



Removing regulatory barriers to circular plastics

Enabling complementary mechanical and chemical recycling in Europe

This policy brief targets EU and national decision-makers responsible for plastic and plastic packaging waste management, circular economy and climate policy.

Introduction

Global plastic production has reached 8.3 billion tonnes since 1950, creating 6.3 billion tonnes of plastic waste, most of which has ended up in landfills or the environment, driving pollution and microplastic contamination (Evode et al., 2021). This growing environmental burden and material loss underline the necessity of accelerating the transition to a circular plastics economy, centred on increasing collection rates, improved sorting quality, and effective recycling solutions. In Europe, 32.3 Mt of post-consumer plastic waste were collected in 2022, and separate waste collection overtook mixed waste collection for the first time, showing clear progress but also the gap to further strengthen waste management. Given that separately collected plastics are recycled 13 times more frequently than mixed waste, effective source separation remains a critical enabling factor for plastic circular economy (Plastics Europe, 2024).

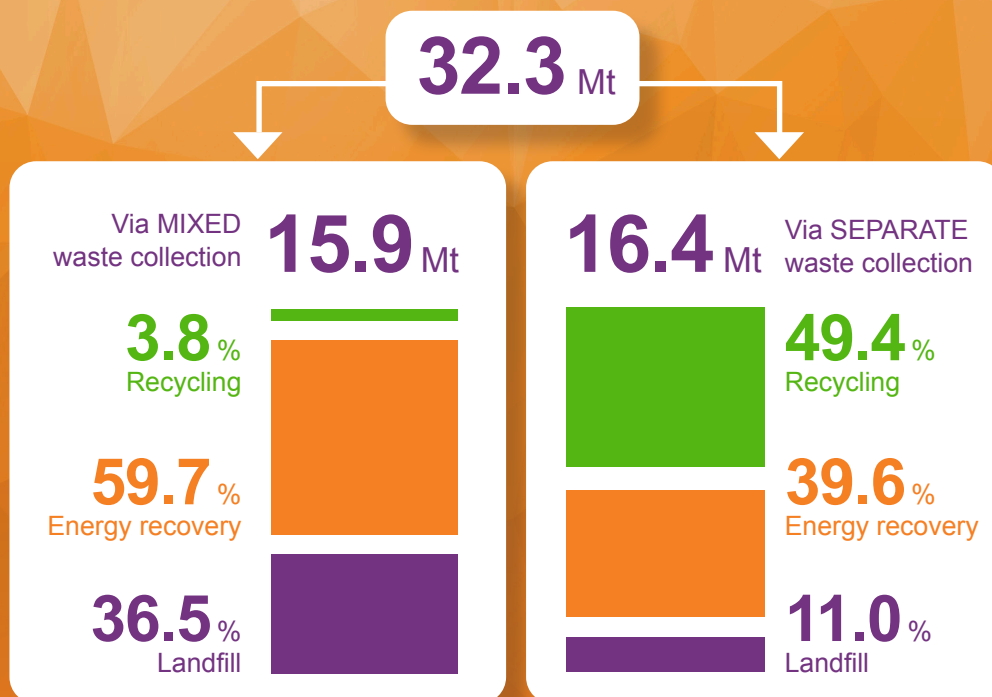


Figure 1. Post-consumer plastic waste collection and treatment in Europe 2022. Source: Plastics Europe, 2024.

When considering plastic recycling pathways, mechanical recycling is a well-established and energy-efficient technology that preserves the polymer structure, making it the cornerstone of circular plastics systems. Chemical recycling serves as a complementary pathway, enabling the conversion of complex or contaminated plastic streams into chemical feedstocks suitable for high-quality applications. Achieving a circular plastics system therefore requires both technologies working in synergy to maximize resource recovery, reduce reliance on virgin fossil-based raw materials, and limit disposal through landfill.



Policy recommendations

Achieving a plastic circular economy requires further regulatory advancement beyond existing drivers such as recycling targets and recycled-content mandates. Current legal and technical barriers hinder the development of complementary mechanical and chemical recycling systems. To unlock the full potential of circularity in plastics, the following regulatory actions are recommended.

1 Develop harmonised End-of-Waste criteria for plastic waste

The absence of EU-wide end-of-waste (EoW) criteria for plastics undermines market confidence, limit recycle uptake, and discourage investment in recycling infrastructure (EuRIC, 2023). It is recommended that the European Commission, through DG ENV and DG GROW, in close cooperation with Member States, establish harmonised EoW criteria under the Waste Framework Directive (Directive 2008/98/EC). This measure should clearly define the conditions under which plastic waste ceases to be classified as waste and becomes a secondary raw material, thereby promoting legal certainty and facilitating cross-border trade in recyclates.

2 Strengthen separate collection and sorting of plastic waste

Effective separate collection and sorting are essential to generate high-quality plastic feedstock for recycling. Robust source separation provides cleaner material streams, while advanced sorting of mixed waste increases recovery of recyclables. To this end, policymakers should reinforce the implementation of separate collection obligations and strengthen Extended Producer Responsibility (EPR) schemes, complemented by targeted consumer awareness initiatives. These measures should promote transparency, accountability, and widespread participation across the plastics value chain. Coordination should be led by the European Commission (DG ENV, DG GROW), with implementation supported by Member States, municipalities, EPR organisations, and industry stakeholders.

3 Recognise chemical recycling under the EU regulatory framework

The current definition of recycling under the Waste Framework Directive primarily encompasses mechanical re-processing, creating regulatory ambiguity for chemical recycling technologies. This uncertainty inhibits investment, slows innovation, and generates inconsistencies between Member States, where chemical recycling outputs such as pyrolysis oil are often categorised as fuels rather than recycled materials (Packaging Europe, 2023). The European Commission and Member States should formally recognise chemical recycling as a legitimate recycling operation where it demonstrably delivers material recovery compliant with circular economy principles. Furthermore, standardisation of chemical recycling processes and products should be developed, alongside a harmonised mass-balance accounting methodology to ensure traceability of recycled content when blending virgin and recycled feedstocks. Implementation should involve collaboration among the European Commission, Member States, relevant industry associations (e.g. Plastics Europe, EuRIC), and standardisation bodies (CEN, CENELEC).

4 Expand the scope of Food Contact Regulation to enable innovative recycling technologies

The current Food Contact Regulation (Regulation (EU) 2022/1616) primarily permits mechanically recycled PET within closed-loop systems, constraining the uptake of innovative recycling technologies for food-grade applications (European Commission, 2022). It is recommended that EU policymakers expand the Regulation's scope to include more advanced mechanical and chemical recycling processes capable of achieving safety levels equivalent to virgin materials. In parallel, harmonised assessment procedures under the European Food Safety Authority (EFSA) should be developed to expedite the authorisation of novel recycling technologies. These actions should be coordinated by the European Commission (DG SANTE), in cooperation with EFSA, national food safety authorities, and stakeholders from the plastics and packaging sectors.



Case study | TREASoURcE

Complementary mechanical and chemical recycling technologies for circular plastics

As part of the TREASoURcE project, VTT Technical Research Centre of Finland is testing an integrated recycling system that links together collection, sorting, pretreatment, mechanical recycling, and chemical recycling (Figure 2).

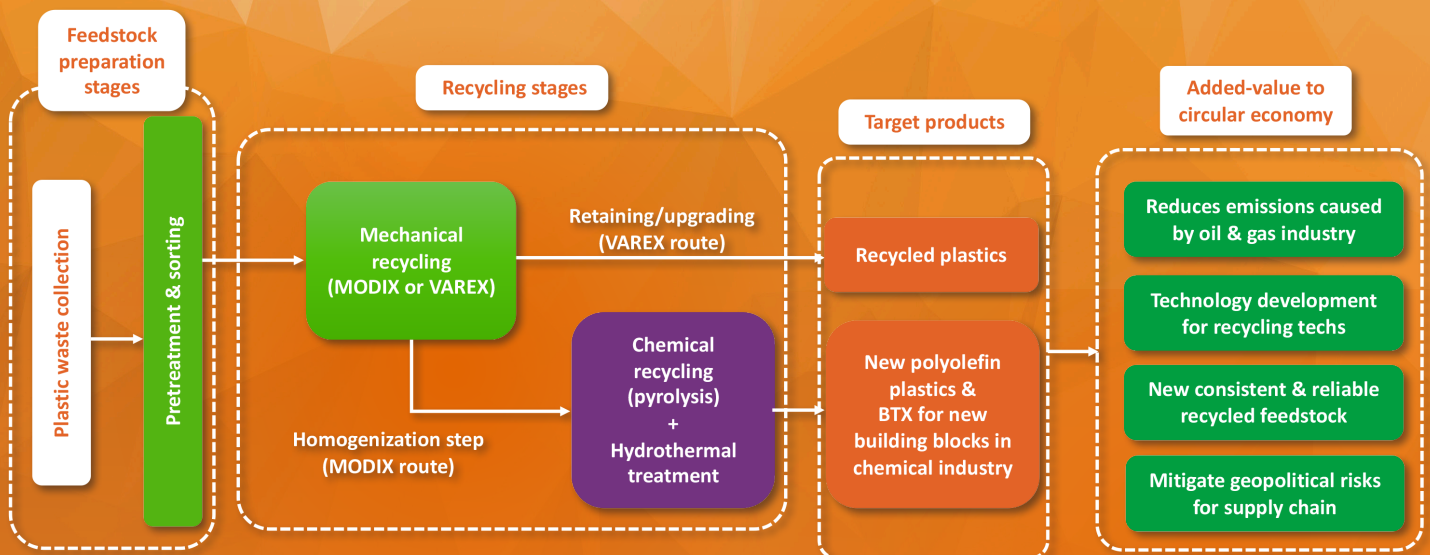


Figure 2. TREASoURcE plastic mechanical and chemical recycling process flow

The process starts with the collection and sorting of agricultural, municipal, and industrial plastic waste to separate clean mono-material streams from mixed or contaminated fractions. Sorted plastics are pretreated in the VTT's Modular Mixer (MODIX), where compaction, homogenisation, partial dehalogenation, and removal of volatiles create a stable and consistent feedstock.

Clean polymers are routed to mechanical recycling using VTT's Value Retention Extruder (VAREX), which restores polymer properties through real-time rheological monitoring and adaptive stabiliser dosing, yielding near-virgin-quality recyclates. More complex or contaminated plastics are treated via chemical recycling, including pyrolysis and hydrothermal upgrading, converting polymers into hydrocarbon oils and BTX streams for new polyolefin production and chemical feedstocks.

The TREASoURcE approach demonstrates that by integrating advanced sorting, pretreatment, and complementary mechanical and chemical recycling processes, complex and contaminated plastic waste can be effectively recovered. This not only produces high-quality recyclates and valuable chemical feedstocks but also significantly reduces the volume of plastics sent to incineration or landfill, lowering greenhouse gas emissions and strengthening Europe's circular and climate-neutral plastics economy.



This policy brief has been produced as part of the TREASoURcE project work package “Circular economy framework analysis and actions to enhance circular economy”. It provides policymakers and stakeholders with a foundation for developing effective practices to promote the transition to circular economy. This policy brief is based on a conducted literature review as well as stakeholder engagement, which was used to validate the findings. The project report [D1.3 Legislative and regulatory framework for target value chains](#) addresses critical challenges and opportunities for advancing the circular economy transition.

Publication date: 04/2026

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TREASoURcE is a four-year (2022–2026) EU Horizon Europe-funded project aimed at promoting the circular economy through regional circular economy pilots. The project focuses on three value chains: unused plastic waste, reuse of electric vehicle batteries, and biobased side and waste streams. Utilizing diverse stakeholder work, the project’s goal is to significantly increase the circulation of products and materials and the circular economy knowledge of citizens in the Nordic and Baltic regions.

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