

A circular plastic future enabled by a knowledge-based policy framework

Plastics play an almost irreplaceable role in society, mainly due to their beneficial functionalities and properties, such as low weight. Simultaneously, the downsides of current plastic use need to be addressed. Circular plastics are an important part of the solution, e.g. by replacing new plastics with recycled plastics of sufficient quality. To achieve this, we need sophisticated -preferably inexpensive and environmentally friendly- sorting and recycling technologies. In the MOOI project Integrated approach towards Recycling of Plastics (InReP), a large consortium of recyclers, converters, brand owners and knowledge institutes obtained knowledge and developed technologies to make high-quality recycled packaging plastic available for the three dominating market polymers polyethylen (PE), polypropylene (PP) and polyethylene terephthalate (PET). As illustrated by the Circular Plastics Table (CPT), there are major inconsistencies between the needs of industry and the limited options legislation offers for a successful transition towards circular plastics. Based on the results of the InReP project we call for action!

Call to action

To overcome external barriers that hinder the progress towards high-quality plastic recycling we urge policymakers to:

1. provide an integral vision supported by coherent and realistic policy and regulations to stimulate innovation;
2. develop a legal framework for the mandatory standardisation of packages to stimulate circularity, enabling higher recycling rates and higher qualities;
3. develop a clear policy framework for cascading recycling technologies in order to achieve sufficient volume of high-quality recycled material.

1.1. Integral vision to stimulate innovation supported by coherent and realistic policy & regulations

Challenge

Scattered, unclear and unrealistic policies hamper investment in sorting and recycling innovations in the market.

Through European policy and legislation such as the packaging and packaging waste regulation (PPWR)¹, efforts are made to increase recycled content in plastic packaging. This is essential for the transition towards circular plastics. However, regulations are ambiguous and often conflicting, such as the mandatory use of recycled content versus the strict safety regulations on food-contact material. The lack of a clear vision accompanied by continuously changing policies delay decision making for different stakeholders in the value chain. Consequently, investing in technological innovations for higher quality recycling has slowed down, while acceleration of the transition is needed.

Solution pathway

Provide an integral system vision that enables coherent and realistic policy making to stimulate innovation.

This system vision should be based on knowledge, obtained from relevant stakeholders. It is advised to organise sessions involving experts (industry, knowledge institutes, executive agencies and extended producer responsibility organisations) and discuss how policies can accelerate and support the circular plastic transition. The initiation of the Circular Plastics Table in the Netherlands is a good example of how an

¹ Regulation (EU) 2025/40 of the European Parliament and the council of 19 December 2024 on packaging and packaging waste, amending Regulation (EU) 2019/1020 and Directive (EU) 2019/904 and repealing Directive 94/62/EC.

integrated system view can be generated, involving all different stakeholders in the field. The report this initiative published is a relevant result of how stakeholders should work together and where policymakers can act on. We recommend continuing the CPT and tackle various topics in this manner. Packaging regulations would be a great example, where the InReP project could provide information on specifics for sorting and recycling technologies, their system integration and costs, required for integral packaging regulations. In this way, multiple views can be accommodated, facilitating policy makers to make informed decisions.

1. Standardisation for design for recycling

Challenge

Plastic waste streams are too heterogeneous and contaminated for sufficient high quality recycled material.

Sorting and cleaning of current waste streams is a huge challenge and very costly. This is mainly due to a vast amount of different packaging types (polymer grades, pigments, functional additives, labels, etc.) and the presence of contaminants from product residue and cross-contamination. This current variation occurs because of a lack of standardized design: producers have freedom to select any packaging type for their products.

Solution pathway

Create a legal framework to enforce the standardisation of packaging design: design for recycling.

Design for recycling principles need to be based on current knowledge of recycling technologies to increase recycling yields and quality. Standardisation of design can significantly reduce the amount of different (mixed) packaging types, making waste streams more uniform. Currently, there is no legal basis to force brand-owners to standardise their packaging designs; this should be mended. This allows for recycling technology development to become more effective. Consequently, plastic waste can be recycled more easily with higher yields and enhanced quality. A good example of standardised packaging is the HDPE 2L milk jug: different brand owners sell milk in the same packaging, reducing the complexity of sorting and recycling the waste stream.

The introduction of a digital product passport for all plastics products to be put on the market (as proposed in the CPT report) will create a system in which the flow of products, from waste to recycling, becomes transparent. This will make it possible to implement standardisation, valorise design for recycling and make an eco-modulation tariff system effective. This will be a clear incentive for final product producers.

1.2. Clear policy framework for cascading recycling technologies

Challenge

Mechanical recycling cannot produce enough high-quality recycled material for a circular plastic future.

To facilitate a circular plastic value chain, recycled content targets in plastic products are set through policies. For food-contact materials or food packaging, the quality of the recycled content has to meet very high-quality standards, sometimes even more strict than for virgin material. To meet these standards, only one mechanical recycling technology (post-consumer PET mechanical recycling) has been deemed suitable to produce recycled material for food-contact materials. However, current mechanical recycling technologies cannot deliver sufficient recycled material volumes with the required high-quality standards, given the available collection methods, non-standardized packaging designs and waste streams in the Netherlands. To increase the available volume of high-quality recycled materials, cascading different recycling technologies, including chemical routes are essential.

Also, to apply for new recycling technologies for food applications, EFSA needs to publish an opinion, followed by an approval by the European Commission. This process can take a long time (up to 7 years) and thus new innovations cannot get to the market in time in order to reach ambitious recycled content targets.

Solution pathway

An integral system of cascading recycling technologies is essential to achieve sufficient volume of high-quality recycled material.

To reach a circular plastic value chain, a clear perspective has to be provided for all types of recycling. Every recycling technology plays a role with respect to specific (and often complex) waste streams, each suited for improving yields and/or quality of recycled material. In this circular transition, novel technologies emerge, leading to new cascading solutions: complex waste streams are converted into feedstock for different, higher value plastics. For instance: PET waste can be used as input to make high value aramid (a polyamide fiber) or complex sorting residues are converted into benzene, toluene and xylenes BTX, base chemicals for the chemical and polymer industry). The production of these types of feedstocks is essential for the circular plastic transition. Hence:

- Approval of technologies should be made achievable by setting realistic conditions for new technologies similar to existing production technologies.
- Approval procedures need to be accelerated, clearer and straightforward.
- Approval and regulation of the use of virgin and recycled plastics need to be based on the same basic principles.
- A mass balancing approach is needed to account for chemical recycling in terms of recycled material.

The CPT-report proposed a commitment by brand owners and retailers for the use of 115 kton recycled material for packaging, on top of the regulated PWR goals. Although hard to realise on short term as the technologies are not available at scale this can only be achieved through chemical recycling of (PET and polyolefin based) materials for the application in food-grade plastic packaging, because other ways of recycling are lacking food approval and the 7 year approval period makes a business case challenging. This calls for an integrated, cascade based, recycling system to have the right allocation and use of the various plastics streams over the different recycling options, as proposed based on the InReP results.

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InReP – Integrated approach towards Recycling of Plastics

