

Modelling the future of flexible packaging – legislative targets and the circular economy

What will the flexible packaging value chain need to look like by 2030 to meet recycled content and recycling rate targets required in European legislation and deliver the circular economy?

To answer this question, and others, CEFLEX has developed a new model – called Möbius - designed to bring greater understanding of the material flows and infrastructure required to develop the circular economy for flexible plastics.

It builds on a long-standing collaboration with the University of Gent, assessments of sustainable end markets, CEFLEX's 'Quality Recycling Process' project data and our Chemical Recycling Project data – plus expert input to investigate potential scenarios and explore different choices and their implications.

With this body of knowledge, CEFLEX aims to demonstrate the role that modelling material flows can have. As well as helping us to understand the situation at present, the process can help to identify gaps in knowledge which hinder the development of evidence-based targets in the future.

Policy uses could be to help assess the impact of the 55% recycling target adopted in the PPWR definition of 'recycled at scale' taking into account various aspects of the legal framework that help or hinder achievement of this target. It could also provide a robust method for determining the grade A and B recycling targets which are to be set in an implementing act.

The Circular Economy for Flexible Packaging (CEFLEX) initiative is a collaboration of over 180 European companies, associations and organisations representing the entire value chain of flexible packaging. Together, we work to make all flexible packaging in Europe circular.

Our modelling and economic analysis engages industry and decision-makers with data-supported insights - informing them of the implications, opportunities and challenges ahead.



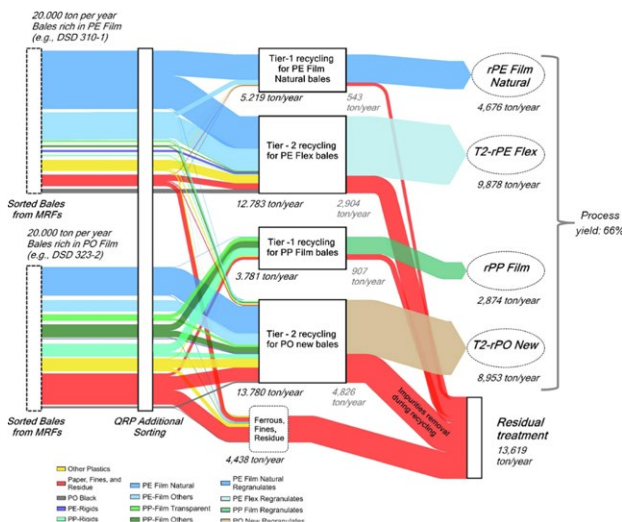
CEFLEX's 'Mission Circular' and mapping material circularity

The Circular Economy for Flexible Packaging initiative was conceived and exists to overcome the technical, environmental and economic barriers to material circularity for flexibles. This extends from innovating and simplifying packaging design to use less materials and improve recyclability - to engaging with Extended Producer Responsibility (EPR) schemes and everything in between.



Our ultimate objective: collection of all flexible packaging, with over 80% of materials entering a recycling process to be returned to the economy and used by sustainable end markets to substitute virgin materials.

Understanding what materials are placed on market – and how they subsequently flow through collection, sorting and recycling processes has been central to CEFLEX building understanding and action around this vision. In collaboration with the University of Gent, a **Material Flow Analysis model** provided a good understanding of current systems, future scenarios for materials and helped clarify the steps to become more circular.



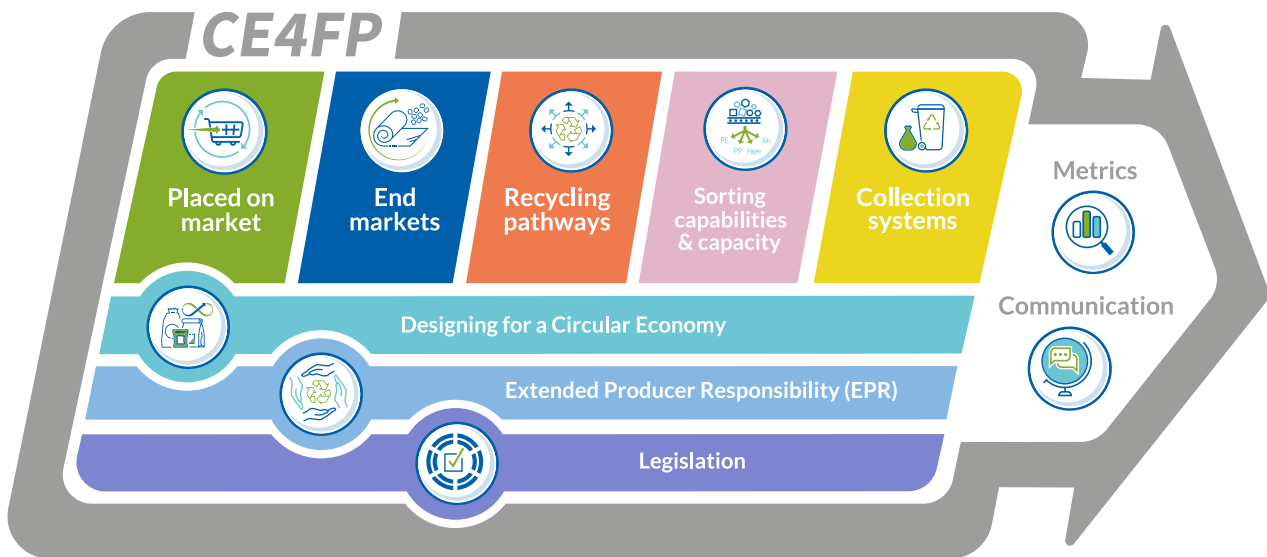
Understanding and improving design, sorting and recycling is helping the flexible packaging value chain increase recycling rates and boost use of recycled materials.

Over time, CEFLEX stakeholders and team were able to refine understanding of the different options and pathways conducting numerous semi-industrial trials as part of a **'Quality Recycling Process'** project to explore different strategies and better understand potential end markets for recycled content.

CEFLEX's 'Quality Recycling Process' project demonstrates how combining existing sorting and recycling technologies can provide high quality recycled materials from household waste for use in a range of circular products in high demand. It has been used to define a blueprint for a new generation of recycling infrastructure and investment and a planned commercially operating plant.

This work ultimately shows creating more value for sustainable end markets and a business case to boost the recycling rates and circularity of flexible packaging is feasible and the technology in place to achieve it.

By doing so, it reinforced a commitment to exploring material flows and the economics of the circular economy. It marked a new stage of identifying new and existing end market demand for recycle as the key driver of sustainable change and CEFLEX's 'demand-driven' circular economy model. This shapes the initiatives' work programme: prioritising sustainable end markets for recycled content and key enablers such as EPR as fundamental drivers for transition.



The CEFLEX demand driven circular economy model

MÖBIUS – a new phase stepping up CEFLEX’s modelling work

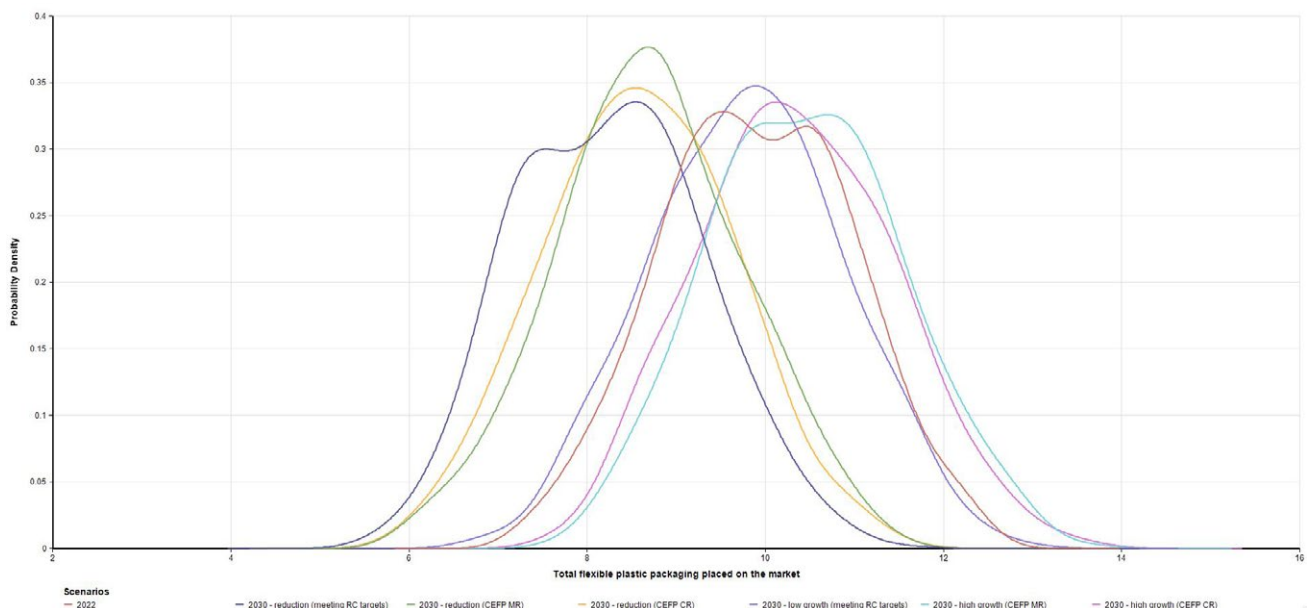
Since 2022, additional analysis into end markets for polyolefin recyclates, mechanical recycling material flows and a cutting-edge project to assess yields and feedstocks from chemical recycling has strengthened CEFLEX’s understanding and capacity.

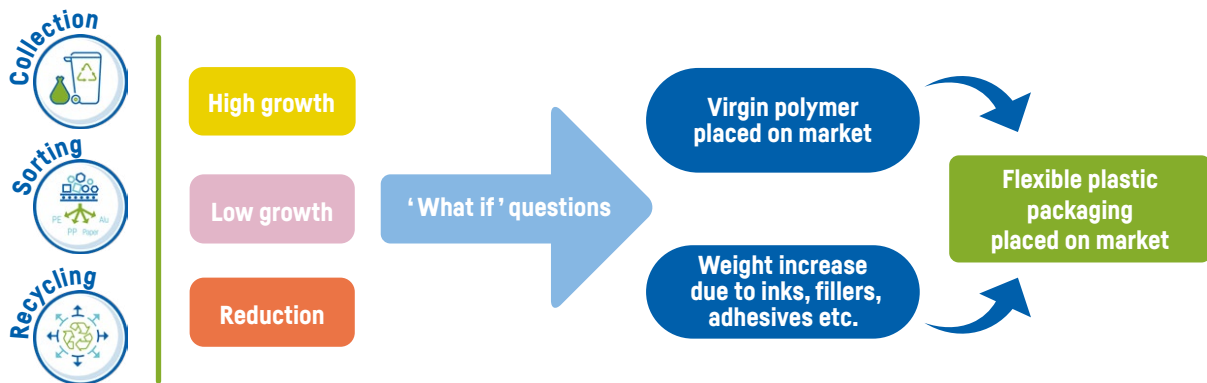
The result is a new modelling platform able to work with multiple baseline scenarios and assess possible outcomes. Called Möbius, it has been designed to bring greater understanding of the material flows and infrastructure required to develop the circular economy for flexible plastics.

Möbius works with an extensive set of assumptions based on data and expert judgement, which makes it a continuous work in progress – but it has already proven instrumental in evaluating different scenarios for the recycling of flexible plastic packaging in Europe. Future modelling prospects for Möbius include incorporating other sources of plastic waste, new recycling technologies and price effects.

The model will provide useful data and technical expertise to help decision makers working on **implementation of the Packaging & Packaging Waste Regulation** and it could also be used to support the development of Extended Producer Responsibility schemes.

Modelling possible futures with Möbius



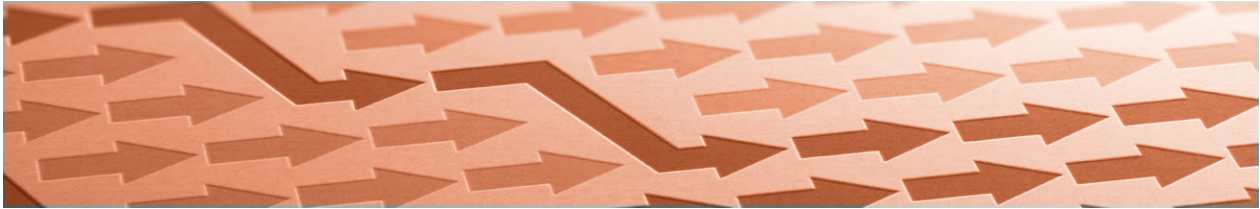


CEFLEX uses Möbius to support our collection, sorting and recycling strategy recommendations. By exploring a number of different combinations of technologies and capacity choices required to achieve the circular economy for flexible packaging we can assess and inform industry of the implications of delivering on recycled content and recycling targets in PPWR legislation.

It provides a solid basis for engaging the wider value-chain, other material sectors and decision-makers with data-supported insights within feasible established boundaries.

PPWR: a new focus point for urgency and action to model and explore

Today, 'Mission Circular' and legislative targets are happily converging to accelerate circular materials. In particular, the Packaging and Packaging Waste Regulation (PPWR) is giving additional focus and urgency - including three critical pillars shaping a circular economy for flexible packaging: Design for Recycling, Recycling at Scale and Recycled Content. It is therefore critical to understand key targets of the legislation and assess the conditions, investment and steps needed to achieve them.



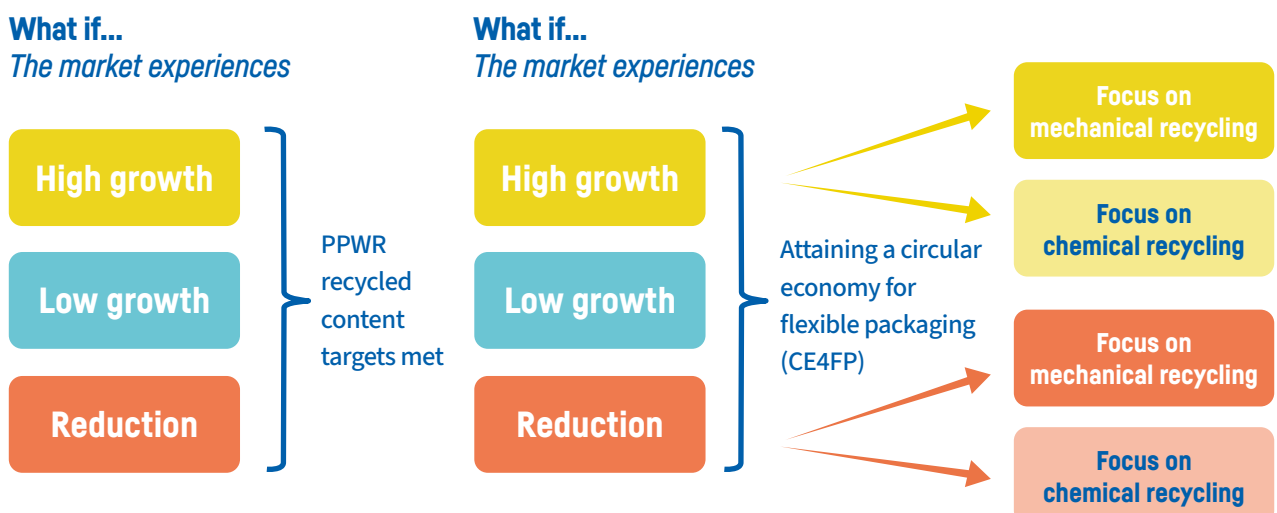
Our primary objective was to establish an ‘envelope of possible futures’, using a 2022 baseline scenario and six ‘what if’ questions. These are designed to explore the outer edges of what the future might look like for the recycled flexible plastic packaging sector in Europe – and give us a canvas for further investigation and exchange.

The 2022 baseline was developed as a sense check to ensure that the model was working correctly and allow comparison with different future ‘what if’ situations. It uses 2022 market data and legislative conditions combined with CEFLEX experts’ best estimates of the current values of a wide range of variables such as collection rates, sorting yields and recycling yields to provide an assessment of the current recycling rate for flexible plastic packaging.

These ‘possible futures’ boundaries give us a framework for developing a recycling strategy and associated recommendations – which provide data-driven insights to inform industry and decision-makers on implications for PPWR implementation and beyond.

The ‘envelope of possible futures’ (2030)

Recycling capacities and technologies to achieve legislative targets and the circular economy



To explore PPWR and circular economy targets, Möbius has been designed as a probability model. It uses a range of feasible distributions for the same variable based on available data from industry and academia. While a single, definitive statement on a figure would be more reassuring, this probabilistic approach is more robust, working - for instance - on a range of sorting yields for separately collected household waste rather than just a single figure.

Möbius also allows us to model possible futures in different market scenarios, such as reduced demand for flexible packaging, low growth and high growth. CEFLEX is also using it to explore the highest possible circularity potential for flexible plastic packaging (CE4FP), independent of the new legal targets.

Assumptions and data fuelling Möbius

Nearly 80 different assumptions were used in the Möbius model. In compiling and applying them, we acknowledge some of the uncertainty around key indicators, such as material returned to the market, and the model uses ranges to reflect this uncertainty. The Monte Carlo analysis approach was used to combine the ranges; a recognised and established statistical method of working with uncertainty.

Exploring the Möbius modelling approach in more detail

Möbius model outputs are expressed in ranges because of the inherent uncertainty in a project of this nature. The outputs are a model programmed using Lumina Analytica software, based on a set of assumptions and calculations using publicly available data, purchased data, academic analysis and expert judgement.

Using these inputs, the ranges are described using triangular distributions. These distributions are defined by minimum, maximum and mode (most likely) values in line with the approach used together with the University of Ghent in previous modelling work.

To model the three possibilities of 'reduction', 'low' and 'high' growth, CEFLEX is taking published industry studies and market intelligence and supplementing these with estimates with expert judgement from the CEFLEX team and stakeholders to plot credible 'What Ifs' for the model to explore.

Looking beyond current investigations – a basis for dialogue with stakeholders and decision makers

In addition to the key questions CEFLEX is currently examining, Möbius can be used to examine different scenarios for the recycling of flexible plastic packaging in Europe from those developed for the Recycling Strategy and could in future be further developed to incorporate other sources of plastic waste, new recycling technologies and price effects.

CEFLEX is open to engage with all interested parties and material sectors to help boost understanding and share data and insights to inform PPWR implementation. This includes key objectives and pathways to reaching higher recyclability performance, ‘recycled at scale’ and a 55% recycling rate – but might also provide value to EPR schemes and questions arising through the Waste Framework Directive revision.



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