EU accounting methodology for recycled plastic content

ECOS feedback | Draft implementing decision, Single-Use Plastic Directive

Brussels, July 202531 July 2025

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Contents

Executive summary....2

Ensure consistency with EU recycling and chemical rules....3

Restrict the scope of mass balance attribution....4

Simplify and make mass balance attribution reliable....5

Ensure actual circular use of plastics....6

Ensure sustainable circular economy....7

Conclusion: the proposal is neither proportional nor mature....8

Annex: Gas chromatography: a subjective and deficient method....8

References....9

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Executive summary

ECOS welcomes the opportunity to provide feedback to the European Commission's draft implementing decision overhauling the EU rules for calculating, verifying and reporting on recycled plastic content in single-use plastic beverage bottles and repealing the current decision (EU) 2023/2683.

We are highly concerned that the proposed mass balance attribution accounting methodology based on the fuel-exempt method, the dual use factor and very complex calculation points will not help meet the very own goal of the Single-Use Plastic Directive (SUPD): "to ensure the circular use of plastics" by promoting "the market uptake of recycled materials."[1] It virtually inflates plastic products' reported recycled content, allowing to claim more while continuing business as usual. This proposal also includes several unclarities and inconsistencies with the existing European legal framework, especially the EU Waste Framework Directive (WFD)[2], which should urgently be addressed.

Even though this draft implementing decision is limited to beverage bottles for implementing the SUPD 2025 recycled plastic content target, it will set a blueprint for other EU legislation on recycled content (e.g. for packaging, textiles and vehicles), and potentially at the international level too. It will also be used as a basis for the development of a European standard on accounting recycled plastic content in products, which is underlying several product certification schemes and companies' green claims, resulting in high risks of greenwashing.

The Commission's proposal should also be a wake-up call: the extremely complicated fuel-exempt mass balance method will be very hard and costly to verify with high risks of subjectivity, unpredictability and misrepresentation. This shows applying the fuel-exempt method is impossible to verify with high certainty without producing something utterly complicated. On the contrary, **proportional attribution of recycled plastic content across outputs is the simplest methodology aligned with the EU legislation, the one created the least red tape, by far.** It is the only mass balance attribution accounting method ensuring a **level-playing field between recycling technologies**.

Therefore, it is crucial that the rules in the present act are amended to establish a trustworthy, transparent and clear methodology in line with the EU circular economy and competitiveness agenda, in support of an actual reduction of virgin plastic use, while respecting the level playing field between recycling technologies. Last but not least, a revised proposal for accounting recycled plastic content in PET bottles, and beverage bottles more generally, should be adopted once European sustainability criteria for plastic recycling technologies have been set for packaging to ensure a sustainable circular economy.

Ensure consistency with EU recycling and chemical rules

ECOS welcomes that 'eligible material" only includes "post-consumer plastic waste and material stemming from post-consumer plastic waste" to calculate, verify and report recycled plastic content in beverage bottles for the SUPD targets *(recitals 7 & 16, and article 1.7)*. This is in line with the spirit of EU environmental legislation, communication, and case-law, as explained in a letter from the Rethink Plastic Alliance.[3]

The proposed mass balance method, however, allows to factor in **both 'eligible material' and 'non-eligible material'**, including from pre-consumer waste or non-waste origin *(recitals 8, 18 and articles 6.1 and 7.3.c)*. If pre-consumer plastic waste is included, this would give perverse incentives to wasteful and inefficient production processes, since waste plastics can then be considered as recycled even if they have never reached consumers. The European recycled content targets should only incentivise the collection and management of waste from products that have already been placed on the EU market. If non-eligible material is counted in it, it would also incentivise the use of virgin plastics in chemical recovery processes and count them as 'recycled material'. **This is in total contradiction with the very definition of recycling from the European WFD.**[4]

Moreover, the new concept of **'dual-use output' is not in line with the European waste legal framework.** It is defined as "outputs, other than losses, that can be reprocessed either into fuels or materials other than fuels" *(recital 20, article 1.14)*. This means eligible plastic waste that could be reprocessed into fuels can be accounted for even if they leave the "recycling pathway", defined as "a process which preserves the potential of eligible material being processed into a non-fuel" *(article 1.19)*.

This is uncoherent with the proposal recital stating "economic operators should deduct eligible material that is processed into fuels or losses from the calculation of recycled content, in order to comply with Article 3.17 of Directive 2008/98/EC of the European Parliament and of the Council. This applies also for dual-use outputs" *(recital 20)*. Most importantly, **this is again in contradiction with the EU definition of recycling in the WFD** as it considers the "potential for recycling" not actual recycling. As a result, this will not help "promote the market uptake of recycled material" in PET beverage bottles. Instead, **it will promote the market uptake of fuel disguised as recycled material.** As a result, it will represent an **undue competitive advantage for economic operators applying the dual-use output method.** As an order of magnitude, recycled PET was sold at a price premium of 600€ per tonne to virgin PET in early 2025.

In addition, the definition of supply chain should be completed to **include all stages of the plastic value chain until the beverage bottles reach customers**, in line with the Ecodesign for Sustainable Product Regulation (ESPR)[5]. This will help ensure a level-playing field between recycling technologies and a consistent calculation methodology that includes all recycling steps.

We finally regret that the concept of 'chemical building blocks' used for chemical recovery technologies has been maintained in the proposal. It is a marketing concept, which should be replaced by **'intermediates'** to ensure consistency with REACH and further scientific accuracy.[6] A reference to the definitions of 'polymer' and 'monomer' from the REACH Regulation should also be added as they are mentioned in the proposal.[7]

	Amendment proposals to ensure consistency with EU recycling rules
Article 1.8	'supply chain' means the series of processes or activities involved in the production and distribution of beverage bottles, ***up to the point where beverage bottles reach the customer***
Article 1.14	Delete "or will be" from the definitions of 'non-fuels' and 'fuels'. Delete the definition of 'dual-use outputs'.
Article 1.15	Replace the definition of 'chemical building blocks' by a reference to the definition of 'intermediate' in article 3.15 of the REACH Regulation. Add: 'polymer' and 'monomer' as defined in Article 3.5 and 3.6 of the REACH Regulation.
Article 1.19	Delete the definition of 'recycling pathway'.
Article 1	Add the definition of "recycling process' from Regulation (EU) 2022/1616: "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"[8]
Article 6.1	Calculation points shall be established whenever the chemical or physical composition of the material stemming, wholly or partly, from post-consumer plastic waste is changed, including where it is mixed with any other material, ***but should only count in eligible material***.
Article 7.3.c	The input material shall only be eligible material.
Article 7.4	Delete the calculation point of material "not on the recycling pathway", especially for dual-use outputs.
Article 7.5	Replace 'chemical building blocks' by 'intermediates'.
Article 8.4	Replace 'chemical building blocks' by 'intermediates'.
Recital 8	Add: Only eligible material should be counted in the calculation points.
Recital 20	Remove the concept of 'dual-use outputs'.
Recital 22	In addition, operators processing material consisting of ***intermediates*** but not polymers at the input stage, the output stage, or both, should be subject to third-party verification.

Restrict the scope of mass balance attribution

First, some sweeping statements about "chemical recycling" should be removed. For example, it is not true "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" *(recital 5)*. Actually, **most plastic waste is unsuitable for chemical recovery** because too heterogeneous and with the wrong chemical composition. Even common homogeneous plastic wastes cannot be treated: **pyrolysis cannot handle polyethylene terephthalate (PET)** and polyester – disposable bottles and textiles.[9] Based on these false assumptions, the proposal introduces new detailed rules for "chemical recycling, and the related supply chain (such as pyrolysis oil)" *(recital 4)* even though **pyrolysis cannot treat PET**.

Importantly, PET represents more than 80% of the plastics in beverage bottles in the scope of the SUPD targets.[10] This polymer is "today properly and safely recycled by mechanical process. Thanks to the investments of the European mechanical recycling industry, the installed capacity for PET food-grade in 2022 is already enough to meet, not only the 2025 target of 25% recycled content for beverage bottles, but also the 2030 target"[11]. As for depolymerisation of PET, the rules set up in the Commission Implementing Decision (EU) 2023/2683 could be applied because the reporting chain from Regulation (EU) 2022/1616 is also valid for this technology *(article 5.2)*.

Moreover, the proposal insists on the environmental principle according to which "**chemical recycling should complement mechanical recycling**, which is in general preferable from an environmental point of view, where it delivers sufficient quality and technical performance of recycled outputs" *(recital 5, also in recital 27)*. The proposal gives as an example that "the weight of chemically recycled polyolefins used in the cap should be calculated via mass balance accounting" *(recital 14)*. However, this is not mentioned in the mass balance rules that apply to the whole beverage bottle, including its body, cap, lid, and label or sleeve. This creates an unfair competitive advantage to chemical recovery processes for accessing plastic waste feedstock over mechanical recycling, and risks jeopardising mechanical recycling of plastic waste. This "represents 30,000 jobs in 850 companies, 90% of which are SMEs and could be directly affected by such competition"[12].

The proposal should thus clarify that mass balance attribution accounting applies to the polyolefins used in the beverage bottle, such as Polyethylene (PE) or Polypropylene (PP), if not already addressed by the Regulation (EU) 2022/1616.

Amendment proposals to clarify the scope of mass balance attribution	
Article 6.3	***For the polyolefins used in the beverage bottle for which*** paragraph 2 of this Article does not apply, mass balance ***attribution*** accounting shall be used in accordance with Article 7.
Recital 5	Delete 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.
Recital 20	For the application of mass balance ***attribution*** accounting ***to the polyolefins used in the beverage bottle***, it is necessary to establish rules on how the input eligible material can be allocated to the outputs in case of multi-output processes.
Recital 22	Where recycled plastic content data is obtained by other means, in particular mass balance ***attribution*** accounting ***for the polyolefins used in the beverage bottle***, a new verification system should be established.

Simplify and make mass balance attribution reliable

In addition, the proposal omits several steps in the chemical recovery process, such as **the purification / upgrading of the chemically recovered oil**[13]. These steps shall be taken into account for pyrolysis, which produces an oil so contaminated it must be heavily diluted with virgin crude oil and treated with significant effort before it can enter material processing facilities. This long series of downstream processing steps results in the amount of actual recyclate passing to the next stage being much lower than before purification**. At most only 0.03% recycled content is possible in new plastics when pyrolysis of polyolefins is used**[14]. Hence, the proposed mass balance attribution accounting for pyrolysis is used to fudge over the reality. Instead, for the full system boundaries to be considered, recycled plastic content should be verified after the steam cracking stage, where plastic precursor monomers are finally made; or more precisely, after the steam cracking monomers have been subject to both polymerisation and product shaping, for only then has recycling occurred.

In addition, the proposed method to determine the weight of the eligible material fed into the steam cracker evaporated at the "maximum acceptable boiling point", in accordance with a standard test method for boiling range distribution of petroleum fractions by gas chromatography *(article 7.3)*, brings in **extra and unnecessary layers of complexity, is subjective and will magnify an already troublesome 'dual-use outputs' concept** (see further explanations in the annex). It will thus exacerbate the problem of creative accounting in recycled plastic content. This is **definitely not in line with the European better regulation agenda.**[15]

Worst still, the boiling point calculation method is not even necessary. A much simpler and workable methodology can rely on proportionally discounting the mass lost as fuels and energy losses at each and every prior stage in order to take into account the full system boundaries. For pyrolysis, it means proportionally discounting the mass of intermediate outputs lost as fuels and energy at pyrolysis, fractional distillation, hydro-treatment (several stages), hydro-cracking, steam cracking, and repolymerisation once the monomers have been subject to both polymerisation and product shaping. The reason is that the pyrolysis oil needs these processing stages to reach similar quality as virgin petroleum oil.[16] Accounting for the full system boundaries will help ensure a level-playing field with mechanical recycling, for which all recycling processing steps are counted in "including by sorting, grinding, washing, separating materials, drying, extruding and re-crystallisation" *(article 1.20)*.

Besides, **verifying the application of 'dual-use outputs' will be very difficult** *(as required in article 8.4)*. Dual use would apply to everything that is not disposed or used as fuels. This will involve additional red tape for auditing companies considering the multiple processing stages in a petrochemical refinery, i.e. fractional distillation, hydro-treatment, hydro-cracking, steam cracking. In petrochemicals plants, for example, distillate not sent to the steam cracker, along with residue not made into monomers from the steam cracker, will be re-routed through different processes, such as fluid catalytic cracking and hydro-processing. How are the operators going to audit these processing of oils? Doing a mass balance on each process does not seem realistic. And what about imported materials? **Member States cannot realistically verify the accuracy of the information and the application of the proposed methodology to imported beverage bottles or their materials**.

Amendment proposals to simplify and make mass balance attribution reliable	
Article 1.21	Delete the definition of maximum acceptable boiling point.
Article 7	Change the title to: mass balance ***attribution*** accounting
Article 7.3	Replace the calculation point based on the maximum acceptable boiling point by proportionally discounting the mass lost as fuels and energy losses at each and every processing stage (i.e. fractional distillation, hydro-treatment, hydro-cracking, steam cracking, repolymerisation, shaping).
Article 8.4	Change to: Economic operators that calculate data [...]: And add: Keep all evidence that the mass lost as fuels and energy losses at each and every processing stage is proportionally discounted, considering the full system boundaries;
Recital 22	Change to: This verification should cover all information relevant for the allocation of eligible material under mass balance ***attribution*** accounting, such as process-specific amounts and categorisation of inputs and outputs, ***evidence that only eligible material are counted in, and evidence that the mass lost as fuels and energy losses at each and every stage is proportionally discounted, considering the full system boundaries***.

Ensure actual circular use of plastics

The proposed mass balance "fuel-use excluded" method for accounting recycled plastic content only deducts eligible material processed into fuels or losses (recital 20, article 7). It will not deduct eligible material processed into intermediate outputs that will be further processed into other substances or materials than plastics, e.g. lubricants.

Instead, **a proportional allocation method** should be used**.** It is the only mass balance attribution accounting method ensuring **a level-playing field between different recycling technologies**, and will prevent low-yield chemical recovery technologies, such as pyrolysis, to benefit from undue economic and marketing advantages by arbitrarily allocating the recycled content to the most expensive outputs.

Thanks to proportional allocation, the dilution factor of recycled content into virgin content will be comparable between recycling technologies and reflect their actual recycling yield into beverage bottles, thus **their actual value retention in a circular economy**.

Besides, the proposed mass balance attribution accounting method is expected to be used as a basis for the development of a **European standard** on accounting recycled plastic content in products within CEN/TC 249/WG 11 "Plastics recycling". Today, the European standard EN 15343[17] is underlying several voluntary certification schemes and companies' green claims. Including mass balance attribution accounting based on the 'fuel-use excluded' approach in this standard – or a new standard – can only bring consumers' distrust in the credibility of economic operators' claims and reports, and consequently in Member States' and EU's recycled content targets.[18] The European Decision will thus induce **structural greenwashing in economic operators' declarations of recycled plastic content, at product level.** This will completely contradict the objectives of the SUPD to promote the transition to a circular economy.

Amendment proposals to ensure fair competition between economic operators	
Article 7.5	After having distributed attributed amounts pursuant to paragraphs 2, 3 and 4, the economic operator may reallocate the attributed amounts ***proportionally*** among the different outputs subject to the following conditions [...]
Recital 5	Delete: "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."
Recital 20	For the application of mass balance ***attribution*** accounting, it is necessary to establish rules on how the input eligible material can be allocated to the outputs in case of multi-output processes. The rules laid down in this Decision reflect the so-called ***'proportional allocation'*** approach, meaning that at each calculation point economic operators should deduct eligible material that is processed into fuels or losses from the calculation of recycled content ***and attribute them proportionally to the different outputs***, in order to comply with Article 3(17) of Directive 2008/98/EC of the European Parliament and of the Council

Ensure sustainable circular economy

We urgently need **European sustainability criteria on plastic recycling technologies** for post-consumer plastic waste, as expected in the Packaging and Packaging Waste Regulation (PPWR)[19] by end 2026. These will help introduce safeguards so that "the way in which recycled content is obtained does not cancel out the environmental benefits of using such recycled content in subsequent plastic packaging".[20] Only then can we ensure a high level of protection of the environment and human health.

These environmental concerns have been taken into account in the PPWR recycled plastic content targets. They are also true for the SUPD recycled plastic content targets, whose 2030 target for recycled plastic content in all beverage bottles has been replaced by the PPWR target[21]. They are similarly true for the SUPD 2025 recycled plastic content target on PET beverage bottles.

Pyrolysis significantly increases the greenhouse gas emissions from processing plastic waste from polyolefins. The former Agilyx (pyrolysis) plant in the US emitted over 3 t of CO_2 for every tonne of plastic waste processed in 2019, and a huge 47 t of CO_2 per tonne of plastic waste processed the year before; this came from burning over 250,000 m^3 of natural gas per year to heat pyrolysis along with burning some of the plastic waste itself.[22]

In the GHG analysis, the full system boundaries should be considered, including the additional upgrading necessary to strip out additives from plastic-derived pyrolysis oil, the steam cracking stage down to the repolymerisation stage.

As a result, the European Commission's draft implementing decision overhauling the EU rules for calculating, verifying and reporting on recycled plastic content in single-use plastic beverage bottles is **premature**. It should be **adopted once European sustainability criteria for plastic recycling technologies have been set.**

Conclusion: the proposal is neither proportional nor mature

The Commission has failed to provide sufficient qualitative and quantitative evidence to justify the proposed mass balance attribution accounting method for chemical recycling processes using multi-outputs can contribute to the SUPD 2025 recycled content target in PET beverage bottles and the overall goal to ensure the circular use of plastics. The proposal does not provide any evidence how this will help ensure economic viability for all plastic recycling technologies, nor why such permissive and untransparent accounting would be necessary to meet recycled content targets. On the contrary. The proposal risks jeopardising a well-established and efficient recycling technology, mechanical recycling of PET bottles. It will also not guarantee actual value retention in these products, resulting in the promotion of unsustainable oil-burning technologies and lock-in assets. Hence, it does not meet the proportionality principle from article 5(4) of the Treaty on European Union, and even breaches EU law, such as the WFD.

Annex: Gas chromatography: a subjective and deficient method

The subjectivity of the gas chromatography analysis comes from the identification of individual compounds based on the peak areas, as acknowledged in EN 15199-4 clause 11[23]. Different column materials and different temperatures affect the clarity of results, with some column materials not being as effective at separating out the mixture. Identifying peaks thus involves some **subjectivity** to identify their size and area. Some hydrocarbon molecules also have similar retention times, some potentially hiding others and peaks overlapping. This can result in an **inaccurate estimation of the mass of the hydrocarbon** (e.g. ethane or butane).

Moreover, the examples of retention index data and chromatogram for identifying individual components from Annex A of EN 15199-4 rely on the light fractions of crude oil. Economic operators can use it as a reference to estimate the nearest likely component. But **pyrolysis oil from plastic waste is not a standard oil**. It is completely different than naphtha in its hydrocarbon composition. It is also **very heterogenous and variable in quality**. What's more, the sample analysed by gas chromatography will be very small (about 5g) from a process of many tonnes, for a laboratory scale purpose. Yet, the proposal does not refer to any frequency of testing, nor verification, just "an annual verification at facility-level performed by a verifier". These points leave even more scope for inconsistency and misrepresentation of the peak areas of pyrolysis oil, hence the weight of the hydrocarbons.

Therefore, **determining the weight of the eligible material** fed into the steam cracker evaporated at the maximum acceptable boiling point, in accordance with a standard test method for boiling range distribution of petroleum fractions **by gas chromatography. It will not help identify the individual components from pyrolysis oil that subsequently go on to make recycled plastic.**

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[17] EN 15343:2007, *Plastics - Recycled Plastics - Plastics recycling traceability and assessment of conformity and recycled content.*
[18] The Netherlands Authority for Consumers and Markets (ACM) pointed in their investigation of the clothing company H&M for misleading green claims that the companies gave the impression individual products were manufactured with "sustainable cotton" (through a 'mass balance system'), whereas **it was "impossible to guarantee that an individual product" actually contained sustainably sourced cotton**.
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