

Mass-Balance for chemical recycling is essential for achieving higher recycling rates, incorporating recycling content and reducing dependency on crude oil

The Mass-Balance approach:

- is a proven chain of custody approach used in many areas bringing innovations to the market such as fair-trade practices in the food industry and the adoption of “green energy” where the Mass-Balance approach enables its flow through the same grid as for fossil energy and the significant development of the industry,
- is essential in meeting recycling targets for plastics in Europe,
- brings transparency and audited traceability process.

1. Purpose of paper

Chemical Recycling Europe is an association representing the chemical recycling industry towards the public and European institutions. It aims to promote and implement innovative chemical recycling technologies and to boost the circular plastics economy

This paper is in response to the revision of the Packaging and Packaging Waste Directive from DG ENV, as supported by consultants Eunomia, focusing on how hydrocarbon products from chemical recycling of plastics can be accounted for within a recycling system that encompasses petrochemical processing infrastructure.

2. Introduction and Context

Increasing EU plastic recycling rates to the 2030 targets will require the development of a range of complementary recycling technologies to recycle the different types and quality of polymer on the market, and to generate the desired quality and characteristics of the product from that recycled output.

Polyolefins represent around 50% of the total plastic production (25Mt), and close to 70% of the plastic packaging production (16Mt) in Europe¹. Polyolefinic waste plastic packaging, particularly flexibles and films used for food contact, represents the main unrecycled fraction that is sent for recovery in energy from waste, disposed of in landfill or which enters the environment.

Whilst technological improvements to sorting processes and mechanical recycling systems are being developed, a significant amount of waste polyolefin material continues to evade mechanical recycling systems, particularly to generate recyclates suitable for food grade applications.

Chemical recycling, particularly thermal technologies where waste plastics are transformed back into hydrocarbon feedstocks, are an essential solution to enable the recycling of flexibles, multi-layered and more complex plastic materials. Chemical recycling provides a range of virgin-quality outputs

¹ PlasticsEurope – Plastics Facts



suitable for new plastics production, and other circular products such as oils, solvents, and waxes. Chemical Recycling enables the outcomes of the EU Circular Economy Action Plan and Plastics Strategy to be achieved for the substantial quantities of, currently, unrecyclable plastic packaging. Without chemical recycling, improvement in recycling rates will be limited and demand for virgin-quality recycled content for polyolefins will not be fulfilled, undermining the EU's ambitions for sustainability in packaging.

3. The case for Mass-Balance as a reliable solution to account for recycled content

With significant expectations on, and financial investment in, recycling, it is widely accepted by all stakeholders that recycling needs to be a transparent and verifiable process, to ensure material provenance and probity of the entire system. For various industrial manufacturing processes, a so called 'mass-balance approach' has been successfully developed and implemented to attribute the appropriate quantities of recycled feedstock created, to an output product, accounting for the full value of this recycled output through a transparent and audited traceability process. This approach has been supported by NGOs such as the Ellen MacArthur Foundation².

Mass balance is already a proven tool that provides that clear and verifiable demonstration and has helped enable new processes and technologies to come to market and deliver significant societal and environmental benefits. It has been used extensively for example in promoting green energy or fair-trade practices in the food industry. Enabling "green energy" flow through the same grid as fossil energy has been the key factor enabling this industry to grow to its current state.

Taking this approach enables all stakeholders to be clear on the quantity of recycled content of specific products. Today, established certifications schemes are already applied to products from chemical recycling. Recyclers within the chemical recycling sector are proposing therefore to follow this approach, building on the experience and successful implementation of mass balance schemes globally.

Chemical recycling technologies are creating hydrocarbons indistinguishable from crude oil-based feedstock (e.g. naphtha) and which can therefore replace it in existing petrochemical infrastructure. The substitution of crude oil-based feedstock with recycled hydrocarbon is integrated within petrochemical facilities, a broad interconnected system where recycled and fossil molecules cannot be readily followed or chemically distinguished.

At the current state of development, chemical recycling will not generate enough quantity of recycled hydrocarbons in the next decade to justify a segregation solution (as used for mechanical recycling). Significant investment in chemical manufacturing facilities (e.g. *steam-cracker*, *fluid catalytic cracking*, *etc.*) dedicated to the sole processing of products from chemical recycling would be required to achieve this state. In addition of being premature, it would discard the gradual approach to integrate and test innovations.

In order to deliver the required provenance for recycled content, chemical recyclers are therefore proposing to build on the established principles of mass balance and certification schemes deployed across a range of sectors. Using this approach, chemical recycling can integrate into the existing and technically established infrastructure of the petrochemical industry. Therefore, to support the development of chemical recycling to scale, it is highly advisable to grow the industry through existing

² Enabling a Circular Economy for Chemicals with the Mass Balance Approach – available at <https://emf.thirdlight.com/link/f1phopemqs36-8xqjzx/@/preview/1?o>



infrastructure and build new supply chains using the mass balance approach for recycled content provenance.

4. Accounting the value of recycled carbon from chemical recycling

Chemical Recycling Europe has identified various interpretations of the mass-balance approach reflecting different accounting methodologies of the value of recycled carbons from chemical recycling: free-attribution, fuel-exempt, polymer-only.

It should be noted at this point that chemical recycling produces a recycled output/product that is then used as a recycled feedstock replacing virgin fossil feedstock, in established and highly efficient chemical processing.

The accounting approaches are:

- **Free-attribution:** This interpretation values the full recycled output and enables for this output to be allocated to polymers and/or other chemicals production within a reliable and trusted certification environment. This allows the recycled hydrocarbon to be fully valued in recycled product(s) within the current petrochemical system and would most accelerate the development of the chemical recycling industry.
- **Fuel-Exempt:** This interpretation would discard the proportion of the recycled output that goes towards fuels/energy based on the chemical facility distribution of products at the end of the chemical facility. The risk is that this portion of the recycled output would be lost to the system. **Under this interpretation, it would be essential to have clarity how these products would be valued through an appropriate EU-wide scheme.**
- **Polymer-only:** This interpretation discards the high-value, non-polymeric, chemical products that are generated in chemical recycling processes. This would therefore not be aligned with the definition of “recycling” as stated in the Waste Framework Directive and would treat mechanical and chemical recycling processes differently. **This is a very restrictive interpretation and the sector is opposed to this being applied.**

Chemical Recycling Europe strongly supports the goal of keeping the maximum value and amount of recycled carbon in the loop by replacing the current crude oil ‘lock-in’ by recycled products. This can be realized by using recycled (hydro)carbon for a wide variety of applications falling under the European definition of ‘recycling’ such as for recycled chemicals or recycled plastics.

Therefore, our position is that all Mass-Balance interpretations should ensure that the full recycled output from chemical recycling finds a credible value and recognition through the system.

5. Lack of clarity on Mass-Balance compromises the development of chemical recycling

Chemical Recycling cannot develop without the recognised mechanism to account for the value of the recycled products from chemical recycling produced from waste plastics.

Some key consequences of the lack of clarity on mass-balance and of not recognising the full value of recycled carbons include:

- **Uncertain demand and price for recycled content:** Demand for virgin-quality recycled material has driven the development of chemical recycling. Despite a rapidly growing demand for recycled materials, uncertainty around the recognition and interpretation of mass-balance will deter some polyolefins users from being proactive in terms of circularity of plastics due to the uncertain



environment (recognition of mass-balance, possible claims, price of recycled content...).

Many applications, such as food-grade packaging, would struggle to find solution to their circularity challenges.

- **Uncertainty in business case & investment**: many announced investments for chemical recycling have been based on an understanding of mass-balance with free-attribution certified by international schemes. A different interpretation of mass-balance will lead to a different business case and potentially to a reconsideration of these investments. This will be detrimental to the dozens of start-ups and SMEs that have independently invested millions in R&D for the improvement and development of chemical recycling and the development of projects.
- **Recycling and recycled content targets**: We strongly believe that all recycling solutions will need to be deployed jointly to tackle the plastic waste issue and enable circularity for plastics. Without thermal technologies the European recycling targets will likely be missed, and the plastic strategy of the EU is unlikely to be successful. This would inevitably impact on the dual ambition significantly to increase recycling rates for polyolefins, and incorporate virgin-quality recycled content in plastic products, particular for food grade applications.
- **Emission targets**: If polyolefins continue to be incinerated at the end of their life and crude oil continue to be used for new plastic and other chemical products, the linear economy will be perpetuated with limited possible emission reduction. Creating a circular economy for plastics through various recycling technologies will reduce CO₂ emissions and will contribute to reaching the EU net-zero targets by 2050.

6. What do we need to develop the chemical recycling industry, to contribute to increase recycling rates and recycled content targets?

In order for the chemical recycling industry to achieve its full potential to deliver a true plastic circular economy, we politely call for further engagement between the Commission, its consultants and with our experts at Chemical Recycling Europe on:

- A strong, trusted and legally compliant regulatory framework for mass balance.
- The recognition of the full recycled output of chemical recycling through appropriate certification scheme(s)
- A thorough legal assessment of the compatibility of the mass balance allocation options with the current definition of 'recycling' in the Waste Framework Directive.
- Appropriate education and consultation on this issue for all plastics including polyolefins and mixed plastics.
- Future reviews of Regulations and Directives relevant to the recycling of plastics.



CHEMICAL RECYCLING EUROPE

Contact details: solutions@chemicalrecyclingeurope.eu