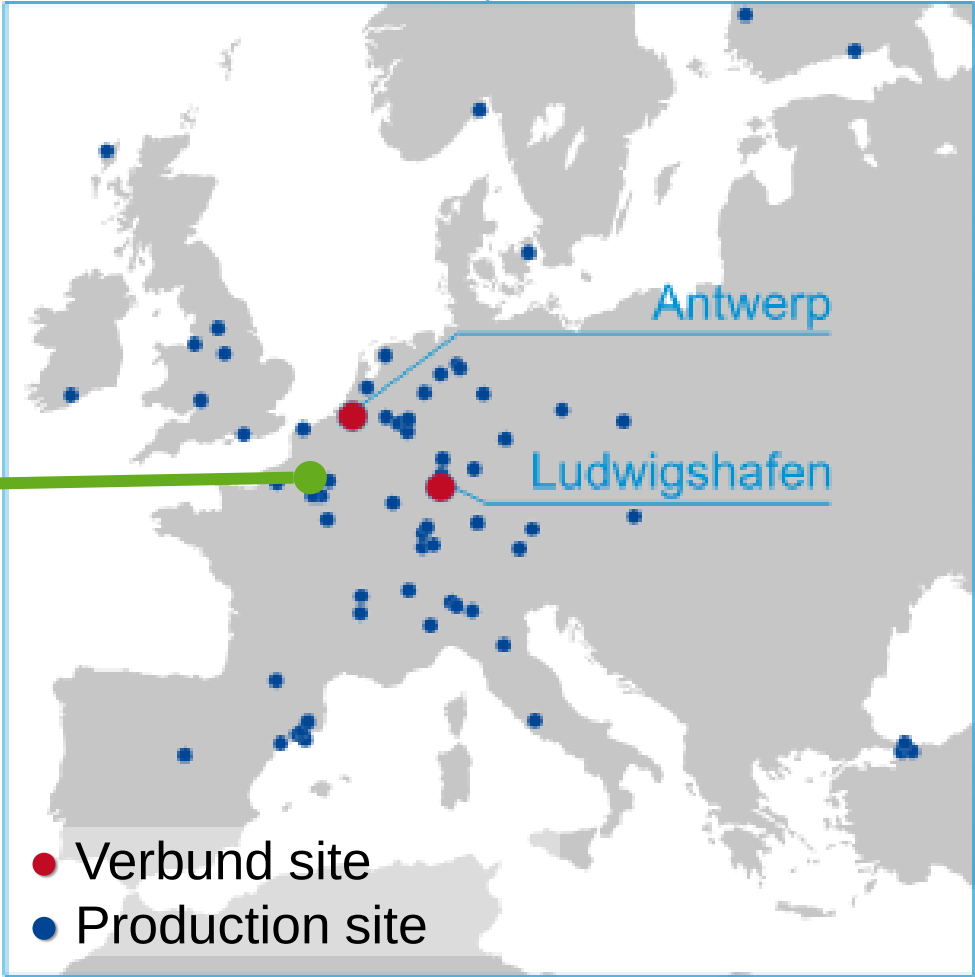
Dr. Giulio Latini & Dr. Lena Funke

DKT Tagung Nürnberg July 1st – 4th, 2024

BASF Polyurethanes



Lemförde

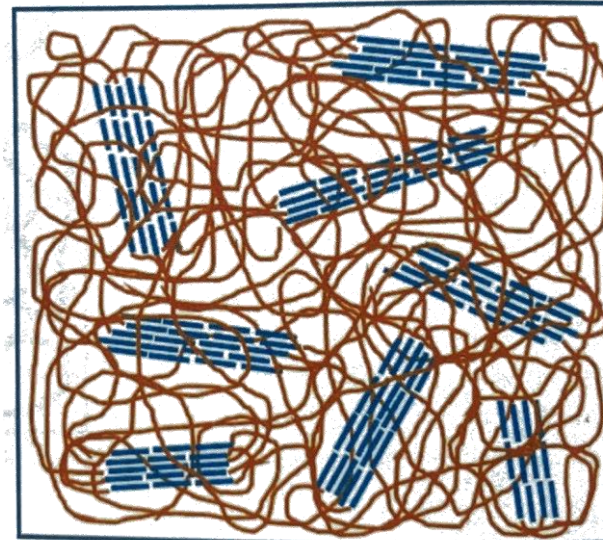
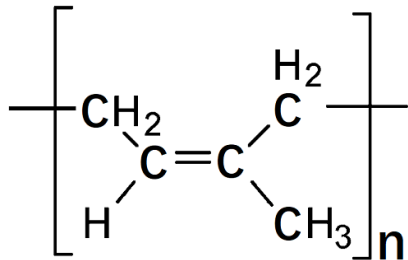
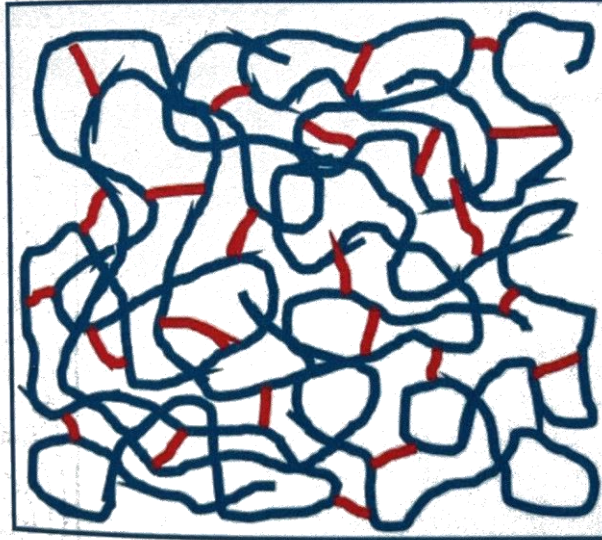


 **BASF**
We create chemistry

Rubber and TPU

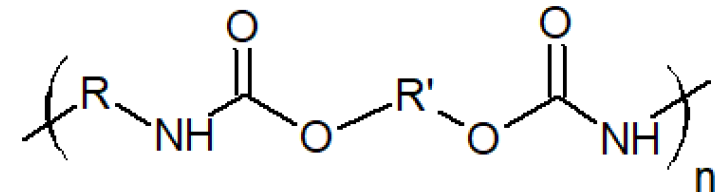
Vulcanized rubber

- Thermosetting
- Chemical crosslinking
- Homoatomic



TPU

- Thermoplastic
- Physical crosslinking
- Heteroatomic



Our contribution to a climate-neutral future



Carbon Management

2030: -25% emission compared with 2018.*

2050: Net zero emissions.

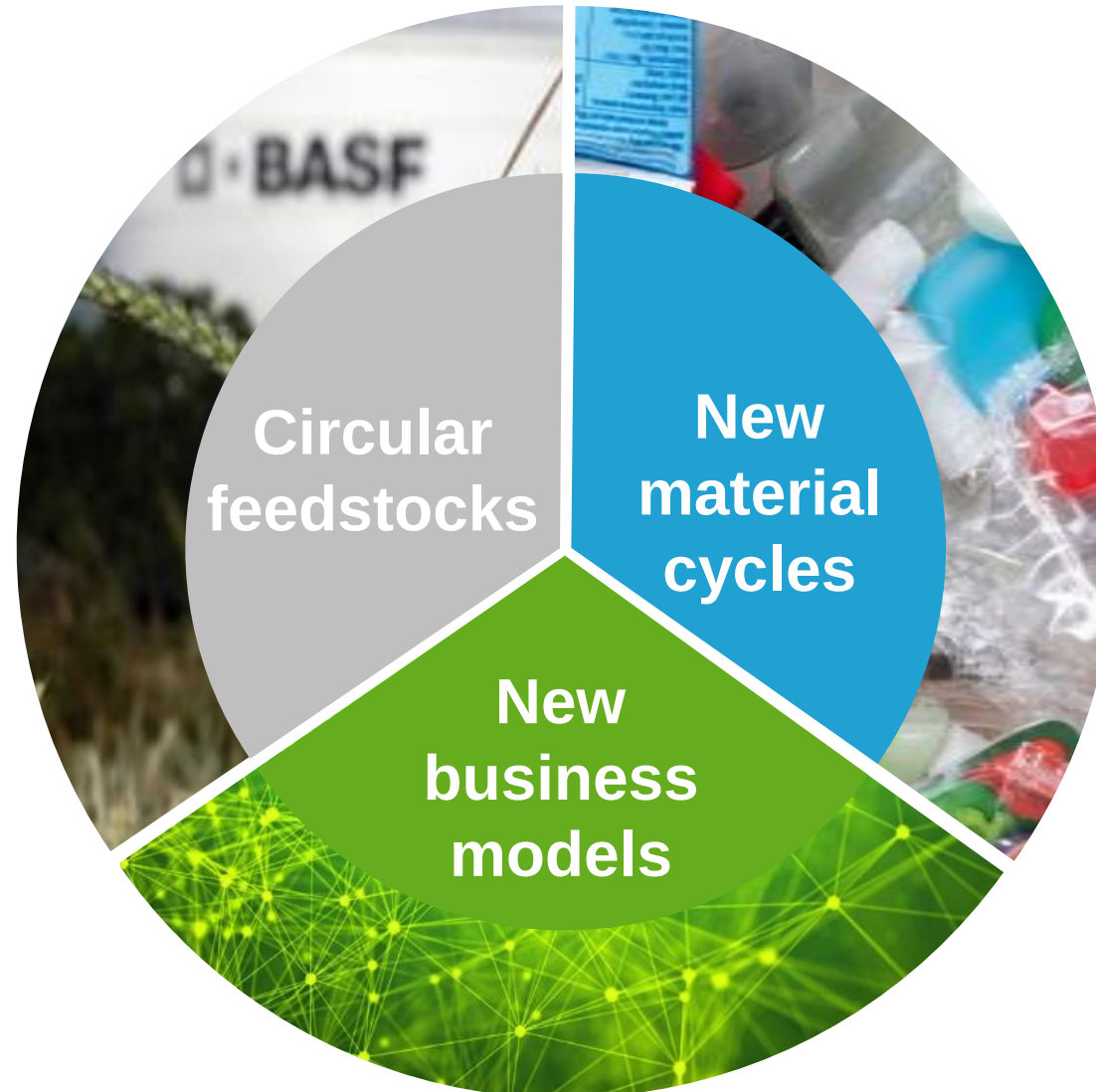


Circular Economy

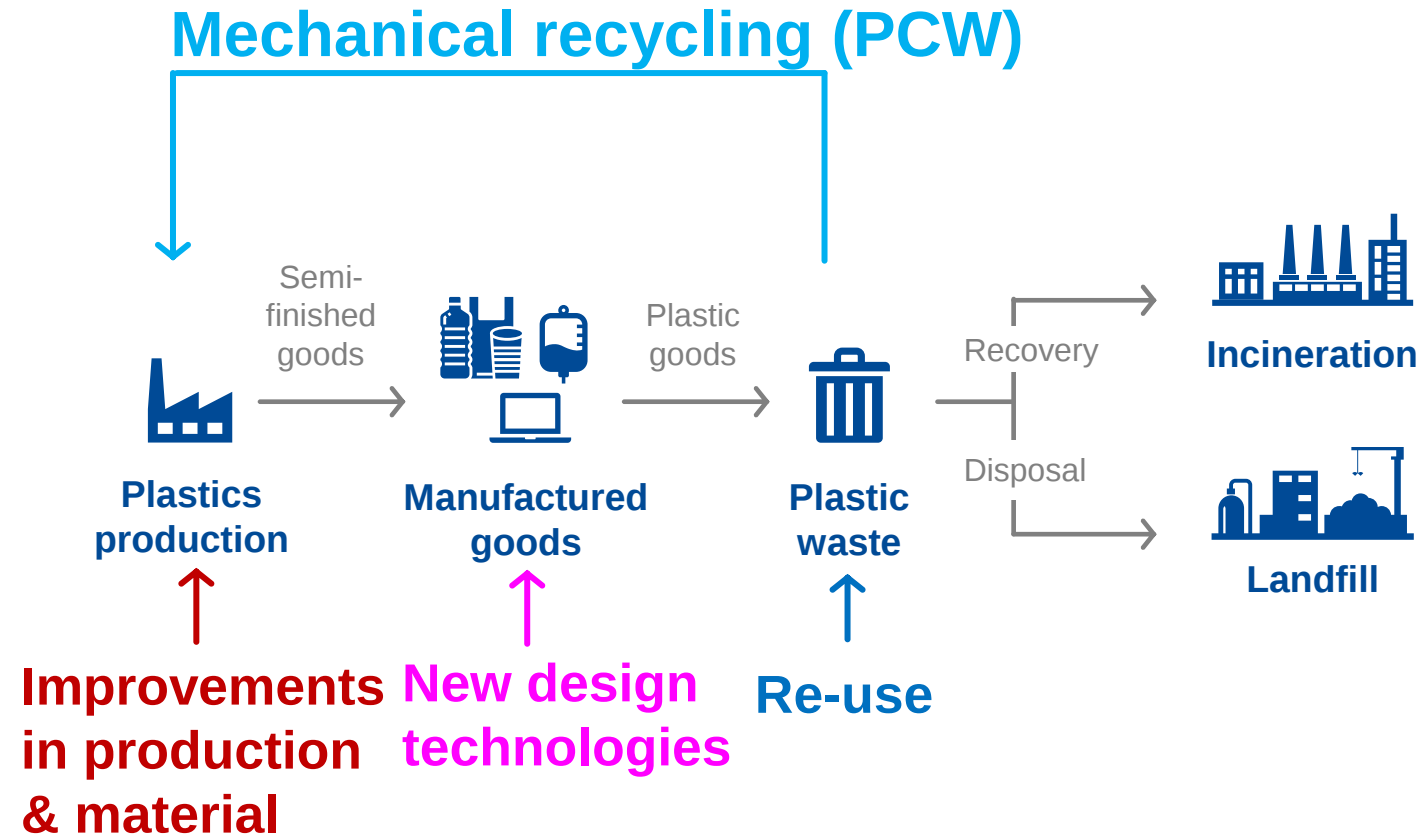
2030: double** circular sales to reach **€17 billion.**

- Recycled and renewable feedstocks
- Close and extend material loops

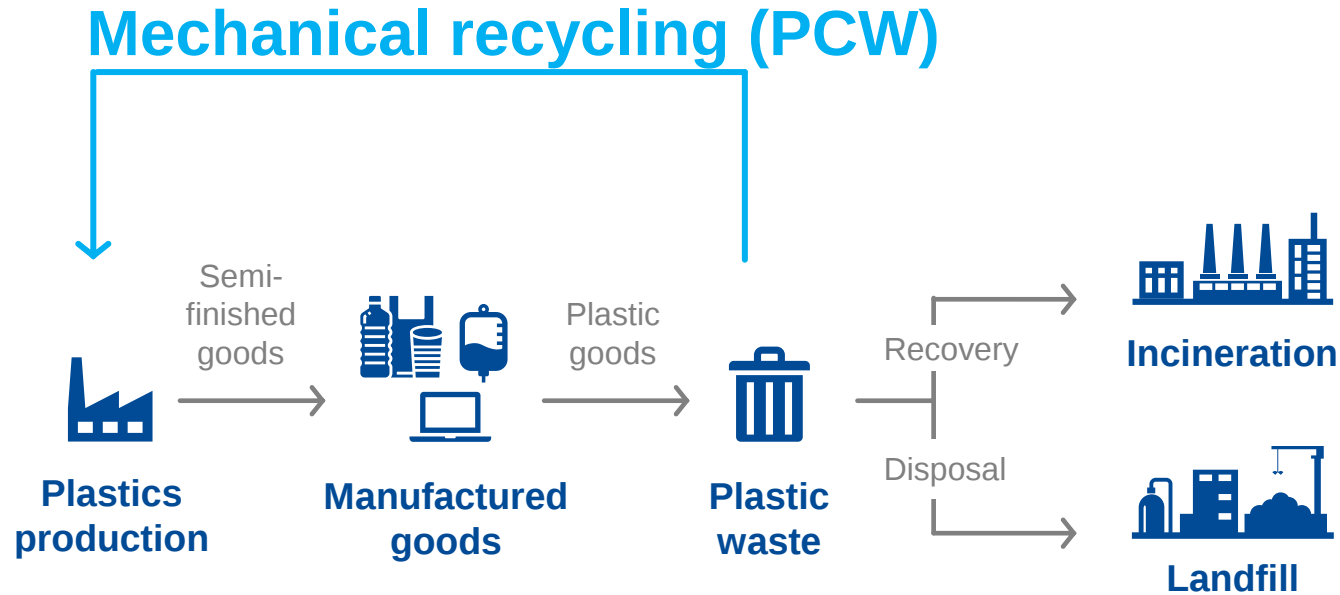
We have three areas of focus



Post-Consumer Waste (PCW) loop – 1



Post-Consumer Waste (PCW) loop – 2



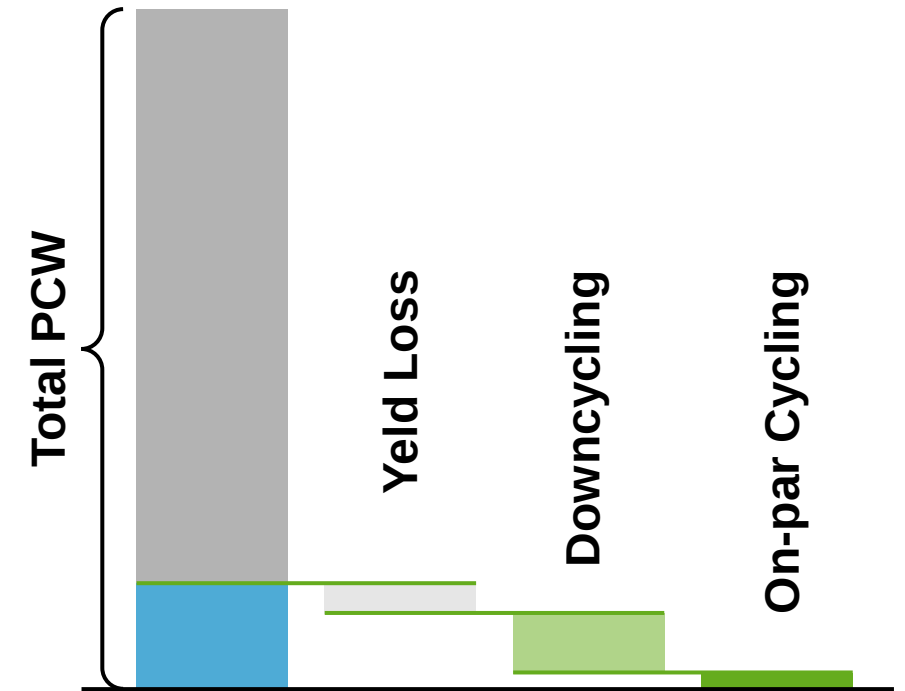
❖ Chemical aging

❖ Sorting accuracy

❖ Contamination

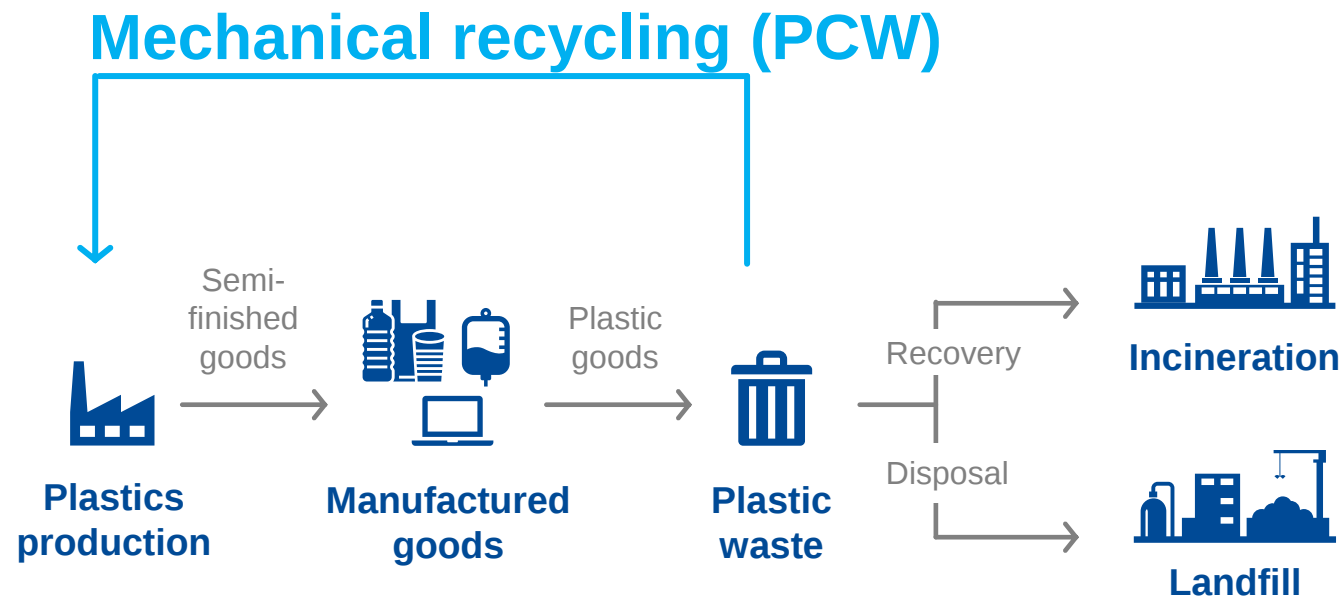
❖ Banned substances

Only 10% of plastic wastes are recycled*



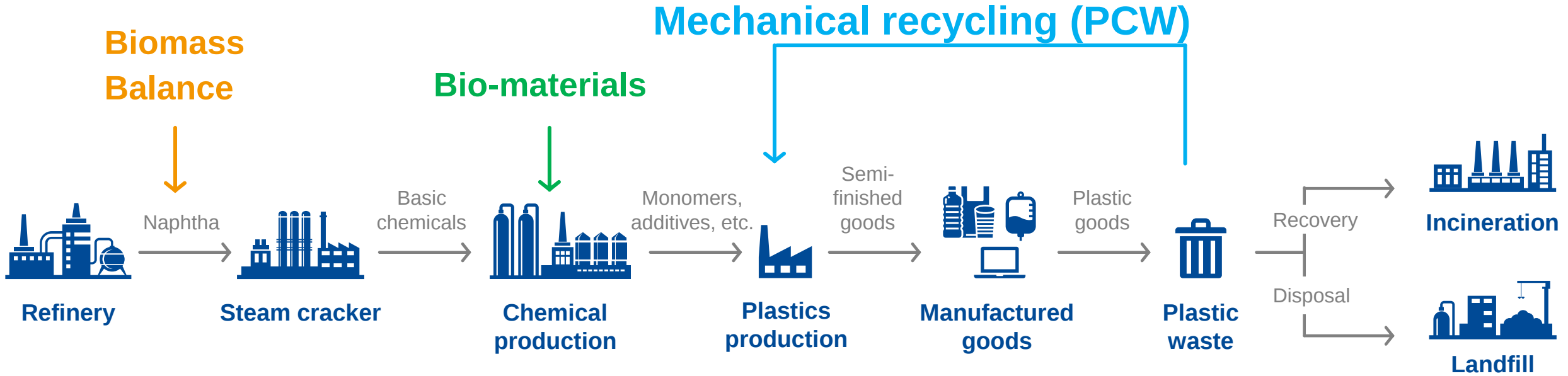
* Based on KPMG report – „From waste to Commodity - delivering on the EU's vision of a circular plastics economy"

Post-Consumer Waste (PCW) loop – 3



More info at [MechanicalRecycling.com](https://www.mechanicalrecycling.com)

Mass Balance Certification



Palm oil and Agricultures



Timber



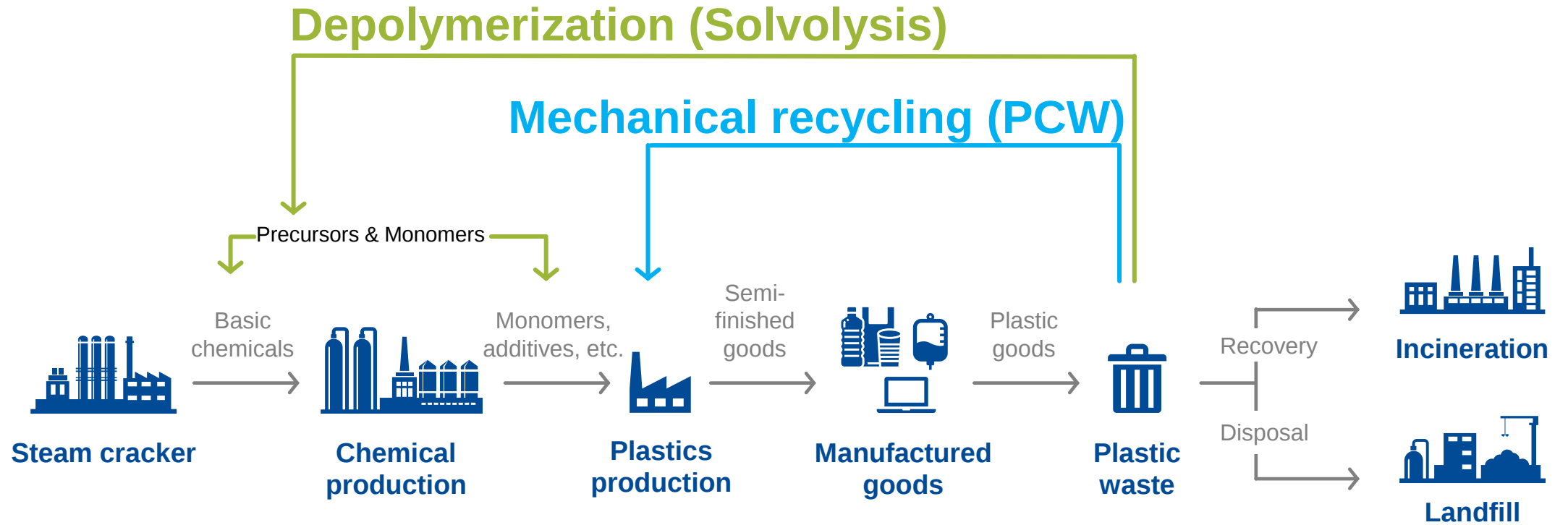
Biofuels



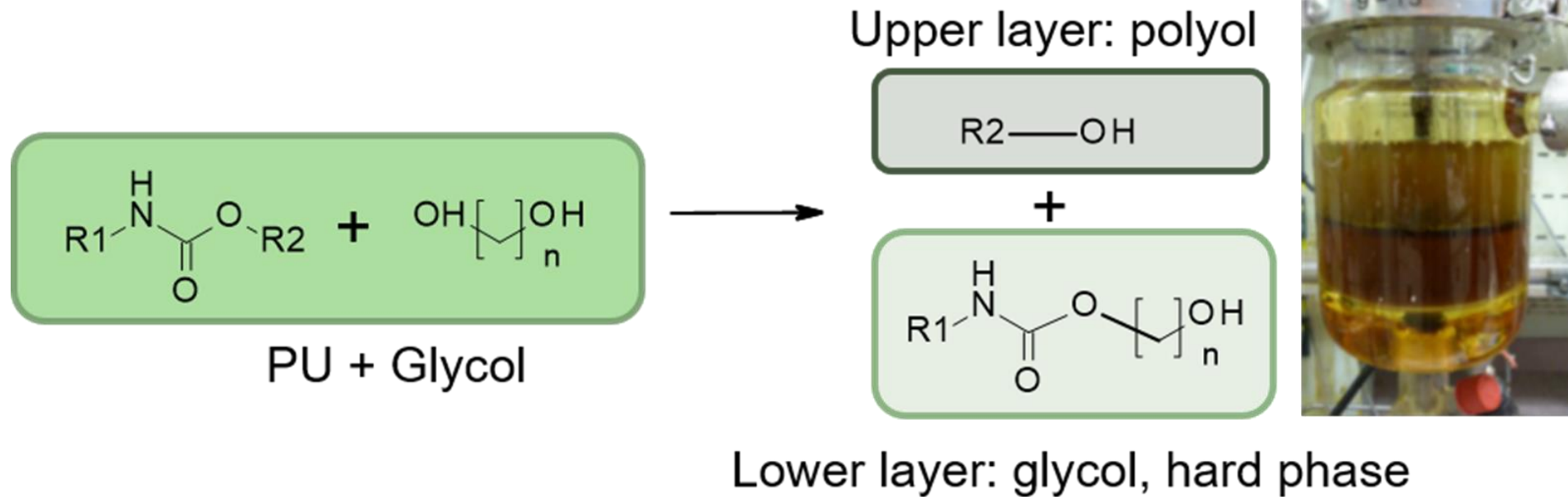
Circular feedstocks



Expanding recycling loops – 1

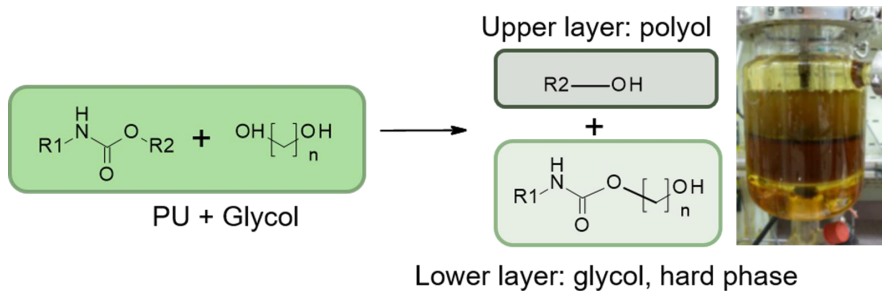


Solvolysis of crosslinked PEOL-PUs

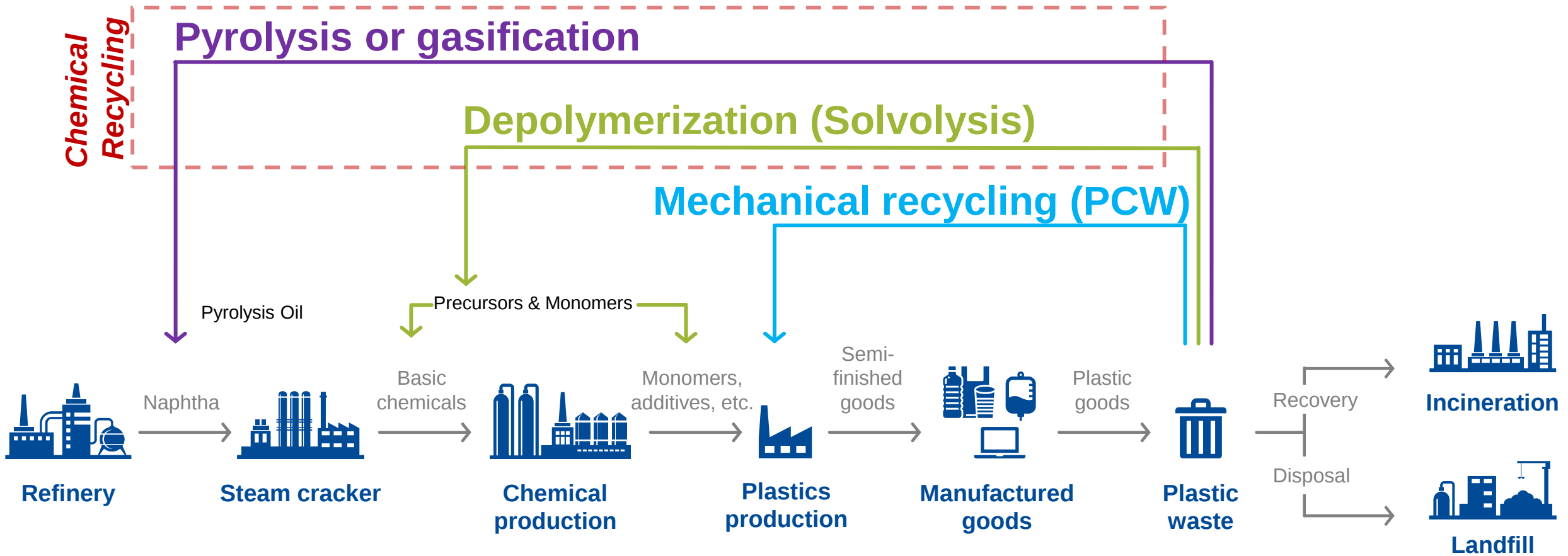


Putting the mattress waste problem to bed with Neveon

- In Europe, **40 million mattresses per year**
- BASF is **recovering high quality polyols**
- Neveon is manufacturing new high-quality **mattresses from regained polyols**
- Together aim to **close the loop**



Expanding recycling loops – 2



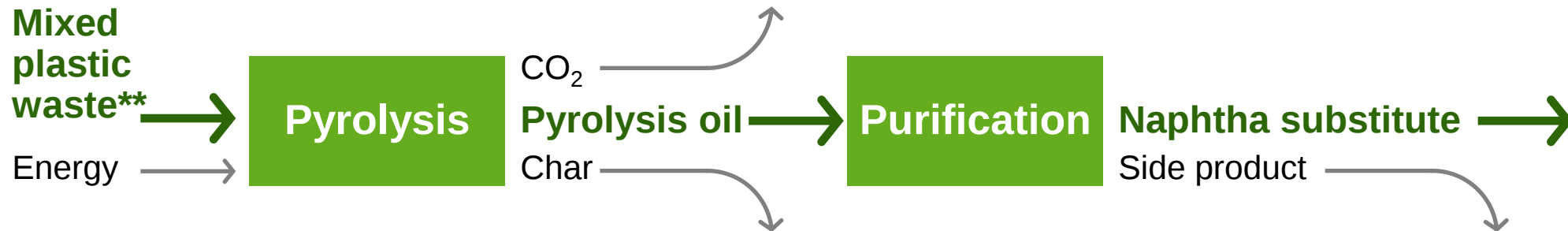
ChemCycling™ (Chemical Recycling via pyrolysis)

~70% conversion to
pyrolysis oil

Almost no external
thermal energy used

~50% conversion to
new plastics

Identical quality as
fossil-based
plastics achievable*



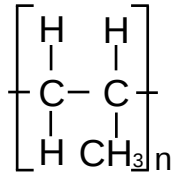
* under application of a mass balance approach

** from a sorting plant

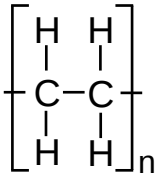
Pyrolysis is not the optimum solution for all waste plastics

Without heteroatoms

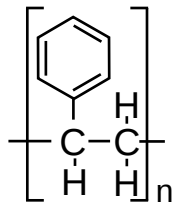
Polypropylene (PP)



Polyethylene (PE)



Polystyrene (PS) + EPS



Pyrolysis works well for **polyolefines** (e.g., NR, SBR, BR rubber, etc)

❖ **Broader waste-mix**

❖ **Pyrolysis plants can be built efficiently on smaller scale**

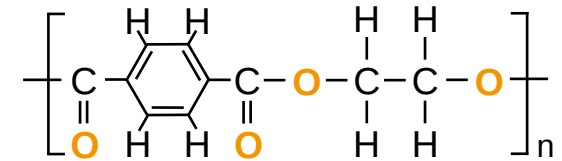
Heteroatomic polymers require elaborate cleaning of pyrolysis oil as

❖ catalyst poisoning (**N**, **O**, **S**)

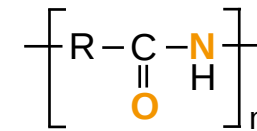
❖ corrosion (**Cl**)

With heteroatoms

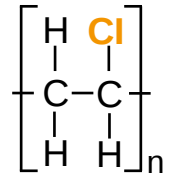
Polyethylene terephthalate (PET)



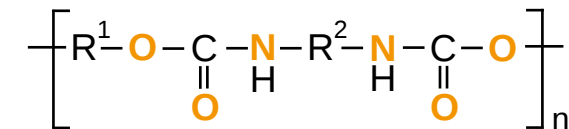
Polyamide (PA)



Polyvinyl chloride (PVC)



Polyurethane (PUR)



Ccycled® products examples in core industries

Since 2020, our customers successfully launched commercial products

Food Packaging



Südpack: Mozzarella and sausage packaging

Vartdal / Ekornes: Fish box

STEPAC: Fresh produce packaging

Imballagi Alimentari: Ice-cream boxes

Packaging



BSH: Protection packaging

Hirsch / Eutecma: Pharma box

Textiles



Vaude: Outdoor gear

Fulgar: Yarns

Pompea: Underwear

Transportation



Mercedes-Benz: Door handle

Engineering Plastics



Zell-Metall: Engineering Plastic Stock Shapes

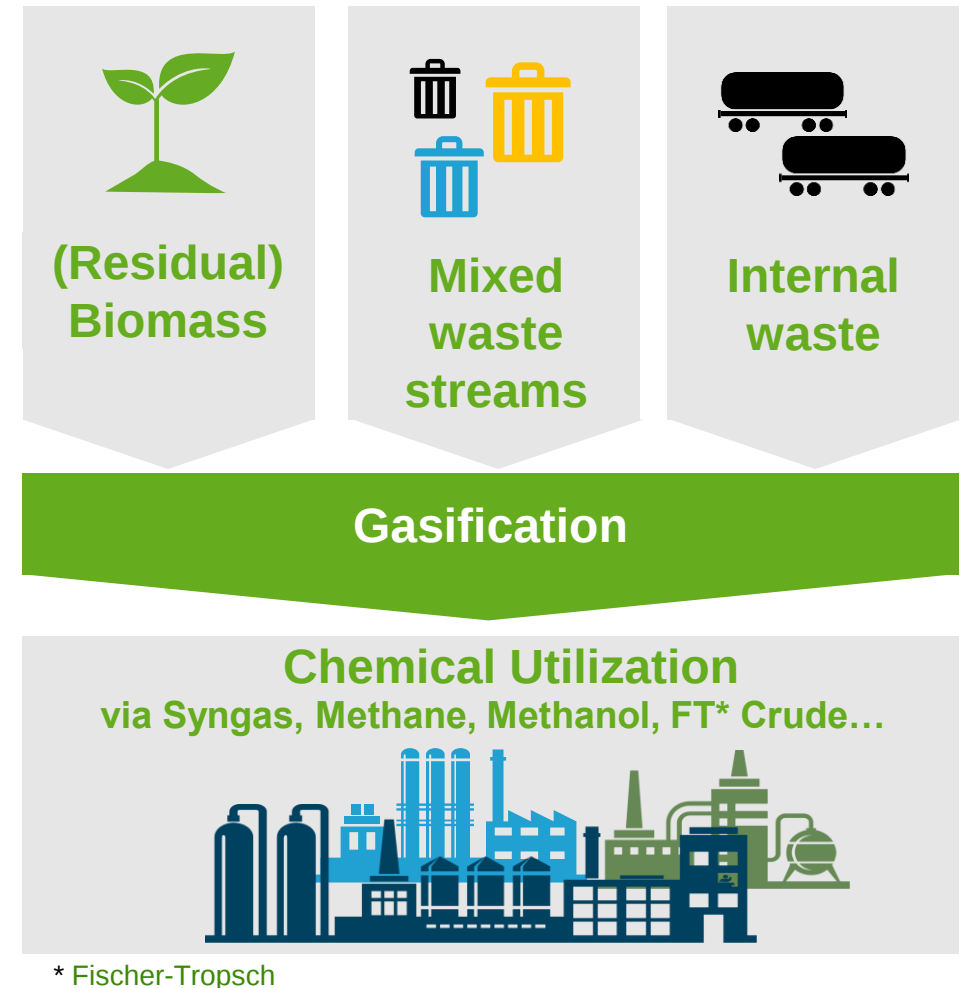
Technical Film



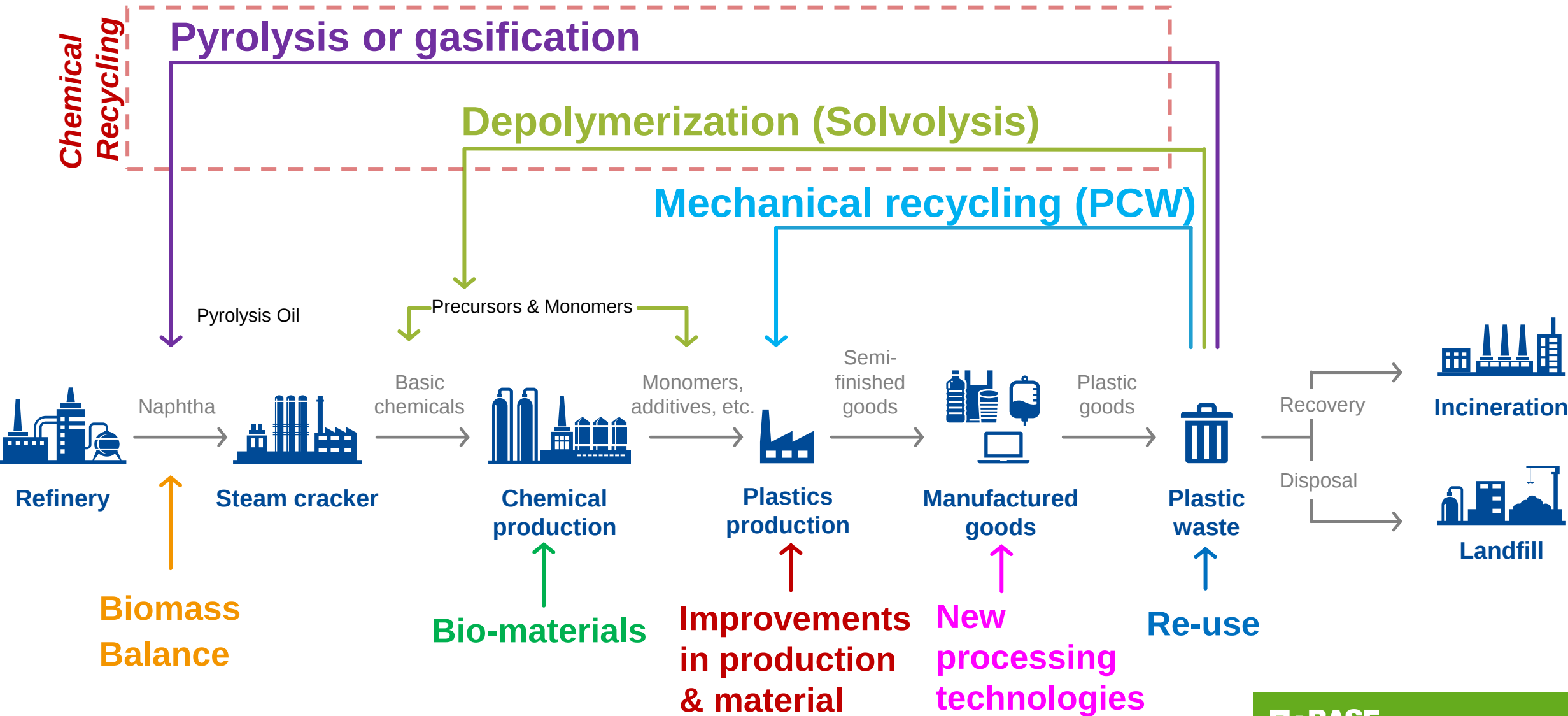
Bowcraft: Roof underfelt membrane

Gasification enables further potentials

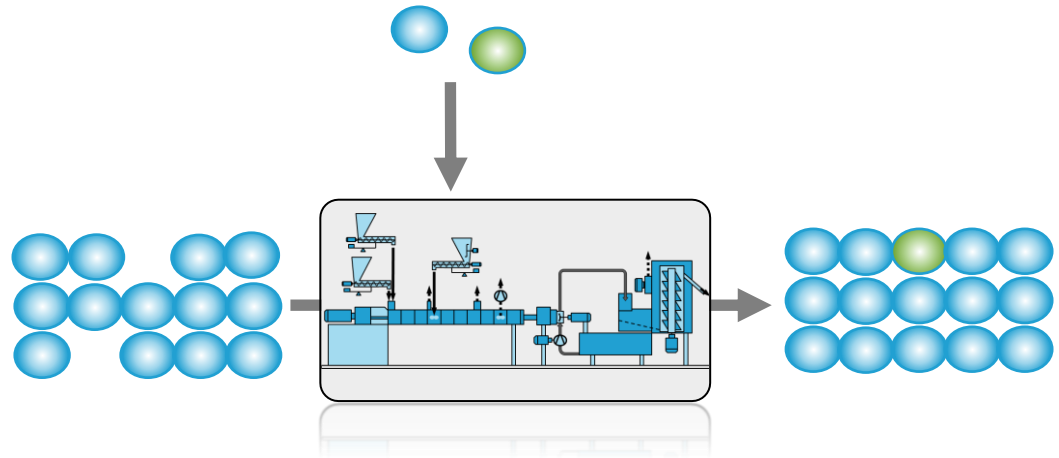
- **Heterogeneous waste streams**
- **Complementary** and scalable solution
- Potential enabler for **recycled and biogenic feedstocks**
- Products for **different value chains**:
 - ▶ syngas,
 - ▶ methanol,
 - ▶ methane,
 - ▶ Fischer-Tropsch crude/liquid hydrocarbons



The circular economy at BASF

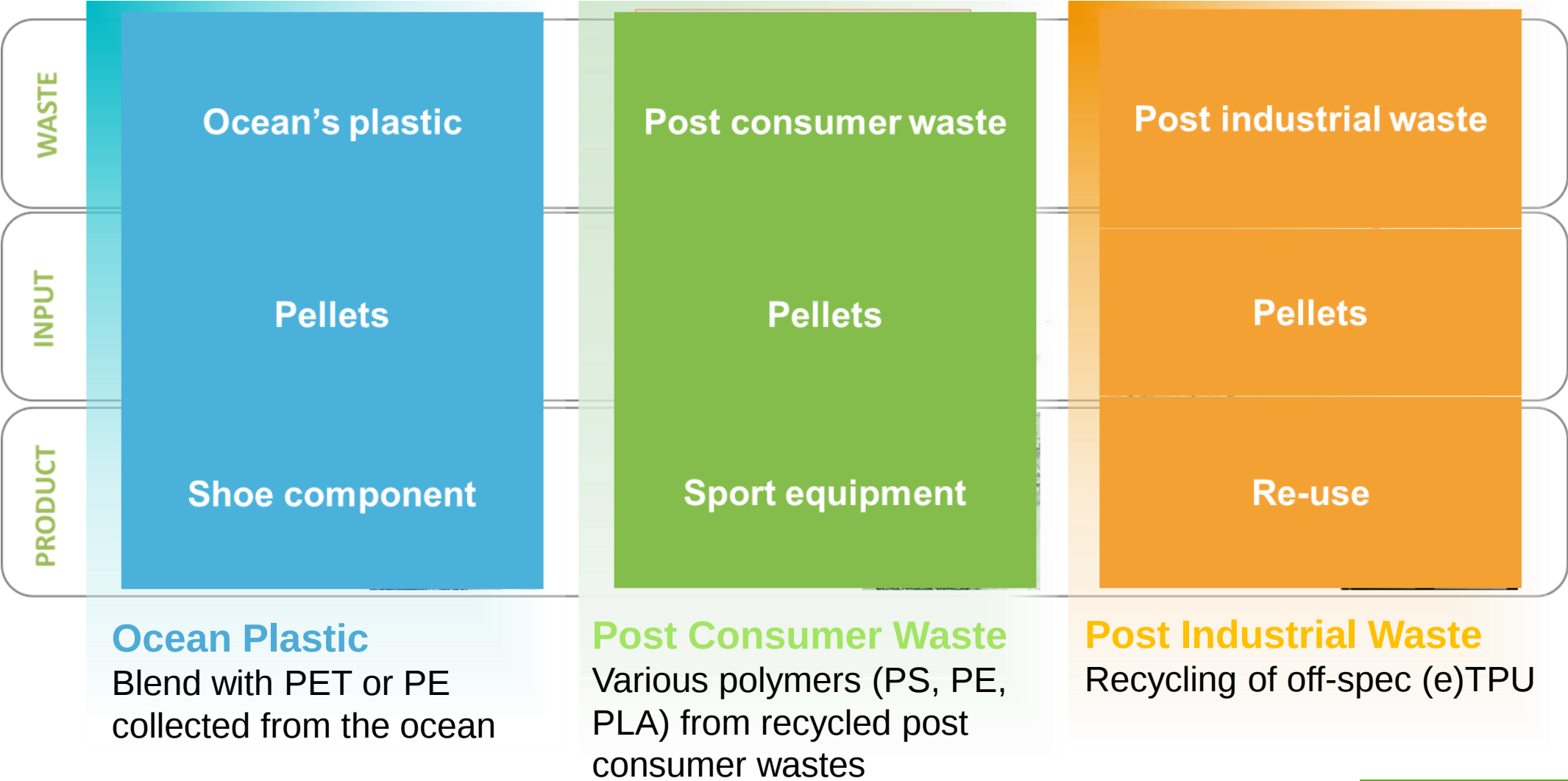


ChemoMechanical Upcycling of TPU – 1



Polymer repair during mechanical recycling
Maintain material properties and quality

ChemoMechanical Upcycling of TPU – 2



ChemoMechanical Upcycling of TPU – 3



Single-material products
(e.g., sneaker) that can easily be recycled

One material (TPU) for all components and processes to create all functions.

Process to recycle the shoes
... maintain high level of material quality

Key takeaway

We are expert in the **chemistry, technologies, laws and regulation** around the world

Partnerships are part of BASF's efforts to develop chemical recycling as a business

Sustainable loops along the entire production chain and product lifetime

Chemical recycling allow transformation of contaminated plastic waste to raw material



***Let's Embrace the Path to
Sustainability Together***

Questions time





We create chemistry