Aalto University
School of Arts, Design
and Architecture

Sustainable design S8

Kick-off for thematic conceptual design case in groups (sessions 8–12)
Monday 22.5.2023

Theme: Plastics

Plastics as the focus theme

Some notions as plastics as a focus theme:

- **Plastics are often outstanding materials for manufacturing with many properties that can be easily managed**
- **They have, however, obvious issues being fossil based, having a high CO2 footprint in production (but often low energy footprint), and severe issues with EoL scenarios (CO2, pollution, micro-plastics, etc.)**
- **There is a clear momentum to increase the use of recyclates as a non-fossil option, but difficulties in quality management, economic feasibility, scale, etc.**
- **What about bio-plastics? To an extent there is also an overlap with biomaterials, however bio-plastics often have issues in high energy for production, and impact on ecological systems (e.g. sustainable scale of material production?)**

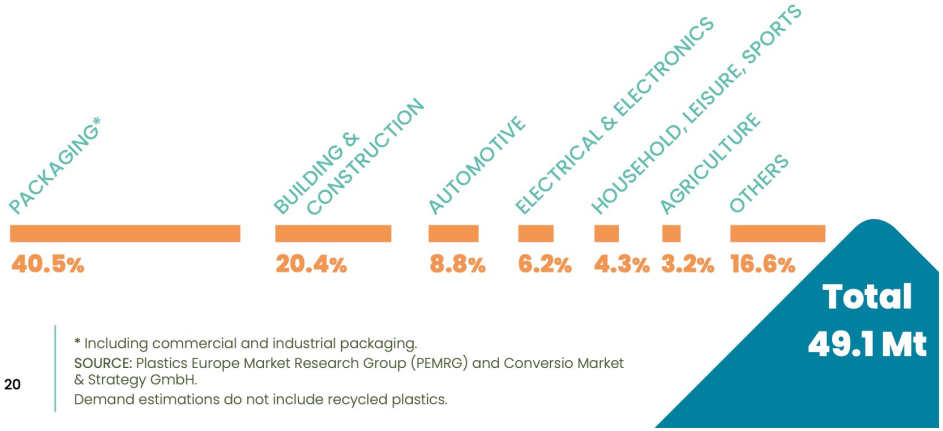
Plastics in the EU (Plastics – the Facts, 2021):

EU27+3 converters plastics demand
BY SEGMENTS 2020

Packaging and Building & Construction by far represent the largest end-use markets.

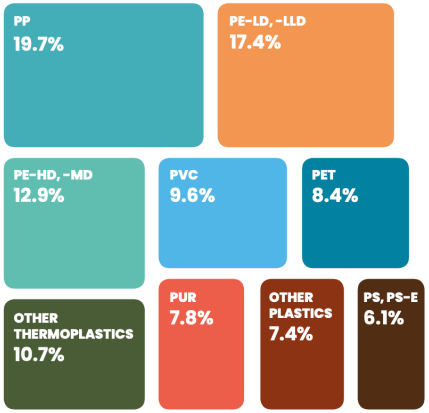
The third biggest end-use market is the **Automotive Industry**.

"Others" includes plastics for furniture, medical applications, machinery and mechanical engineering, technical parts etc.



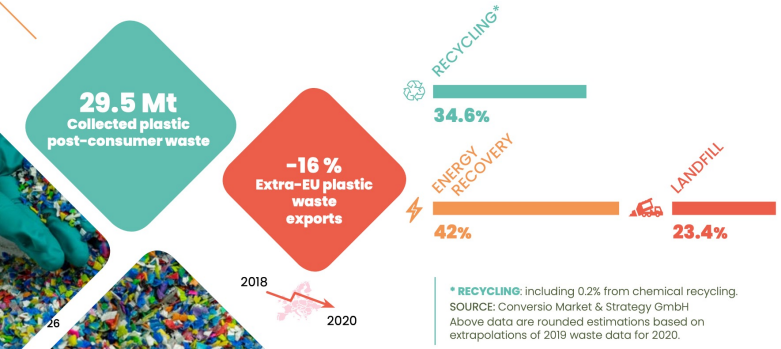
* Including commercial and industrial packaging.
SOURCE: Plastics Europe Market Research Group (PEMRG) and Conversio Market & Strategy GmbH.
Demand estimations do not include recycled plastics.

EU27+3 converters plastics demand
DISTRIBUTION BY POLYMER TYPES 2020



PP	Food packaging, sweet and snack wrappers, hinged caps, microwave containers, pipes, automotive parts, bank notes, etc.
PE-LD, -LLD	Reusable bags, trays and containers, agricultural film, food packaging film, etc.
PE-HD, -MD	Toys, milk bottles, shampoo bottles, pipes, houseware, etc.
PVC	Window frames, profiles, floor and wall covering, pipes, cable insulation, garden hoses, inflatable pools, etc.
PET	Bottles for water, soft drinks, juices, cleaners, etc.
PUR	Building insulation, pillows and mattresses, insulating foams for fridges, etc.
OTHER PLASTICS	Includes other thermosets such as phenolic resins, epoxide resins, melamine resins, urea resins and others.
PS, PS-E	Food packaging (dairy, fishery), building insulation, electrical & electronic equipment, inner liner for fridges, eyeglasses frames, etc.
OTHER THERMOPLASTICS	Hub caps (ABS); optical fibres (PBT); eyeglasses lenses, roofing sheets (PC); touch screens (PMMA); cable coating in telecommunications (PTFE); and many others in aerospace, medical implants, surgical devices, membranes, valves & seals, protective coatings, etc.

SOURCE: Plastics Europe Market Research Group (PEMRG) and Conversio Market & Strategy GmbH.
Demand estimations do not include recycled plastics.



* RECYCLING: including 0.2% from chemical recycling.
SOURCE: Conversio Market & Strategy GmbH
Above data are rounded estimations based on extrapolations of 2019 waste data for 2020.

POST-CONSUMER PLASTIC WASTE
treatment in 2020 (preliminary data)

In 2020, more than 29 million tonnes of plastic post-consumer waste were collected in the EU27+3. Because plastics products have different life span (ranginging from 1 to 50 years or more), of post-consumer plastic waste collection figures do not match demand or consumption figures.

More than **one third was sent to recycling facilities inside and outside the EU27+3** but over 23% was still sent to landfill and more than 40% was sent to energy recovery operations.

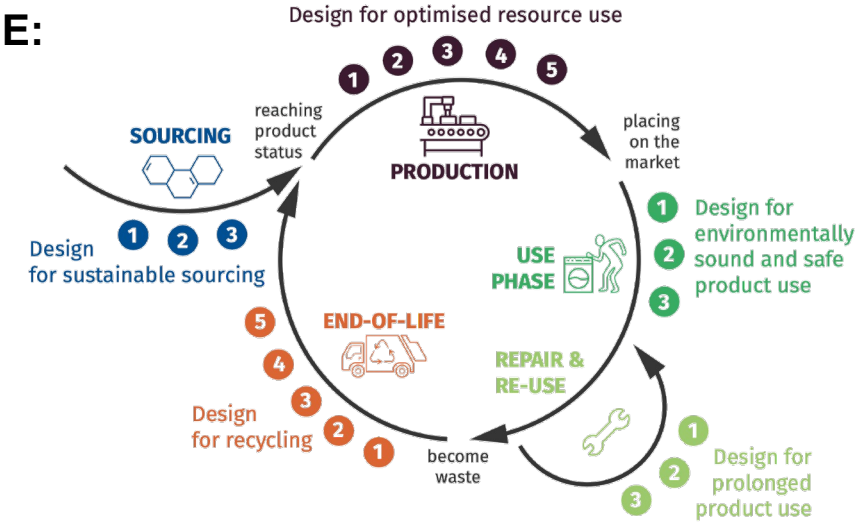
Improving plastics sustainability

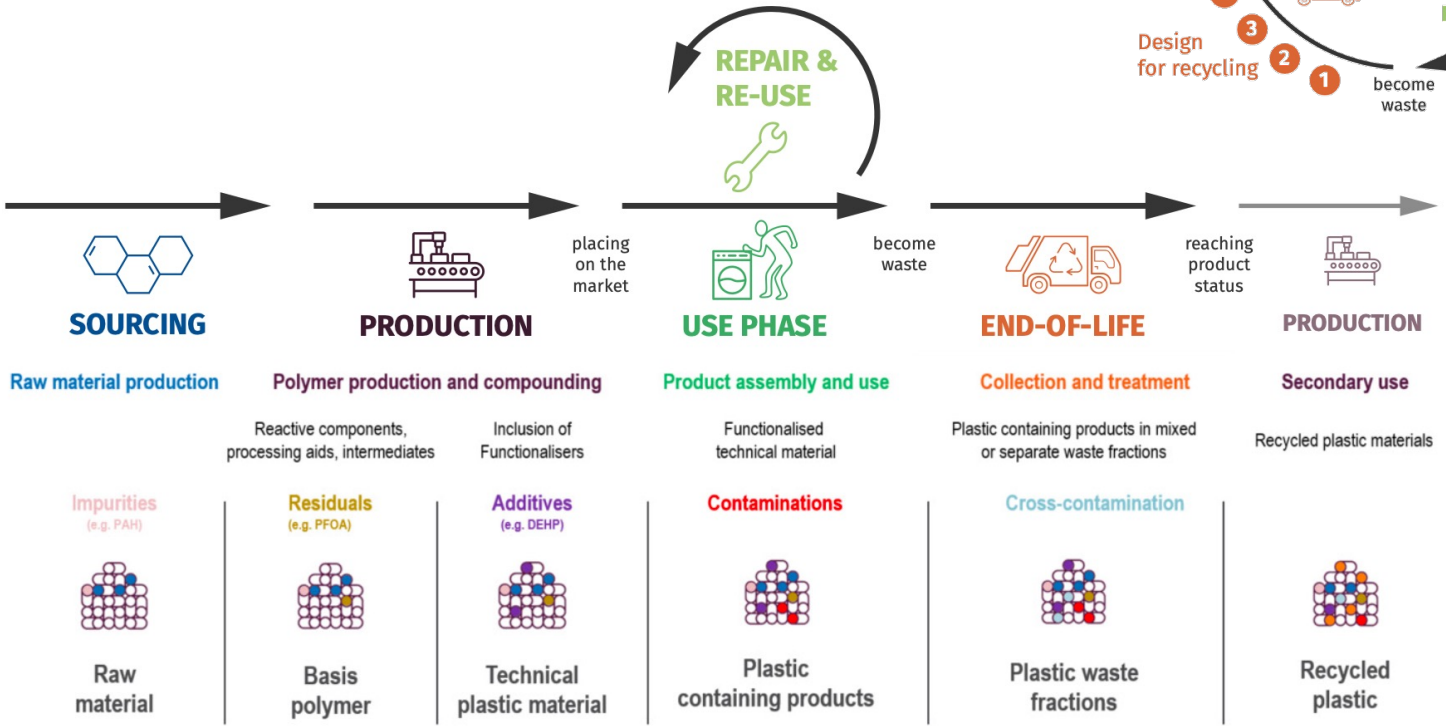
Some strategies or approaches to improve the sustainability of plastics:

- **Product ecodesign (including system redesign)**
- **Extended producer responsibility (EPR policy scheme)**
- **Sustainable product-service systems (PSS)**
- **Circular economy – closing technical loops: Focus not only in material recycling, but also in product/material repair, reuse, redesign**

ECOS (2019) – Policy recommendations for CE:

- ***Design products and systems for longer lifetimes;***
- ***Make products easier to recycle;***
- ***Close the loop through recycled content;***
- ***Focus on chemicals for circular products and materials.***





Materials in MyCourses

Check through the materials on this theme in MyCourses (bottom of Readings & materials -page):

- **Allwood & Cullen (2010). Chapter 21 - Plastics**
- **Plastics Europe (2021). Plastics – the Facts**
- **ECOS (2019). Applying Ecodesign to Plastics**
- **King et al. (2022). Circular economy framework for plastics**
  (use this meta review to find several more sources…)

Thanks!