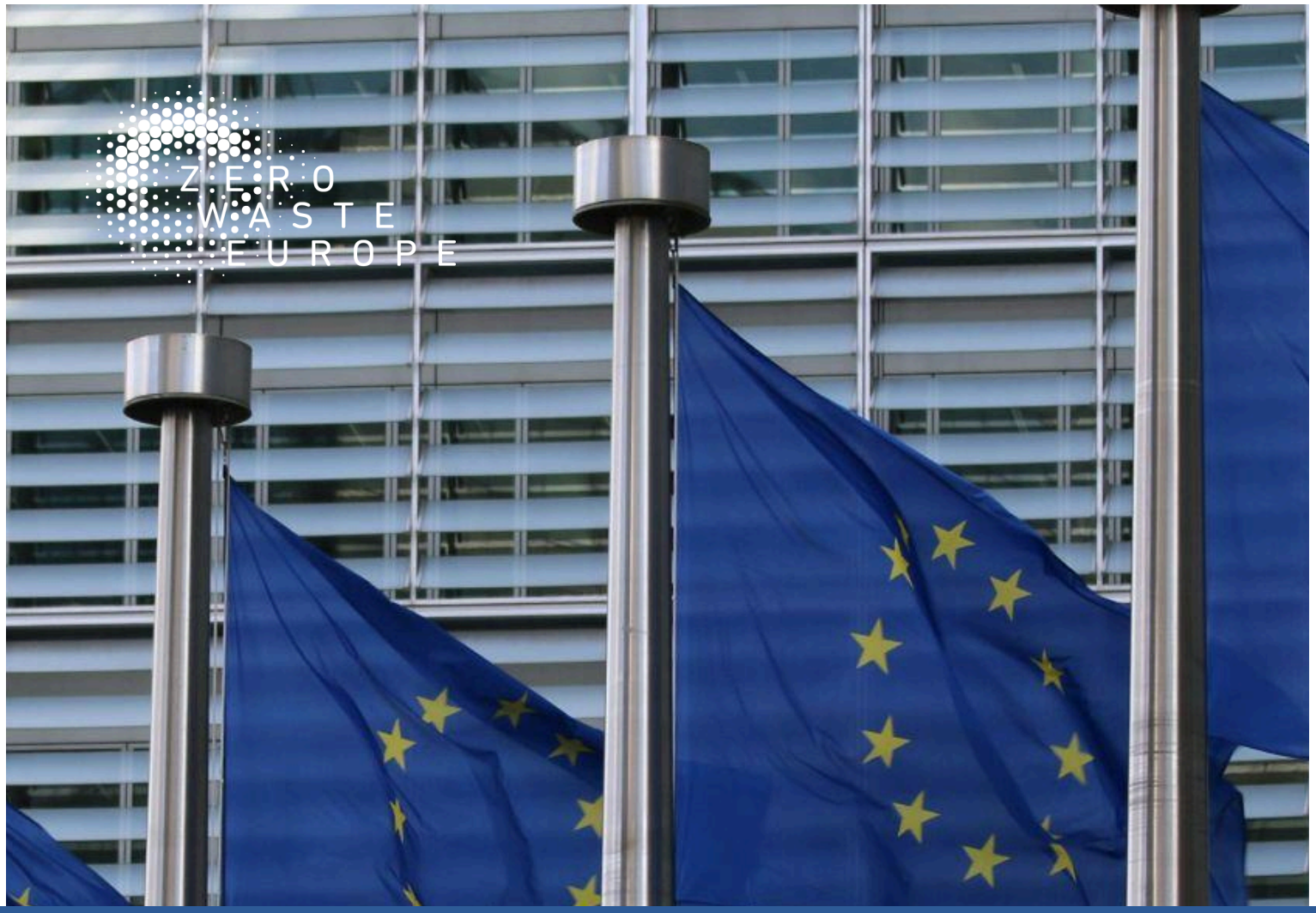

Single-use plastic beverage bottles

EU rules for calculating, verifying and reporting on recycled plastic content

Response to the consultation

August 2025

zerowasteeurope.eu

Zero Waste Europe (ZWE) welcomes the opportunity to provide feedback on the implementing decision laying down common rules for calculating, verifying, and reporting on recycled plastic content in single-use plastic beverage bottles.

Since the **adopted methodology will be the first of this type, it will create a precedent and influence the upcoming legislative pieces related to the issue of recycled content.** This has been enshrined by the proposal, which links the proposal to the Regulation 2025/40 on packaging, and to other sectors like textiles and automotives, as confirmed by the Communication attached to the launch of the consultation.[1] It is of the utmost importance that it is done right to reduce plastic environmental impact, enhance plastic circularity, and respect the level playing field between recycling technologies. As plastics are the first materials facing legislative requirements to introduce recycled content in their final product forms, one can wonder how fair the draft proposal under consultation is towards other recycled materials. If an untransparent and unreliable methodology for plastics recycling is adopted, the sector will be in a position to show an improved recycling pathway at the expense of other materials with fully functioning recycling systems.

Ensuring a clear and consistent legislative framework

In line with the SUPD goals to reduce marine litter and support the development of circular economy, as well as applying the principle of effectiveness,[2] the Implementing Decision (ID) rightly recognises post-consumer plastic waste as the only source for recycled plastic as defined under Article 1 (1) as ***"plastic which was post-consumer plastic waste before recycling, and which has been produced by recycling as defined in Article 3, point (17), of Directive 2008/98/EC".*** **Focusing on post-consumer plastic waste creates an additional incentive to work towards achieving the separate collection introduced by the SUPD itself.**

[1] European Commission Communication, Plastic waste: Commission consults on new rules for chemically-recycled content in plastic bottles, July 2025

[2] Rethink Plastic alliance, Letter on Recycled plastic content in SUP beverage bottles, 2021

Unlike Regulation 2022/1616 on recycled plastics for food contact applications, which does not recognise pre-consumer waste as waste, the concept of mass balance does.[3] The latter is presented as the necessary method to account for recycled content from technologies not covered by Regulation 2022/1616. Recital (8) introduces the **possibility of using a mixture of pre-and-post-consumer plastics waste as input for recycled content**: *"Recycled plastic that is obtained by any other recycling technology, including chemical recycling during which the chemical structure of the material is changed, or that is produced from a mixture of pre- and post-consumer plastic waste, should be taken into account in the calculation, verification and reporting of data on recycled plastic content in beverage bottles to be carried out under this Decision".* **These provisions introduce a loophole in the definition of recycled content that contravenes the main goals of the SUPD on marine litter prevention and the development of a circular economy.** Indeed, Recital (16) confirms that *"there are already sufficient market incentives for the recycling of pre-consumer plastic waste. Moreover, Directive (EU) 2019/904 aims to reduce the impact of certain plastic products on the environment and pre-consumer plastic waste is usually not leaked into the environment."*

Article 11 repeals Implementing Decision 2023/2683 to ensure legal certainty and clarity. This is crucial as both Implementing Acts have different scopes regarding the origin of 'post-consumer plastics waste'. The current proposal includes waste originating from third countries in line with Regulation 2025/40 on packaging (thereafter PPWR). While a **harmonised EU legislative framework with aligned definitions between legislation is key for its implementation and provides certainty,** we must recall the subsequent safeguard introduced while agreeing on the extension of the definition - i.e. the introduction of a mirroring clause -, which was the most sensitive issue in the negotiations on the PPWR. However, this clause has been left out of the current proposal. Considering the current context of the plastic recycling industry, the **provision introducing the mirroring clause shall be introduced in the draft proposal for ID, which would therefore fully align the SUPD and the PPWR**.

While the ID aims to harmonise the definition of 'post-consumer plastic waste', **it is in breach of the European legislative framework on waste** (thereafter WFD). Article 1 (14) defines the different 'output categories', including 'dual-use outputs' defined as *"outputs other than losses that can be reprocessed either into fuels or materials other than fuels".* By **granting the possibility to be reprocessed, the concept is not in line with the definition of recycling from the WFD** as stated under Article 3 (17): *"any recovery operation by which waste materials are reprocessed into products, materials or substances, whether for the original or other purposes. It includes the reprocessing of organic material but does not include energy recovery and the reprocessing into materials that are to be used as fuels or for backfilling operations."* To **remain in line with**

[3] Regulation (EU) 2025/351, Recital 11 : *"During the manufacture of plastic materials and articles, it is not possible to fully avoid the production of off-cuts, scraps and other by-products. Allowing the reprocessing of these by-products for manufacturing plastic materials and articles can contribute to the reduction of the occurrence of unusable manufacturing materials. If by-products can be used directly in the manufacturing of plastics without any further operations than normal industrial practices such as shredding and re-granulation, they are not considered waste. As Commission Regulation (EU) 2022/1616 (9) does not apply to these by-products and clarity is required over which by-products can be considered safe for reprocessing, rules should be laid down to ensure the safety of their use. It is therefore appropriate to include a definition of reprocessing to have a clear delineation between the products to which Regulation (EU) No 10/2011 apply and those to which Regulation (EU) 2022/1616 applies, and to lay down rules for the safe reprocessing of these by-products"*

the WFD, the concept of 'dual-use output' shall be removed and any reference to a potential reprocessing from the output definition of 'output category'.

Consequently, the definition of **'recycling pathway'** in Article 1(19) — i.e *'a process which preserves the potential of eligible material being processed into a non-fuel'* — **fails to guarantee that the input material will actually be reprocessed.** Therefore, this concept can also be seen as inconsistent with the EU Waste Framework Directive (WFD) and should therefore be removed.

Recital (9) states that "*Depending on the stage within the recycling process, 'eligible material' can have the status of waste or non-waste*". This is unclear and creates confusion and uncertainty about the status of the material, as the recycling process is not defined. As the proposal makes several references to Regulation 2022/1616, one can think that the definition from this Regulation is implied.[4] However, it doesn't apply thoroughly in this proposal. This needs to be clarified by clearly defining the **'recycling process' under Article 1 to ensure that all technologies are considered by this definition, and that all their decontamination and post-processing steps are covered before claiming a non-waste status**.

The term 'chemical building blocks', defined in Article 1(15) as "*chemicals that form the base for polymers, as defined in point 5 of Article 3 of Regulation (EC) No 1907/2006, including monomers and other reactants such as initiators for polymerisation*", are inputs, outputs, or both along the value chain, which may result in the production of polymer. However, **to enhance regulatory clarity and ensure alignment with existing chemical legislation, this concept of 'chemical building blocks' should be replaced by the term 'intermediate' as defined in Article 3(15) of Regulation (EC) No 1907/2006** (thereafter REACH): *"a substance that is manufactured for and consumed in or used for chemical processing in order to be transformed into another substance(s)."* This established definition more accurately reflects the role of such substances in chemical transformation processes, where they are consumed and converted into new substances. With the willingness to cover all necessary steps resulting in the creation of a polymer, the concept of 'chemical building blocks' blurs the important distinction between reactants and monomers. In contrast, the REACH definition of 'intermediate' clearly describes the transitional nature of such substances, provides the necessary precision for an effective regulatory implementation, and removes any uncertainty on the classification of the substances under chemical legislation.

[4] European Commission, Regulation 2022/1616 on recycled plastic materials and articles intended to come into contact with foods, 2022 - Article 2 (13) 'recycling process' means a sequence of unit operations that is intended to manufacture recycled plastic materials and articles through pre-processing, a decontamination process, and post-processing, and which is based on a specific recycling technology

Wording suggestions for the implementing decision

Suggestions for amendment

- To meet recycled content targets, exclude pre-consumer waste, even when mixed with post-consumer waste and primary raw material.
- Introduce the 'mirroring clause' requirement in the definition of recycled content to align with the PPWR.
- Remove the concept of 'dual-use outputs' and 'recycling pathway'.
- Delete the use of the future tense in the definition of 'fuels' and 'non-fuels'.
- Introduce the 'recycling process' definition, as defined under Article 2 (13) of Regulation 2022/1616.
- Replace the concept of 'chemical building blocks' with the concept of 'intermediate', as defined in REACH.
- Add the definitions of 'polymer' and 'monomer' as laid down in REACH under Article 3 (5) and (6).

Introducing a mass balance system – an obstacle in the traceability system

Scope of implementation

The introduction of the mass balance chain of custody to account for recycled content is presented as necessary to cover additional technologies that are not covered by Regulation 2022/1616, including chemical recycling. However, the proposal does not define 'chemical recycling', which can cover a broad range of very different technologies, working with different input requirements, processes and with related outputs varying greatly.

Still, it makes general claims around its efficiency as outlined in Recital 5 – i.e. *"Chemical recycling can treat plastic waste which is difficult or impossible to mechanically recycle and can deliver higher quality and technical performance of recycled outputs"*, which is still debated (including the feasibility of chemical recycling on an industrial scale), especially regarding pyrolysis, which is directly mentioned in the proposal.[5] It shall rather be considered a chemical recovery process.[6]

In addition, Recital 5 states that 'chemical recycling' delivers a high quality in terms of both output and process, implying that the process is safe, providing content without harmful chemicals. This is questionable. Chemical recycling technologies (such as chemical depolymerisation) covered by Regulation 2022/1616 are considered as "novel technologies" and still need to be fully assessed for chemical safety and their suitability (authorisation) for food contact applications. Chemical recycling technologies not covered by Regulation 2022/1616 on recycled plastics for food contact applications (such as pyrolysis) are covered by the new Commission Regulation (EU) 2025/351 (amending Regulation (EU) No 10/2011 on plastic materials and articles intended to come into contact with food). The new rules were established to ensure that contamination in the final plastic material does not result in a risk to human health, and require that **substances produced from waste (including monomers) should also be of a high level of purity** (they have to be subject to a toxicological assessment). Indeed, **during chemical recycling, harmful substances present in the feedstock may persist through the process, or new harmful substances may form as a result of**

[5] Zero Waste Europe, Leaky loop "recycling": A technical correction on the quality of pyrolysis oil made from plastic waste, 2023

[6] Deutsche Umwelthilfe, Environmental Coalition on Standards (ECOS), Zero Waste Europe, Chemical Recycling and Recovery, Recommendation to Categorise Thermal Decomposition of Plastic Waste to Molecular Level Feedstock as Chemical Recovery, 2021

chemical reactions due to the intrinsic chemical reactions enhanced by the process.[7,8] When applying a mass balance system, traceability requirements in this draft act are low. Article 7 (5)(a) refers to a "feasible chemical process", which does not give any certainties regarding the proper control of substances. This goes against supporting the transition towards a circular economy, which shall rely on a high level of safety for materials, fitting both primary and secondary uses. This issue shall not be overlooked, given the proven impact of chemicals on our health.[9]

Furthermore, the proposal makes a clear reference to the **complementary role of chemical recycling towards mechanical recycling** as outlined in Recital 5: *"Chemical recycling can treat plastic waste which is difficult or impossible to mechanically recycle"*. Such a statement is problematic as it closes the door to future technological developments improving the quality of mechanical recycling. However, we still welcome the complementary part, despite the absence of a concrete proposal at the core of the text. Due to the better environmental performance of mechanical recycling over chemical recycling, a clear proposal shall be made to ensure that the priority is clearly enabled by the proposal. To correct this, we propose that only the parts of the bottle not covered by Regulation 2022/1616, i.e. body, caps and lid, mostly made of polyolefins, can apply a mass balance system. To further enhance the complementary role and to ensure that the circular economy goes hand in hand with the European climate commitment to achieve climate neutrality by 2050, the proposal should include the sustainability criteria for plastics recycling technologies as agreed in Article 7(9) of the PPWR. It also enables a better alignment within the legislative framework and helps identify the processes that are merely recovering chemicals from those actually helping to recycle plastic waste.

To ensure a **proper comparison between technologies and having a real framework to support complementarity**, it is key to have the same boundaries for recycling and recycled content. Therefore, the calculation points shall also discount energy use and losses for the processes after the steam cracking stage, i.e. repolymerisation and plastic pellet shaping. This will ensure the full system boundaries are considered and the processing stages are comparable with mechanical recycling, which include *"sorting, grinding, washing, separating materials, drying, extruding and re-crystallisation"* - Article 1 (20).

[7] Zhou H, and all, Polycyclic aromatic hydrocarbons (PAH) formation from the pyrolysis of different municipal solid waste fractions, Waste Manag. 2015
[8] ZWE, Leaky loop "recycling": A technical correction on the quality of pyrolysis oil made from plastic waste, 2023
[9] ZWE, We had a Green Deal, now Europe needs a Health Deal, 2023; The Lancet Countdown on health and plastics, 2025

A proposal that bucks the trend of the current simplification wave

The proposed ID introduces a mass balance system based on the so-called *"fuel-use excluded approach,"* as outlined in Recital (20), which is further specified under Article 7.

Before entering into the technicalities of this article, we would like to recall that under these attribution rules, substances that are neither reprocessed into plastic products nor converted into fuels may still be counted as eligible material for recycled content credits. In practice, this means that the **chosen 'recycling pathway' does not guarantee that input materials contribute to plastics recycling;** instead, they may be diverted to other chemical production processes. This approach undermines the objective of fostering circularity in plastics, as set out in the same ID.

To consider the recovering pathway via the steam cracking step, the proposal **introduces the concepts of dual-use output and 'maximum acceptable boiling point'** following a standard test method for boiling range distribution of petroleum fractions by gas chromatography described under Article 7 (3). To account for all losses happening at the different stages of the process, the first calculation point should be at the very beginning of the process, i.e. with plastic waste. In the case of pyrolysis, it means before waste enters the pyrolysis plant. This extension will enable consideration of treatments that are necessary for pyrolysis oil to meet the steam cracker requirements, such as hydro-treatment and hydrocracking, but also for additional treatments that are necessary to bring 'dual-use output' back into circulation. It also uncovers the need for purification of pyrolysis oil. Indeed, the recovered oil is too contaminated or doesn't meet the steam cracker requirements, designed for virgin petroleum naphtha. Purifying it of its contaminants, especially to obtain a high degree of purity of substances/monomers to be applied in plastic contact-sensitive applications, would require multiple stages of energy-intensive treatment, so the only other solution is to dilute plastic-derived pyrolysis oil with virgin petroleum naphtha. Generally, **one assumption is that it might be feasible to blend 5 to 20% pyrolysis oil with 80 to 95% petroleum naphtha to counter contaminants, resulting in the maximum achievable recycled plastic waste content in new plastic being 0.03%.**[10,11]

Article 7 on mass balance introduces another level of complexity and subjectivity to an already problematic framework. Indeed, it describes how to calculate the weight of eligible materials depending on the gas chromatography linked to the 'maximum boiling point'. This process is based on analysing individual hydrocarbon molecules through the analysis of temperature variation and peaks (more information in the Gas Chromatography box below). It is worth noting that the **methodology developed goes against the European**

[10] Zero Waste Europe, Leaky loop "recycling": A technical correction on the quality of pyrolysis oil made from plastic waste, 2023
[11] Enviromental Coalition on Standards (ECOS), Zero Waste Europe, Rethink Plastic alliance,, 'Dual-use output' issues for accounting recycled plastic content, 2024

Better Regulation principle and simplification agenda currently pushed by the European Union.[12] Indeed, what is proposed in this draft will not reduce administrative burden, but rather decrease the competitiveness of SMEs.

In addition, this analysis will be subjective to the person analysing the chromatography, therefore **reinforcing the already creative and deceptive accounting system of mass balance. Indeed, with the spread of the use of the mass balance attribution system, the risk for greenwashing claims on recycled content increases**. This has been done by various institutions already, in the US by the Environmental Protection Agency with its Safer Choice Standards, which states: "Allowing producers to advertise that a product contains 'recycled content' based on the amount of recycled material purchased is deceptive" in its comments to the U.S. Federal Trade Commission in April 2023. This has also been the case in the clothing sector, when the Dutch Authority for Consumers and Markets criticised H&M and Decathlon for their misleading claims.

Gas Chromatography

Gas Chromatography (thereafter CG) has been developed to identify the amount of different types of hydrocarbons from a mixture. Concretely, it boils a sample of oil until it becomes a gas and gets pushed through a tube called a column. Chemicals are travelling at different speeds, resulting in different peaks on an illustrative graph showing how many components are present. This technique is sensitive and can be affected by equipment settings and environmental conditions.

Peaks can overlap during the process, making the identification more challenging. With a non-standard oil like pyrolysis oil from plastic waste, which is very different from virgin naphtha in its composition, the chromatograph will be more difficult to interpret, reinforcing the subjectivity of the process and its susceptibility to bias, individual differences and lack of consistency. The composition of pyrolysis oil fluctuates depending on the waste input, limiting the relevance of one sample (5g for a GC) in comparison to tons processed by a steam cracker. In addition, the possibility to define a weighted average of the maximum acceptable boiling points of all the individual steam crackers, as enabled by Article 1(21), could create unrepresentative accounting. Indeed, taking the weighted average could show a disproportionate use of the heavy oil. All of this can lead to inconsistent results and significant measurement errors when determining the weight of hydrocarbon compounds in steam cracking pyrolysis oil, which are the essential components that serve the attribution process for recycled content.[13]

Furthermore, the absence of specified testing frequency requirements for analysing 'eligible material' composition can lead to significant variability between facilities. If testing occurs only once per three-month mass balancing period, Article 7(6), reporting accuracy becomes questionable, particularly since pyrolysis oil composition varies considerably between batches based on the processed plastic waste. The proposal shall therefore establish clear guidelines regarding the required frequency of testing methods to ensure consistent and reliable reporting across all facilities.

[12] *"The European Union's Omnibus simplification agenda, initiated in February 2025, aims to reduce administrative burdens and enhance competitiveness, particularly for small and medium-sized enterprises (SMEs)"*

[13] Erkmen, B.; Ozdogan, A.; Ezdesir, A.; Celik, G. Can Pyrolysis Oil Be Used as a Feedstock to Close the Gap in the Circular Economy of Polyolefins?, Polymers 2023, 15, 859.

Lastly, the proposal insists on the steam cracking step; however, other steps are needed to process pyrolysis oil, especially dual-use output, like heavier hydrocarbons, like PAHs, which might be sent back into the refinery for upgrading purposes. If so, the proposal does not cover this situation and shall be extended to other processing steps to upgrade pyrolysis oil, like fractional distillation, hydro-treatment, and hydrocracking.

The proposal relying on 'maximum boiling point' goes against the Better Regulation principle, and could be replaced by a more straightforward methodology: **weighing the purified and distilled pyrolysis oil at each step, discounting what is lost and being used for fuel.** The process shall go from the first calculation point, i.e. before the waste goes through the pyrolysis step, until the outcome can be reprocessed directly into a product to align the boundaries between different chains of custody. By introducing this scope and deducting all losses and fuel use, all dual-use output will be covered regardless of the subsequent pre- and post-processing steps. By proportionally discounting losses until the final step, this approach would ensure a level-playing field between different recycling technologies and a proper comparison between technologies based on their capacity to keep plastic materials in the loop.

Wording suggestions for the implementing decision

Suggestions for amendment

- Remove Recital 5.
- Prioritise the traceability of Regulation 2022/1616 over mass balance system.
- Include the sustainability criteria for plastics recycling technologies as agreed in Article 7(9) of the PPWR.
- Replace the 'maximum boiling point' procedure by a proportional discount of pyrolysis oil going for fuel or being lost at each step of the process (i.e. including fractional distillation, hydro-treatment, and hydrocracking).

Enforcing the impossible?

As explained in the previous section, the methodology relying on mass balance is very technical, complex, and subjective. Indeed, the dual-use assessment relying on 'maximum boiling point' and related GC procedure will require a large amount of resources for companies, especially when considering all related steps linked to the steam cracking process (i.e. fractional distillation, hydro-treatment, hydro-cracking).

This will create additional administrative burdens for companies in a context where the Commission aims to reduce them. Alongside the consequent administrative burden, **one can question how the different Member States and responsible auditing/certifying companies will adopt and enforce this methodology**. These concerns are also **relevant for recycled content coming from outside the Union, as it's part of the proposal,** at a time when Member States' market surveillance authorities are already under pressure regarding their capacity.[14] This situation will become even more questionable considering the complexity of the current proposal when aiming to ensure the accuracy of recycled content reporting.

Lastly, in the case of enforcement, the proposal does not define the penalties to effectively ensure action. Indeed, we have learned that, since Member States have not implemented significant financial penalties for non-compliance with the recycled content, certain producers would prioritise cost-saving by using only virgin plastics over rPET as it is still the cheapest option. Indeed, the pricing gap between vPET and rPET is increasing, acting as a disincentive for rPET. In March 2025, according to ICIS, the discrepancy amounted to almost 600 EUR with a ton of food-grade rPET sold at up to 1,800 EUR in Europe.[15] To ensure a proper behavioural change from companies, penalties and disincentives for virgin production shall be increased to encourage moving away from virgin plastics. The price is essential for the penalty to be effective and shall be at least higher than rPET.[16] Considering the increasing capacities (often overcapacity) for virgin polymer production worldwide, the prices of virgin plastics are not expected to rise in the future.

[14] European Parliament, Market surveillance for effective consumer protection in the EU The role of Market Surveillance Authorities and their cross-border cooperation, 2023
[15] Recycling Today, ICIS says rPET incentives remain weak, 2025
[16] B.D. Vogt, K.K. Stokes, S.K. Kumar, Why is recycling of postconsumer plastics so challenging?, 2020

Zero Waste Europe (ZWE) is the European network of communities, local leaders, experts, and change agents working towards a better use of resources and the elimination of waste in our society. We advocate for sustainable systems; for the redesign of our relationship with resources; and for a global shift towards environmental justice, accelerating a just transition towards zero waste for the benefit of people and the planet.
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Zero Waste Europe gratefully acknowledges financial assistance from the European Union. The sole responsibility for the content of this material lies with Zero Waste Europe. It does not necessarily reflect the opinion of the funder mentioned above. The funder cannot be held responsible for any use that may be made of the information contained therein.

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