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100% Greenwash?

Green Claims on PET Beverage Bottles in Europe

October 2023

Published by ClientEarth, ECOS and Zero Waste Europe

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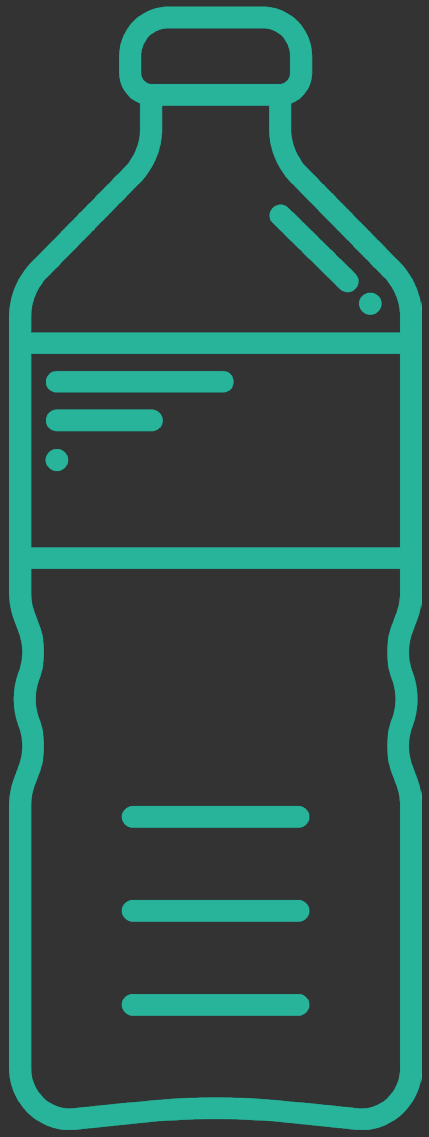
eunomia



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In this report, we explore the current state of PET-based bottle recycling in Europe, as well as its potential for improvement, alongside analysis of common claims made to consumers on bottle labels relating to recycling. As we argue below, such claims can give an impression of 'plastic bottle circularity' that does not reflect reality.

While it is clear that rates of plastic recycling for PET bottle bodies are improving in Europe and are likely to further improve in future years, it is also clear that a fully circular system for PET-based bottles does not exist at present and is not feasible. The idea of used bottles simply becoming new bottles over and over again may be appealing to companies and consumers alike, but it does not reflect the outcomes for PET-based bottles in Europe.

Limits to circularity

Plastic beverage bottles are composed of three components: the body of the bottle, the cap, and any labels (plus any adhesives needed to attach the label to the bottle).

Even for the **PET bottle body** alone, a perfectly 'circular' recycling system in which all PET bottle bodies placed on the market are composed of 100% recycled content, eliminating the need for virgin content, does not exist in practice. This would require a 100% collection rate, no loss of material in either the sorting or recycling processes, and no recycled materials derived from beverage bottle bodies going to other product applications (e.g., other forms of packaging or textiles). Furthermore, even if a 100% collection rate could be achieved and sorting/recycling losses eliminated, there are, at present, technical limitations to the amounts of recycled content that can be maintained over multiple cycles of recycling. The physical qualities of PET material cannot currently be maintained through an infinite number of mechanical recycling cycles.

It seems likely a relatively high proportion of **caps**, which are usually made from either PP or HDPE, are sent for recycling. However, PET is currently the only type of mechanically recycled plastic that is permitted for use as food and drink packaging. There are no authorised mechanical recycling processes for producing food contact rPP and rHDPE in the EU at present, which means that caps cannot be recycled back into new caps for PET-based bottles. Thus, there is currently no circular mechanical recycling system for caps in Europe.

While separated **labels** could technically be recycled, the material is often of a relatively low quality due to high levels of coloured materials, inks, adhesives and, likely, a high moisture content. Therefore, this material is often unsuitable to be recycled back into labels. Additionally, as there is not much demand for this material at present, its value is low. As a result, there is not much infrastructure available to recycle this material in Europe, and as such there is likely limited recycling of labels at all, and likely virtually no recycling of labels back into new labels at present.

Executive summary

Claims to consumers

It has become increasingly common for companies to include claims relating to recycling as part of the messaging featured on beverage bottles. However, recycling claims made to consumers are often factually inaccurate and, in our view, potentially misleading to consumers. We have identified the main categories of on-bottle claims as being:

Claims that bottles are '100% recyclable'

We consider there are two likely consumer interpretations of these claims:

Interpretation 1: All (100%) of the components of the beverage bottle are 'recyclable' (noting that what 'recyclable' itself means is not necessarily clear).

This interpretation is problematic because plastic beverage bottles are composed of three components: a bottle body, a cap, and a label (plus any adhesives required to attach the label to the bottle). Therefore, consumers may interpret '100% recyclable' to mean that each of these components is 'recyclable'. However, in practice the likelihood of each component being recycled varies widely.

Interpretation 2: The beverage bottle will be recycled at a 100% rate.

This interpretation clearly does not reflect reality. Even taking the PET bottle body – the most widely recycled of the plastic components in the beverage bottles – a 100% recycling rate does not exist anywhere in the EU in practice and is not achievable even in theory due to the inevitable losses that occur during the sorting, washing and flaking stages.

Claims that bottles include '100% recycled content'

Logically, an average consumer would interpret a "100% recycled content" claim (and variations of this) to mean that the entire product is made from recycled content. However, there are in fact several issues with such claims.

- **Not all components of beverage bottles are made of recycled content;** generally, only the PET component is made from recycled content.
- **Recycled content claims sometimes contain qualifying statements** highlighting that caps and labels are excluded from the claim elsewhere on the label, but these may be less visible to consumers and otherwise insufficient to counteract the impact of the main '100%' claims.
- **Recycled content claims sometimes refer specifically to PET** (e.g., '100% recycled PET') but in our view, consumers are unlikely to know that only the bottle body is made of PET.
- In some cases, even the bottle body **may not be fully made of post-consumer recycled content;** and
- **Approaches to calculating recycled content may vary,** meaning that specific products purchased by consumers may not contained the amounts of recycled plastic advertised.

Executive summary

Recyclability

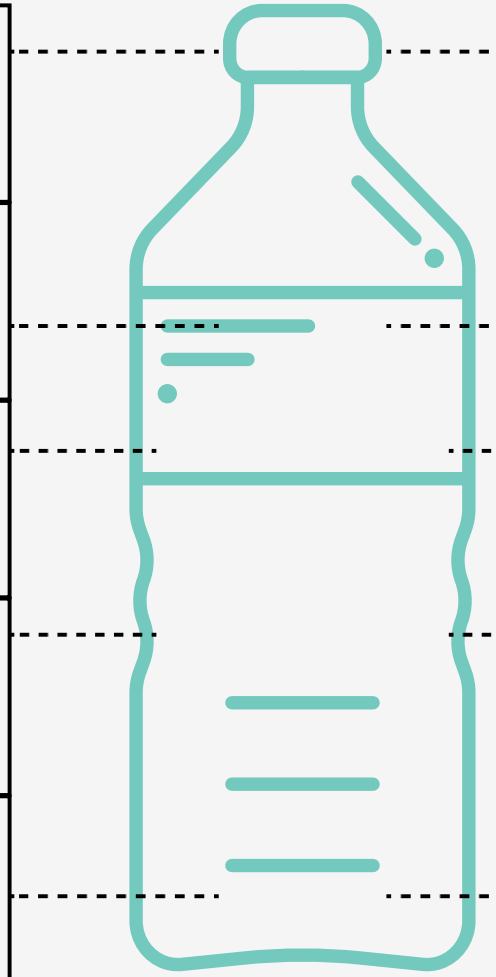
Cap
Technically recyclable? Likely
Recyclable at scale? Likely
Recyclable back into caps? No
Recyclable at 100% rate? No

Ink
Technically recyclable? Very unlikely
Recyclable at scale? Very unlikely
Recyclable back into inks? Very unlikely
Recyclable at 100% rate? No

Labels
Technically recyclable? Likely
Recyclable at scale? Unlikely
Recyclable back into labels? Unlikely
Recyclable at 100% rate? No

Adhesive
Technically recyclable? Very unlikely
Recyclable at scale? Very unlikely
Recyclable back into adhesive? Very unlikely
Recyclable at 100% rate? No

PET Body
Technically recyclable? Yes
Recyclable at scale? Likely
Recyclable back into bottles? Yes
Recyclable at 100% rate? No



Recycled content

Cap
Recycled content? Very unlikely
100% recycled content? No

Ink
Recycled content? Very unlikely
100% recycled content? Very unlikely

Labels
Recycled content? Possibly
100% recycled content? Very unlikely

Adhesive
Recycled content? Very unlikely
100% recycled content? Very unlikely

PET Body
Recycled content? Yes
100% recycled content? Yes

Executive summary

In some cases, recycling claims are supported by the use of circular, closed loop imagery and/or statements and imagery that imply or even state that that the product is 'sustainable'. Many of these claims may be problematic from a factual perspective, and overall, give an impression both of the circularity of beverage bottles and the general 'sustainability' of beverage bottles that does
not reflect reality.

Limitations to LCAs

Life cycle assessment (LCA) is a tool commonly used to assess the environmental impacts of products such as beverage bottles. While LCA is a powerful tool when used correctly, understanding the limitations of LCAs is key to ensuring the findings are not accidentally misused or misconstrued. A recent illustrative case concerning '100% recycled content' PET-based bottles serves as an example of ways in which LCA methodologies may not be fit for purpose in handling '100% recycled content' products, even when considering the PET bottle body only.

- **Studies may not account for system losses** or lack transparency regarding how a collection rate of less than 100% translates into bottles with 100% recycled content;
- **Studies often don't account for degradation of PET polymer over time;**
- **Findings can be generalised to other markets** or used in broader policy discussions where not appropriate.

Recommendations

Plastic packaging is the largest single application of plastics, most of it single-use and destined for the food and beverage sector. In this context, it is important that the public is not misled about the environmental impact of plastic packaging, or led to believe that recycling offers a simple fix to these impacts. Companies should address these practices to avoid misleading consumers and potentially breaching consumer protection law.

Specific legislative provisions establishing a common framework on consumer communications on this topic, as currently envisaged in the European Commission's Packaging and Packaging Waste Regulation, can provide further clarity and harmonisation across the EU. In this light, we make the following recommendations for consumer claims on recycling:

- **The term 'recyclable' is ambiguous and should not be used in claims.**
- **Consumers should have access to clear instructions on how to dispose of packaging for recycling adapted to their market.**
- **A standardised and transparent method for communicating recycled content should be used.**
- **Beverage bottles should not be marketed using language or imagery that states or implies circularity, sustainability and/or climate neutrality.**

PET beverage bottle circularity in the EU

What is meant by 'circular?'

According to the Ellen MacArthur Foundation, the circular economy framework aims to "tackle global challenges like climate change, biodiversity loss, waste, and pollution. It is based on three principles, driven by design: eliminate waste and pollution, circulate products and materials (at their highest value), and regenerate nature. It is underpinned by a transition to renewable energy and materials. Transitioning to a circular economy entails decoupling economic activity from the consumption of finite resources. This represents a systemic shift that builds long-term resilience, generates business and economic opportunities, and provides environmental and societal benefits."[1]

While the terms 'circular economy' and 'circular' have become commonplace in recent years, they are not always used to reflect the full range of strategies that contribute towards the transition from a linear economy to a circular one. 'Circular' is frequently used to simply encompass recycling, especially in the context of plastics.

Although recycling materials at the end of their life contributes to a circular economy, recycling is lower down a hierarchy of 'circular strategies' that also includes waste prevention and reuse, such as reducing resource consumption through product design, redesigning products and materials to maximise their useful lifetimes, providing repair or refurbishment services for products and materials, and opting for reusable rather than single-use packaging.[2]

If one of the goals of the circular economy is to maintain the value of materials for as long as possible, enhancing their efficient use and minimising waste and the release of substances of concern, then taking steps to reduce the need for single-use plastics in the first place is always far more impactful (and 'circular' in the sense of degree alignment with the circular economy framework) than recycling them at end-of-life back into more single-use plastics, since each recycling loop will entail loss of material to the economy.

In this report, we use the term 'circular' in relation to plastic beverage bottles to refer to the cycle of production, collection, sorting, and use of recycled material as an input in the production processes. In this context, circularity is a spectrum: a fully 'circular' system for a particular product or material would be one in which all the material placed on the market was collected, sorted, and recycled back into equivalent products, themselves recyclable in turn, thus eliminating the need for virgin inputs. Meanwhile, a fully linear system would be one in which none of the materials placed on the market were recycled. Therefore, for the purpose of this report, 'circular' refers to the extent to which products are recycled back into those same products (e.g., bottle-to-bottle recycling). We have adopted this language in part because one of the objectives of this report is to challenge the idea of a 'circular' plastics recycling system on the basis that it is not practically or technically achievable. We fully recognise that the broader concepts of a circular economy and circularity cannot be reduced to recycling alone and, furthermore, that conflating recycling and 'circularity' may detract from progress towards achieving a circular economy.

[1] Ellen MacArthur Foundation (n.d.). What is a circular economy? Available online: https://ellenmacarthurfoundation.org/topics/circular-economy-introduction/overview.
[2] This is reflected in the 9 circular economy strategies or principles, as set out in the European Commission's 2020 report, "Categorisation System for the Circular Economy: A sector agnostic approach for activities contributing to the circular economy". Available online: https://circulareconomy.europa.eu/platform/sites/default/files/categorisation_system_for_the_ce.pdf.

What would beverage bottle circularity look like?

A note on terminology

This report concerns the 'circular' recycling of beverage bottles of which the main component is manufactured from polyethylene terephthalate (PET). These bottles, which are comprised of a PET bottle body and other non-PET components such as caps and labels, are commonly referred to as 'PET bottles' which reflects the fact that the largest single component is manufactured from PET. This distinguishes them from bottles that are mainly made of other types of plastics (such as high-density polyethylene - HDPE) or, indeed, other materials such as glass.

Since this report explores the question of how 'circular' PET beverage bottles are as a whole, considering all the components, for the purposes of clarity, we use the term **'PET-based bottles'** when referring to PET beverage bottles including all their components. Where we refer specifically to the PET body component of beverage bottles, we refer to this as the **'PET bottle body.'** When referring to the other components of the beverage bottle, we use the term **'other components'** or refer to them by name specifically (e.g., **'caps'** or **'labels'**). Note that where we use the term 'labels' we refer to a variety of labelling products, including shrink sleeves and wraparound labels.

A perfectly 'circular' recycling system for beverage bottles would be one in which all components were produced from material recycled from other beverage bottle components. In reality, most references to 'bottle-to-bottle' recycling or the 'circularity' of PET-based bottles relate specifically to the PET bottle body, disregarding the other components entirely – though this is rarely made clear.

However, even for the PET bottle body alone, a perfectly 'circular' recycling system in which all PET bottle bodies placed on the market are composed of 100% recycled content, eliminating the need for virgin content, does not exist in practice. This would require a 100% collection rate, no loss of material in either the sorting or recycling processes, and no recycled materials derived from beverage bottle bodies going to other product applications (e.g., other forms of packaging or textiles). Furthermore, even if a 100% collection rate could be achieved and sorting/recycling losses eliminated, there are, at present, technical limitations to the amounts of recycled content that can be maintained over multiple cycles of recycling. The physical qualities of PET material cannot currently be maintained through an infinite number of mechanical recycling cycles.

What would beverage bottle circularity look like?

Clearly, a perfectly 'circular' recycling system at a national level for both PET-based bottles generally and the PET bottle body specifically is, in practical terms, not possible. Therefore, beverage producers' claims around the 'circular' recycling of their bottles need to be understood in the context of the practical realities at play. Before further considering claims that products are '100% recyclable' or are composed of '100% recycled content', the key questions that need to be answered are:

- **How 'circular' is PET-based bottle production in the EU at the present time, considering all of the components?**
- **Looking at the PET bottle body in isolation, as the most widely recycled type of plastic product in Europe, how 'circular' is the current market?**
- **How close to a 'circular' recycling system could the PET-based bottle market get, given the technical limitations?**

The following sections answer these questions, explaining the current state of PET-based bottle 'circularity,' the future potential for PET-based bottle 'circularity,' and providing the context needed to understand how certain claims on bottles may not reflect the current state, especially when all the components are taken into consideration, but even when just the PET bottle body is considered.

Current state of PET bottle circularity

Relevant recycling targets

Recycling rates for beverage bottles have been improving in the EU. This is likely due to both commitments from larger beverage brands and EU member states responding to the requirements placed on them by the EU regulatory framework. The most significant EU targets currently in place are those contained in the Single-Use Plastics Directive (SUPD), which requires member states to achieve:

- **A 77% separate collection rate for single-use plastic beverage bottles by 2025, with the target rate increasing to 90% by 2029.**
- **25% recycled content in PET single-use plastic beverage bottles from 2025, calculated on average for all such bottles placed on the market within the member state.**
- **30% recycled content in all single-use plastic beverage bottles by 2030, calculated on average for all such bottles placed on the market within the member state.[3]**

Further relevant targets will be introduced if the draft targets within the European Commission's proposed revision of the Packaging and Packaging Waste Directive (PPWD) become law. While the details of these targets may change as a result of discussions between the co-legislators, the draft text of the proposal, as it currently stands, would require member states to achieve:

- 30% recycled content in single-use plastic beverage bottles, per unit of packaging, by 2030 (with this replacing the corresponding target in the Single Use Plastics Directive).
- 65% recycled content in single-use plastic beverage bottles, per unit of packaging, by 2040.

[3] With the exemption of single-use plastic beverage bottles intended and used for liquid food for special medical purposes.

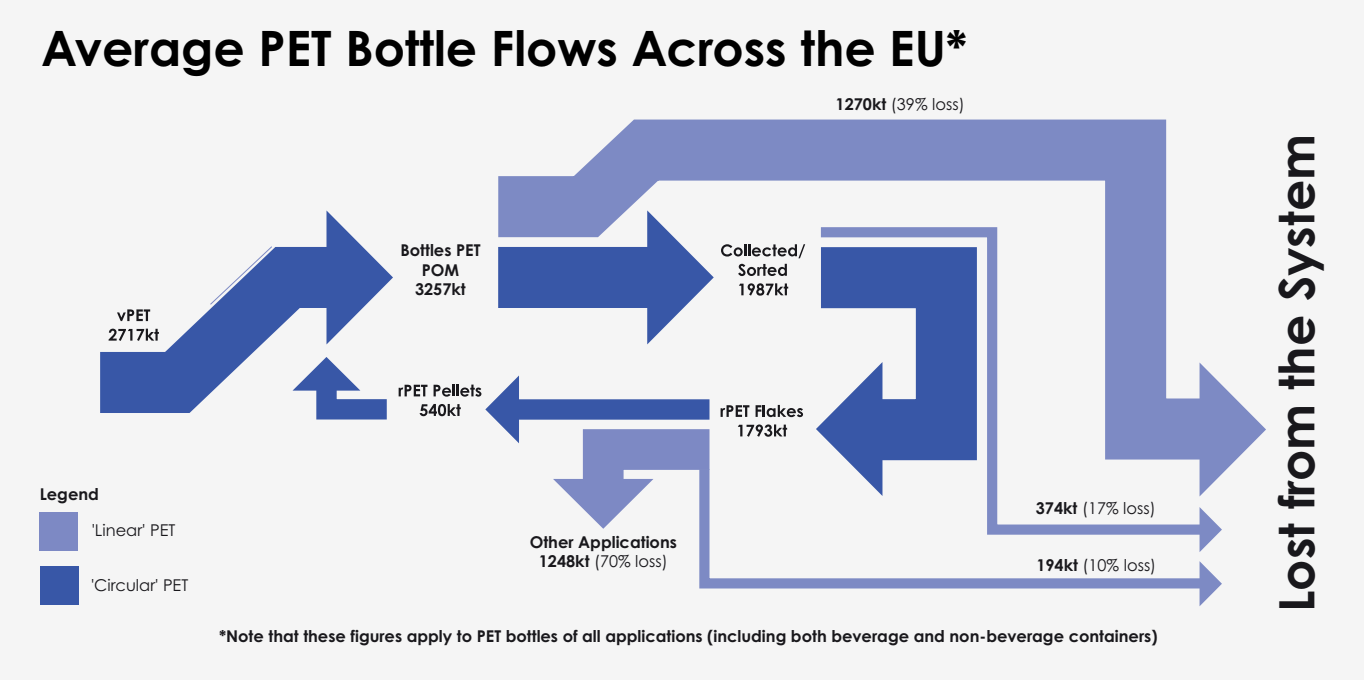
Current state of PET bottle circularity

Averages across the EU

At present member states and extended producer responsibility (EPR) schemes are not obliged to report separate statistics for beverage bottles. While the first mandatory reporting year for data showing performance against the SUPD targets is 2023, these data will not be available until 2025. In the absence of official data, it is possible to look to market reports published by Plastics Recyclers Europe (PRE) for data on PET beverage bottle recycling, the most recent of which presented figures for 2020.[4]

The available PRE data is both estimated and slightly out of date, and in some cases refers to the total PET-based bottle market (i.e. including applications other than beverage containment), from which it is difficult to estimate performance for the beverage bottle share.

Although both collection and recycling rates have likely increased since 2020, a realistic estimate of a rate of increase would probably still show rates that are relatively low. Therefore, it is safe to conclude that the average recycling system in Europe is currently falling far short of a perfectly circular system.



[4] Eunomia (2022). PET Market in Europe, State of Play 2022. Available online: https://www.petcore-europe.org/news-events/409-pet-market-in-europe-state-of-play-2022.html

Current state of PET bottle circularity

Because a circular recycling system depends upon the retention of material across the value chain of production, collection, sorting, recycling, and input into new products, we can assess the current state of play for PET bottle bodies in the EU by examining how much PET is retained at each of these stages. Eunomia's report for Zero Waste Europe, *How Circular is PET?* provides this analysis for 2020 data[5]. In 2020, 3.62 million tonnes (Mt) of PET-based bottles were placed on the market, of which 0.36 Mt were bottle components (caps, lids, and labels) composed of non-PET material. In the same year, it was estimated that 92% of the bottles placed on the market were beverage bottles.

The average EU collection rate for all PET-based bottles (i.e., including applications other than beverage containment) for 2020 is estimated to be 61%. This means that around 1.45 Mt of bottles (and 1.3 Mt of PET material, discounting for non-PET components) were not collected for recycling and were lost from the recycling stream at this stage. This represents the largest single source of 'leakage' in PET circularity.

In the sorting stage, 0.28 Mt of non-PET components were removed, while 0.19 Mt of PET were lost through the sorting, washing, and flaking processes. After subtracting these losses, this left 1.79 Mt of recycled PET flakes. This equates to a recycling rate of 50% for the total tonnage of PET-based bottles placed on the market, and 55% for the PET material (i.e., discounting caps, lids, and labels).

However, of the total quantity of recycled PET only 0.54 Mt was used in beverage bottle manufacturing. Compared to the total weight of PET bottles places on the market in Europe, this results in an average recycled content for PET-based beverage bottles of 17%. As it is likely that most of this material was used in PET-based beverage bottles specifically, it is reasonable to assume that the recycled content in these bottles could have been slightly higher than 17%. Of the remaining recycled PET flakes, 1.25 Mt (approximately 70% of the total) were used in other PET applications, while a further small fraction was lost in the extrusion processes for bottle grade rPET.

There are a number of technical and economic reasons why the majority of recycled PET is not currently used in beverage bottles. One of the reasons is insufficient food-grade PET recycling plant capacity and the subsequent lack of food-grade rPET. In Europe, there has been a movement towards increasing recycling capacity for food-grade rPET and reducing the quantities going to other applications. However, although it is likely that the recycled content in PET-based beverage bottles has risen above 17% since 2020, it is unlikely to be much higher than the SUPD 2025 target of 25%. It is also likely that the EU has become a net importer of rPET for use of in beverage bottles from recycling markets outside the EU.

Whatever the actual average rPET content of beverage bottles is, at this point in time the defining feature of a circular recycling system is the use of recycled material from end-of-life products to make similar products, and with relatively low rPET content in PET-based beverage bottles, Europe is clearly far from having achieved such a circular system.

[5] Eunomia (2022). How Circular is PET? Available online: https://zerowasteeurope.eu/wp-content/uploads/2022/02/HCIP_V13-1.pdf

Current state of PET bottle circularity

Individual countries in the EU

The degree of beverage bottle circularity achieved in different EU countries varies significantly. The particular conditions in specific markets are also relevant to understanding what extent claims made on beverage bottles reflect the current state of circularity in the market in which they are sold.

It is also important to note that there is considerable variation between countries in terms of the quality of reporting with respect to the key circularity metrics for beverage bottles. The only data that tend to be reported at individual country level are quantities of beverage bottles placed on the market, and perhaps estimates of collection or recycling rates. Countries that have implemented deposit return schemes (DRS) for beverage bottles tend to have more accurate figures on beverage bottles placed on the market and collection rates; data for countries without DRS tend to be less clear.

Even where figures are reported, there are often challenges with determining exactly what they show about beverage bottle collections.

The most recent, comprehensive data available on collection rates is for 2020, at which point there were ten Member States with a DRS in place covering beverage bottles.[6] Of these, all but one reported collection rates[7] above 80%, with the highest four performers reporting rates above 90% (Denmark at 96%, Germany 95%, and Lithuania and Finland at 92%). The one country with a DRS not reaching 80% was the Netherlands (65%), but this was for a partial system only covering bottles with a volume greater than 0.5 litres.[8]

Meanwhile, countries without a DRS that relied instead on household collections and bring sites to collect beverage bottles were reporting 2017 collection and sorting rates ranging from lower than 30% (Bulgaria at 22% and Greece at 28%) up to 85% (Belgium), with an average rate of 48% between them.[9]

Three countries did not report a collection and sorting rate (Cyprus, Malta, and Slovakia).

A 2019 study by GVM on waste flows of PET-based bottles in Germany found that between 5% – 10% of mass is lost through the necessary actions of sorting, washing and flaking prior to recycling.[10] Therefore, even if countries with a well-performing DRS can achieve the SUPD 2029 target of 90% collection for plastic bottles, their final collection and sorting rate will still be closer to 81 – 86%. Overall, collection rates across the EU are rising as more Member States implement DRS and improve their systems, but even the best systems cannot avoid losses.

We are not aware of any examples of specific countries reporting their recycled content performance or data being available to the public on this metric. It is reasonable to conclude it will be substantially higher in some country markets than the EU average and therefore in some markets it must be the case that it is lower.

[6] Eunomia (2022). PET Market in Europe, State of Play 2022. Available online: https://www.petcore-europe.org/news-events/409-pet-market-in-europe-state-of-play-2022.html

[7] A formal EU wide method of reporting beverage PET bottle collection rates will not come into effect until 2024 and as such historical reporting of these methods vary from country to country and may in certain cases be likely to overstate the collection rates compared with the formal EU wide methods when they come into force.

[8] The Netherlands extended its DRS to cover smaller in July 2021, and so its collection rate can be expected to have increased since then.

[9] Eunomia (2022). PET Market in Europe, State of Play 2022. Available online: https://www.petcore-europe.org/news-events/409-pet-market-in-europe-state-of-play-2022.html

[10] GVM (2020), Aufkommen und Verwertung von PETGetränkeflaschen in Deutschland 2019.

Current state of PET bottle circularity

Current 'circularity' of caps & labels

Plastic beverage bottles are not only made of PET but are composed of three components: the body of the bottle, the cap, and any labels (plus any adhesives needed to attach the label to the bottle). To determine the level of circularity achieved in the PET-based beverage bottle recycling system, it is necessary to also consider the recycling of bottle caps and labels.

Bottle caps

The cap of a beverage bottle is typically made of polypropylene (PP) or high-density polyethylene (HDPE), both of which are polyolefins. PET and polyolefins require different recycling processes and so caps must be separated from bottle bodies prior to recycling. PET recycling plants tend to do this using a sink and float separation process that produces a polyolefin rich byproduct, which may be recycled in practice.

For recycled content to be used in food-contact applications (such as beverage bottles) it must be recovered using recycling processes assessed for safety by the European Food Safety Authority (EFSA). Commission Regulation (EU) 2022/1616 establishes rules for the authorisation of these recycling processes. Currently, PET is the only type of mechanically recycled plastic that is permitted for use as food and drink packaging. There are no authorised mechanical recycling processes for producing food contact PP or PE in the EU at present.

We are unaware of any data that reveals the extent to which caps are effectively recycled, and the types of products that they are recycled into. It seems likely a relatively high proportion of caps are collected and sent for recycling. However, rPP and rHDPE from caps will not be used to manufacture caps due to the lack of food-grade mechanical recycling processes for polyolefins. Thus, there is currently no circular mechanical recycling system for caps in Europe.

Labels

Labels, including sleeves and wraparound labels, are multi-material products that often comprise a release liner, facestock, ink, finish and sometimes adhesives. They can be composed of a variety of materials, but the plastic component is most commonly made principally of low-density polyethylene (LDPE) or PP films, both of which are polyolefins. Labels can be attached to the body of the bottle using an adhesive and must also be separated from the beverage bottle body before recycling.

We are unaware of any data that would reveal the extent to which labels are sent for recycling in European markets. Additionally, there is no evidence that adhesives are selected for recycling at all.

Although the removal of labels in PET recycling processes produces a polyolefin-rich material stream, the demand for this material is relatively low at present. This is likely due to the presence of inks, coloured resins, adhesives, materials other than PE or PP, and moisture, which tend to mean the material is of comparative poor quality to other sources of polyolefin films for recycling. Overall, the recycling demand for mixed colour post-consumer flexible films is quite low and therefore, as the 'label' streams are of a relatively low quality in a market with low demand, there are currently limited opportunities for recycling.

So, while it is theoretically possible to recycle labels, current challenges and market dynamics mean that it is unlikely that they will be recycled in practice at present, let alone recycled back into new labels.

Limits to PET bottle circularity

Limits to ‘circularity’ of PET

Material losses

As discussed above, even in the best performing countries (e.g., Germany) there are currently losses during collection and sorting. There are also losses during the recycling process. No recycling process has a 100% yield due to the inevitable losses that occur during the washing, flaking and extrusion processes. These losses consist of plastic fines lost in shredder dust, residues lost in wash plant sludge, and plastic flake caught on wash plant screens. There is also some loss at the extrusion stage as the material passes through the filters used. While there is room for improvement in retaining material at all stages, some degree of loss is inevitable.

Therefore, it is impossible to achieve 100% circularity because the material output of the recycling process will always be lower than the amount of material placed on the market. This means that it is impossible for the recycling market alone to supply enough material to match the demand to produce PET-based beverage bottles.

Furthermore, this is assuming the production demand remains constant; in times of growth in the PET-based beverage bottle market, demand for PET will be higher than the recycled material input into the system by an ever-increasing margin.

The recycling market is not, therefore, ever going to able to supply enough mechanically derived bottle rPET for all manufacturers to produce all PET-based beverage bottles with 100% recycled content. The only plausible way to produce all bottles with 100% rPET is to use recycled content from other markets, such as that derived from the depolymerisation of PET from other products such as pots, tubs and trays or polyester textiles. However, we would argue that this would not result in a well-functioning circular recycling system for PET products overall, as it would entail reduced circularity in these other markets.

Limits to PET bottle circularity

Material degradation

Even if it were possible for the market to supply sufficient material through a 100% recycling rate (i.e., with no losses through collection, sorting, and processing), there would still almost certainly be a technical limit placed on the level of circularity achievable through mechanical recycling. Due to overall low levels of rPET in circulation, the limits on the proportion of recycled PET that can be maintained over many recycling cycles is far from being reached. There are, therefore, no examples of 'real life' systems that are close to demonstrating precisely what these limits are in practice.

However, it is clear that 100% recycled content cannot be maintained over multiple cycles.

The mechanical recycling of PET results in partial degradation of the PET polymer during its processing owing to the fragmentation of polymer chains. This has the effect of reducing the polymer chain length and exposing reactive end groups, which causes a decline in the mechanical properties of PET.

A number of undesirable chemical contaminants may also build up in the recycling process, derived either from post-consumer substances, or from degradation of products as a result of PET processing. For example, high temperature treatments during recycling may cause the PET polymer chain to break down into smaller molecules (such as shorter PET chains with acid and vinyl ester end groups). These degradation products act as a catalyst, increasing the rate of degradation reactions, and may also react with additives, resulting in the formation of new compounds. Further to this, the presence of short PET chains with carboxyl end groups results in a reduction in PET thermal stability.

In addition, each cycle of PET recycling and manufacturing involves heating the material to a liquid state, and the combination of successive heat events with unwanted contaminants can result in oxidative degradation, whereby some important characteristics of the plastic can be impacted.

"In most, if not all, EU markets, the amount of PET material exposed to more than a few recycling cycles is extremely small, and the system works due to large inputs of virgin material...it can be expected that maintaining plastic quality using mechanically recycled material will become increasingly difficult as the average recycled content passes beyond 75%"

Limits to PET bottle circularity

To address polymer chain breakage and to reduce the concentration of contaminants affecting the mechanical, physical, or chemical properties of PET, technologies such as solid state polycondensation (SSP) have been implemented by a number of food-grade PET recyclers.

During SSP, PET flakes are heated to a temperature that is below the polymer melting temperature, but above its glass transition temperature (a temperature at which the polymer chains become mobile). Since the polymer chains are mobile, end groups of broken PET chains can be reacted together, reversing chain scission. In addition, since PET is heated to a temperature below its melting point, the production of PET degradation products is minimised. By carrying out SSP under vacuum or in an inert gas flow, contaminants can be removed. To account for contaminants that are not removed, chemical additives may be utilised.

However, SSP cannot enable the infinite mechanical recycling of PET. After repeated recycling loops, the concentration of reactive end groups in the broken PET polymer chains steadily increases, meaning that extended SSP processing is required to rebuild the polymer. This limits the number of mechanical recycling cycles over which the properties of PET can feasibly be maintained.

In addition, some contaminants may not be removed (even with the addition of additives) and may build up in the PET material with each recycling loop. Although the scientific opinion of EFSA Panels suggests that recycled PET obtained from SSP processes is not of safety concern when used to manufacture food-contact materials,[11] [12] such accumulation of chemical contaminants, combined with a reduction in PET polymer chain length, means that it remains highly challenging to maintain purity and material properties after repeated mechanical recycling of PET, even with the employment of advanced processes such as SSP.

In most, if not all EU markets the amount of PET material exposed to more than a few recycling cycles is extremely small because this limited amount of recycled PET materials ends up mixed and diluted. A study by Pinter et al. (2021)[13] indicated that an average split of 75% recycled content and 25% virgin material across the market would be achievable. While other actors have indicated similar findings, we are not aware of any evidence that demonstrates potential for an average recycled content significantly above 75%.

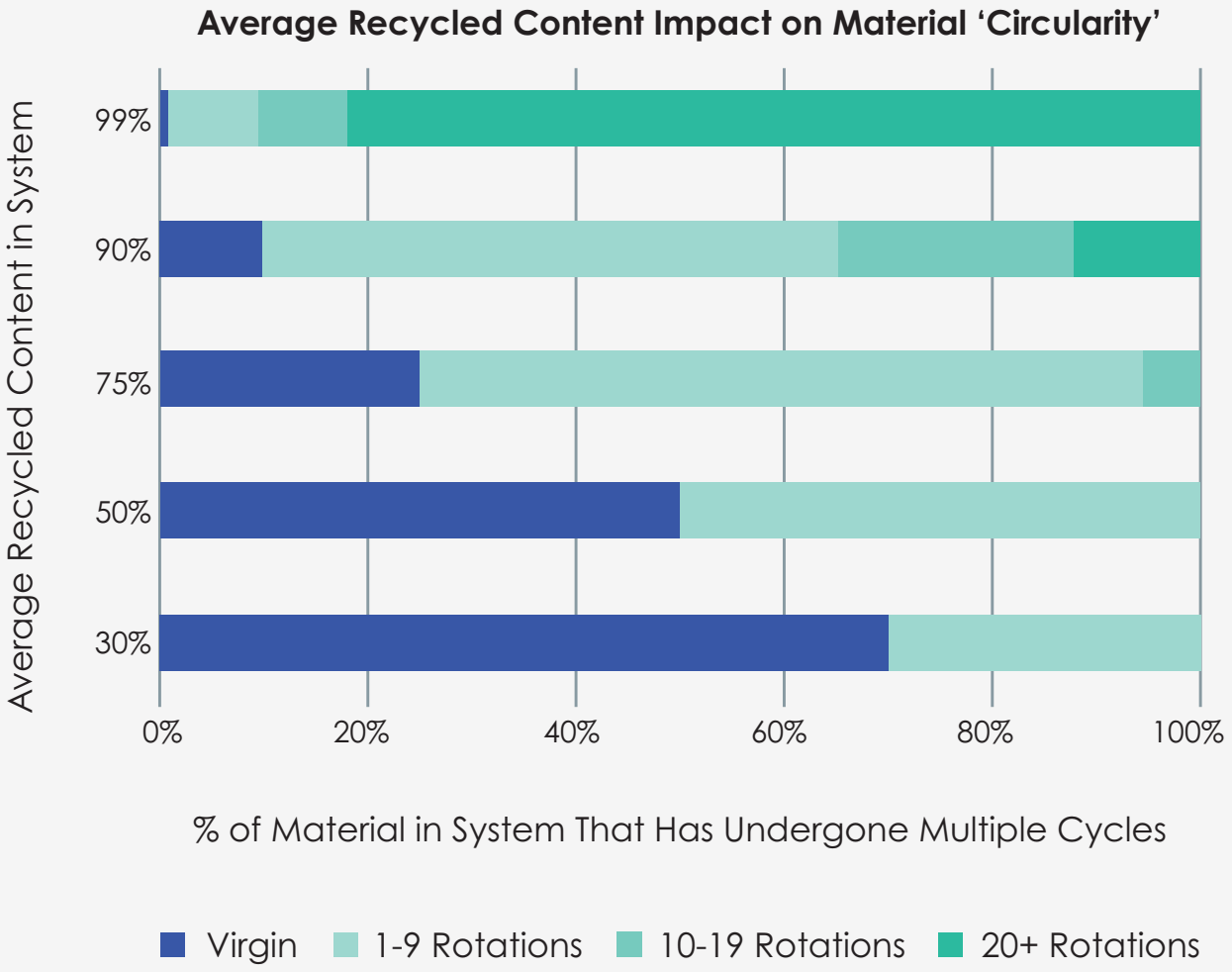
[11] EFSA Panel on Food Contact Materials, Enzymes and Processing Aids (CEP) (2023). Safety assessment of the process Steinbeis PolyVert, based on the Vacunite (EREMA Basic and Polymetrix SSP V-LeaN) technology, used to recycle post-consumer PET into food contact materials. Available online: https://efsa.onlinelibrary.wiley.com/doi/full/10.2903/j.efsa.2023.7919

[12] EFSA Panel on Food Contact Materials, Enzymes and Processing Aids (CEP) (2022). Safety assessment of the process PET Verpackungen Deutschland, based on the EREMA basic and Polymetrix SSP leaN technology, used to recycle post-consumer PET into food contact materials.

[13] Pinter et al. (2021) Circularity Study on PET Bottle-To-Bottle Recycling. Available online: https://www.mdpi.com/2071-1050/13/13/7370

Limits to PET bottle circularity

While an average of 75% recycled content appears to be technically achievable, the level of material that has been through many more heat cycles increases dramatically as you move towards 100% recycled content. At 75% average recycled content, **6%** of material will have gone through 10+ heat cycles, but this number leaps up as average recycled content increases, to **35%** in the 90% average recycled content scenario and **91%** in the 99% average recycled content scenario (see figure opposite). Thus, it can be expected that maintaining plastic quality using mechanically recycled material will become increasingly difficult as the average recycled content passes beyond 75%, with the remaining percentage made up with the addition of virgin plastic after a certain point.



Limits to PET bottle circularity

Limits to 'circularity' of caps & labels

In addition to the arguments above regarding recycled content in food contact applications such as caps, establishing a circular recycling system for labels presents additional challenges.

While separated labels could technically be recycled, the material is often of a relatively low quality due to high levels of coloured materials, inks, adhesives and, likely, a high moisture content. Therefore, this material is often unsuitable to be recycled back into labels. Additionally, as there is not much demand for this material at present, its value is low.

As a result, there is not much infrastructure available to recycle this material in Europe, and as such there is likely limited recycling of labels at all, and likely virtually no recycling of labels back into new labels at present.

Note on Depolymerisation

Depolymerisation is the term used to describe a subset of chemical recycling processes that are applied to polyesters including PET (such as methanolysis, hydrolysis and glycolysis). This describes a family of processes that are capable of taking PET waste such as PET flakes derived from beverage bottles and producing recycled materials from them. Whereas mechanical recycling processes essentially preserve the plastics characteristics, a depolymerisation process breaks the plastic down to several constituents which are the building blocks for PET. By processing PET waste in this way, PET building blocks can be derived which can then be recombined back into PET polymers to produce material with "virgin" like properties. As such, depolymerisation/ repolymerisation may well have an important role in the PET recycling system in Europe in the near future.

Substantial investments have been made into European depolymerisation plants and hundreds of thousands of tonnes per year of depolymerisation capacity will start operating at industrial scale in the next two to four years. However, it is important to frame these advancements correctly. Key entities in the PET recycling supply chain acknowledge that mechanical recycling has a lower environmental impact than depolymerisation and, as such, mechanical recycling should be the preference for materials that can be effectively managed in this way (e.g., clear beverage bottles). It is also important to note that depolymerisation is not a solution for PET leakages from collections and other process losses and therefore cannot get us to a fully 'circular' system.

Claims to consumers

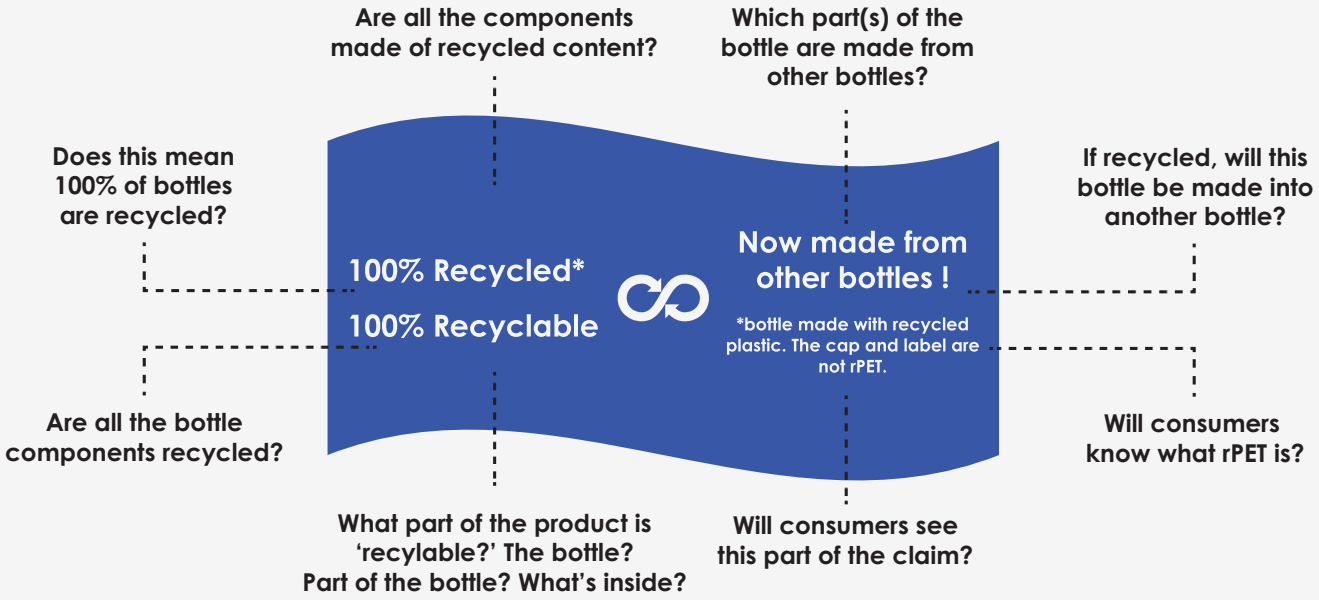
Introduction to PET beverage bottle recycling claims

It has become increasingly common for companies to include claims relating to recycling as part of the messaging featured on beverage bottles. We have identified various categories of claims frequently made by companies placing these products on the market that are sometimes used alone, but in many cases, in combination with each other. As we explain in previous sections of this report, many of these claims may be problematic from a factual perspective, and overall, give an impression both of the circularity of beverage bottles and the general 'sustainability' of beverage bottles that does not reflect reality.

Based on examples taken from PET beverage bottles placed on the European and UK markets, we have identified the main categories of on-bottle claims as being:

- Claims that bottles are '100% recyclable'.
- Claims that bottles are '100% recycled'.
- Claims that are modified by qualifying claims placed elsewhere on the package.
- Claims that refer to the specific polymers used in the bottle components.

In addition, in some cases, such claims are supported by the use of circular, close loop imagery and/or statements and imagery that imply or even state that that the product is 'sustainable'.



‘100% recyclable’ claims

Typical examples of claims

“Bottle 100% recyclable”

“100% recyclable”

“Bottle with 100% recyclable plastic”

What does it mean for a beverage bottle to be ‘recyclable?’

The term ‘recyclable’ does not have a single, clear, objective meaning either by law or in common parlance. The lack of consensus and a clear, established definition and common understanding of ‘recyclability’ is a problem for businesses and consumers alike.

Legal definitions

The European Commission has proposed a definition in the proposed Packaging and Packaging Waste Regulation (see Appendix), but this definition is yet to be adopted into law and is subject to amendments by the European Parliament and the Council according to the legislative procedure.

Some national legislators have introduced definitions in their own legal frameworks, notably, France, through the law against waste and for a circular economy (the ‘AGEC’ law). These (proposed) definitions differ, but contain some common themes in terms of factors that must be taken into account to establish whether the product or packaging is ‘recyclable’, such as:

- The availability and effectiveness of collection and sorting infrastructure for the material nationally,
- The scale of recycling that takes place
- The outcome for the recycled material obtained, for example, whether recycled material derived is of sufficient quality to substitute raw materials (in the case of the PPWR) and whether there is an established market for that type of recycled material (in the case of the AGEC law).

The AGEC law also takes into account the yield rates of the recycling processes for materials and requires the absence of substances that could disrupt the recycling process or limit the uses of the recyclate obtained (such as contaminants or chemicals).

There are other legal definitions (such as that incorporated in the US State of California’s Environmental Advertising Bill) that set out different criteria for establishing ‘recyclability’, demonstrating that even legally, there is a lack of consensus on what ‘recyclable’ means.

‘100% recyclable’ claims

Industry definitions

Recyclability assessment frameworks such as RecyClass and NGO the Ellen MacArthur Foundation have provided their own definitions and criteria to assess recyclability (see Appendix). **These definitions generally emphasise either the *technical recyclability* of a product (i.e., whether the item can be recycled in theory) and/or the *scale of recycling* (i.e., whether the item is technically recyclable and how widely the item is recycled in practice).**[14] In Europe, PET beverage bottle bodies are likely to meet both recyclability definitions as they are generally recyclable from both a ‘technical’ and ‘at scale' perspective. However, neither definition is designed specifically to support claims made to consumers, but rather, to support industry actors in designing products to improve recycling outcomes and/or facilitate data collection and transparency.

Consumer understanding of ‘recyclable’

When it comes to establishing whether claims are misleading under EU law, what matters is what an average consumer understands by the claim.[15] It therefore follows that even if the ‘at scale’ and ‘technical’ definitions highlighted above are met for the item in question, this does not rule out the claim from being misleading under consumer protection law. This could still be the case if the consumer understands a ‘recyclable' claim to mean that, for example:

- the item will definitely be recycled in practice,
- that it is more likely than not to be recycled, and/or
- that it will be recycled into the same kind of product.

We note that the last interpretation is particularly relevant to beverage bottles, where advertising has emphasised the idea of bottle-to-bottle recycling (e.g., by stating or suggesting that “bottles are made from bottles” and “bottle can become bottles again”).

Given the likely variations in what companies, policymakers and consumers may mean or understand by the term ‘recyclable,’ we also question how helpful ‘recyclability’ claims on products are and whether it is preferable for consumers to instead be given clear and simple instructions on how to correctly dispose of products in their area, adapted to local recycling and waste management infrastructure (see ‘Summary & Recommendations' for further detail).

[14] Other definitions of recyclability can be found in national legislation, demonstrating the lack of consensus around the meaning of the term and which can further increase uncertainty about the meaning of these claims. (e.g. French Décret n° 2022-748 du 29 avril 2022 relatif à l'information du consommateur sur les qualités et caractéristiques environnementales des produits générateurs de déchet, https://www.legifrance.gouv.fr/jorf/jo/2022/04/30/0101 or State of California Senate Bill No. 343, An act to amend Sections 17580 and 17580.5 of the Business and Professions Code, and to amend Sections 18015 and 42355.5 of, and to add Section 42355.51 to, the Public Resources Code, relating to environmental advertising Bill Text - SB-343 Environmental advertising: recycling symbol: recyclability: products and packaging. (ca.gov)

[15] Pursuant to EU Directive 2005/29/EC on unfair business-to-consumer commercial practices.

‘100% recyclable’ claims

“PET bottles are made to be remade. As the only plastic which can be 100% recycled in close loop, bottle-to-bottle recycling, this versatile material is the complete opposite of disposable, single-use plastics.”

Extract from “End Waste Recycle the One” website, a campaign convened by Petcore Europe – industry association for the PET value chain.

What does it mean for a beverage bottle to be ‘100% recycleable?’

If the term ‘recyclable’ is ambiguous, ‘100% recyclable’ must be considered even more unclear. As a minimum, we presume that the addition of ‘100%’ must somehow be intended to alter the meaning of the original claim and implies a better outcome than if the product was just labelled as ‘recyclable’.

We consider there are two likely consumer interpretations of these claims:

Interpretation 1: All (100%) of the components of the beverage bottle are ‘recyclable’ (noting that what ‘recyclable’ itself means is not necessarily clear).

Interpretation 2: The beverage bottle will be recycled at a 100% rate.

‘100% recyclable’ claims

What does it mean for a beverage bottle to be ‘100% recyclable?’

Interpretation 1: All (100%) of the components of the beverage bottle are recyclable

This interpretation is problematic because, as noted in the section ‘Limits to PET Bottle Circularity’, plastic beverage bottles are composed of three components: a bottle body, a cap, and a label (plus any adhesives required to attach the label to the bottle). Therefore, consumers may interpret ‘100% recyclable’ to mean that each of these components is ‘recyclable’. However, in practice the likelihood of each component being recycled varies widely.

Cap: We are unaware of any data that reveals the extent to which caps are recycled in practice, or the applications that the recycled material derived are used for. While, anecdotally, a relatively high proportion of caps are likely to be recycled, the lack of suitable recycling technologies of polyolefins for food contact purposes according to EU Regulation 2022/1616 means that in all cases the caps will not be recycled back into caps.

Ink: We are not aware of any evidence that inks are even technically recyclable, let alone that recycling takes place in practice.

Adhesive: We are not aware of any evidence that adhesives are technically recyclable.

Labels: We are unaware of any data that reveals the extent to which labels are recycled in practice, or the types of applications that any recycled material derived are used for. However, the demand for this material is currently low, likely due to the high levels of contamination from inks, coloured resins, adhesives and moisture. Therefore, while labels may be technically recyclable, it is unlikely that they are recycled in practice, and even less likely that they are recycled back into bottle labels due to the high levels of contamination present.

PET Body: While there are limits to the circularity of PET (as described earlier) PET bottle bodies are recycled in practice and at scale in Europe.

‘100% recyclable’ claims

What does it mean for a beverage bottle to be ‘100% recyclable?’

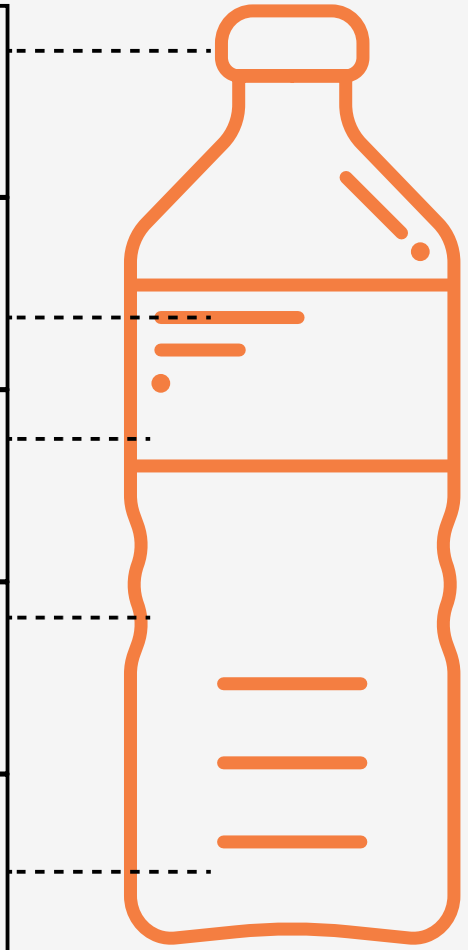
Interpretation 2: The bottle will be recycled at a 100% rate

Another possible interpretation of ‘100% recyclable’ claims is that there is a 100% recycling rate for the beverage bottle. This interpretation clearly does not reflect reality. Even taking the PET bottle body – the most widely recycled of the plastic components in the beverage bottles – a 100% recycling rate does not exist anywhere in the EU in practice and is not feasible due to the inevitable losses that occur during the sorting, washing and flaking stages. Although these losses are small and difficult to properly quantify, they are impossible to eliminate in their entirety.

For the other components, a 100% recycling rate is an even more distant prospect.

Recyclability

Cap	
Technically recyclable?	Likely
Recyclable at scale?	Likely
Recyclable back into caps?	No
Recyclable at 100% rate?	No
Ink	
Technically recyclable?	Very unlikely
Recyclable at scale?	Very unlikely
Recyclable back into inks?	Very unlikely
Recyclable at 100% rate?	No
Labels	
Technically recyclable?	Likely
Recyclable at scale?	Unlikely
Recyclable back into labels?	Unlikely
Recyclable at 100% rate?	No
Adhesive	
Technically recyclable?	Very unlikely
Recyclable at scale?	Very unlikely
Recyclable back into adhesive?	Very unlikely
Recyclable at 100% rate?	No
PET Body	
Technically recyclable?	Yes
Recyclable at scale?	Likely
Recyclable back into bottles?	Yes
Recyclable at 100% rate?	No



‘100% recycled content’ claims

Typical examples of claims:

“100% recycled”

“Bottle with 100% recycled plastic”

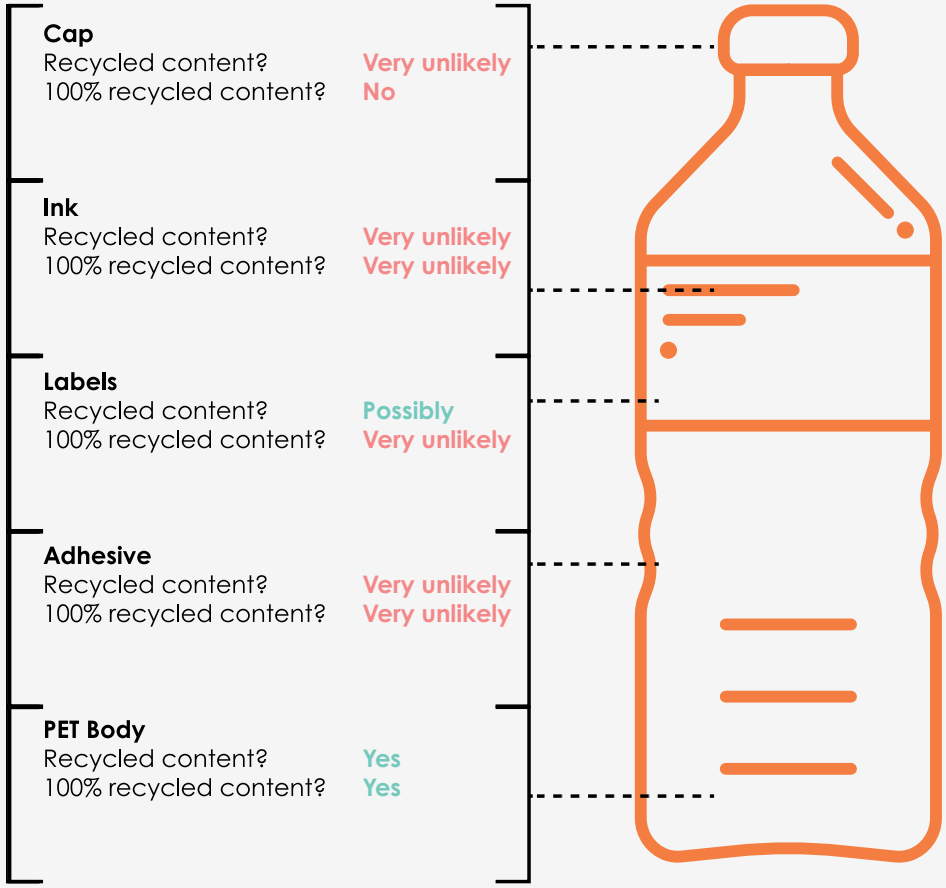
“100% rPET”

“100% recycled* [elsewhere on label:] *cap and label not made from recycled plastic”

On the surface ‘100% recycled content’ claims may seem more straightforward than a ‘100% recyclable’ claim. In theory, whether or not ‘recycled content’ is physically present in a product or component is binary – it either is or is not. Logically, an average consumer would interpret a “100% recycled” claim to mean that the entire product is made from recycled content. However, as discussed on the next page, there are in fact several issues with such claims.

Not all components of beverage bottles are made of recycled content

As noted earlier in the report, beverage bottles comprise several components. In general, only the PET bottle body is made with recycled content. As discussed earlier, caps cannot legally be made with recycled content. It seems that labels often contain little or no recycled content at all in practice, and we are unaware of any examples of labels that contain over 50% recycled content. As such, in every case, the beverage bottle as a whole is *not* manufactured from 100% recycled plastic.



‘100% recycled content’ claims

Recycled content claims sometimes contain qualifying statements elsewhere on the bottle.

As noted above, in some cases, companies qualify the ‘100% recycled’ claim with the clarification that the cap and label are not made from recycled plastic. Sometimes, the additional information is adjacent to the original claim (but often in smaller font). Often this information is located elsewhere on the label – generally also in smaller font - in some cases linked to the main claim via an asterisk.

The provision of this additional information may make the claim technically accurate, but in our view, it does not necessarily remedy the potentially misleading effect of the claim from a consumer perspective, as the qualifying statements render the original claim unclear, may be insufficient to remedy the initial impact of the ‘100%’ attached to the claim and/or are unlikely to be read by consumers.

Recycled content claims sometimes refer specifically to PET

As noted above, in some cases, companies formulate recycled content claims as “100% rPET” (i.e., recycled PET) as opposed to the more general “100% recycled” or “100% recycled plastic”, presumably with the intention of communicating that only the PET element is made from recycled plastic. Again, while the provision of the additional information may make the claim technically accurate, in our view, an average consumer is unlikely to know that only the bottle body is generally manufactured from PET, and that the other components are manufactured from other plastic resin types. As such, we do not think this formulation adequately addresses the risk of misleading the consumer.

In some cases, even the bottle body may not be made fully of post-consumer recycled content

We believe it is likely that an average consumer would understand ‘recycled’ plastic to mean plastic from a product that has been used, passed through the waste management system, and recycled. However, it is possible that in some cases, companies making ‘100% recycled’ claims on beverage bottles are including pre-consumer waste of plastic along with post-consumer recycled plastic. Pre-consumer wastes are waste plastics that arise during the product manufacturing process and are generated before the product is placed on the market (e.g. from faulty production line off-spec, which is recycled using a different processing line to make a different product). They are of similar quality to virgin plastics, and have not been subject to consumer use, nor passed through the waste management and recycling system, and in our view, would not correspond with an average consumer’s understanding of ‘recycled plastic.’ Claims of ‘100% recycled’ made on this basis may therefore (further) risk misleading consumers.

‘100% recycled content’ claims

Approaches to calculating recycled content may vary

At present, companies use different approaches to track recycled content through the supply chain and calculate the proportion of recycled content in products. These approaches are known as ‘chain of custody’ methods. They include the following:

1. **methods that fully ensure the physical presence of recycled content in final products (known as ‘identity preservation’ and ‘segregation methods’), as they require the separation of virgin and recycled content at each step of the supply chain,**

2. **where virgin and recycled plastic are mixed together in order to manufacture products, a ‘proportional mass balance’ approach may be used. This means the products manufactured from the mixture will each be allocated a proportion of recycled content based on the ratios of virgin to recycled plastic used to manufacture the products, and should therefore be a fair representation of the amount of recycled content in each product, and**

3. **‘free allocation mass balance’, on the other hand, is a method through which businesses ‘allocate’ recycled content to any output product. If a recycled content claim is made to a consumer on the basis of this approach, the product purchased may contain less recycled content than the amount claimed, or even none at all. This could potentially mislead consumers who we consider would naturally expect that the recycled content described on the label matches the level of recycled content in the bottle they are holding.**

As there is currently no legally mandated methodology specifying which chain of custody models can be used for tracing recycled content in different situations that applies across the EU, companies making ‘ 100% recycled’ claims may be applying any of these different methods at present.[16]

Where companies make claims to consumers regarding the recycled content in products or packaging, we consider that they should be able to ensure that claims accurately reflect the (post-consumer) recycled content in the products that bear the claims. Since it is not possible to verify the actual proportions of recycled content in PET-based bottles (and indeed other products and packaging) in the final product independently, it is essential that companies can substantiate claims using third-party certification schemes.

[16] Legal requirements on calculation, verification and reporting of data on recycled content are currently being prepared by the UE and covered by the Draft Implementing Decision on the calculation, verification and reporting of data on recycled plastic content in SUP beverage bottles, Comitology Register (europa.eu)

Overall impression of ‘sustainability’

The on-bottle claims about recycling outlined above are sometimes supplemented with ‘circular’ imagery (e.g., close-loop arrows, or loops inter-locking infinitely), as well as generic environmental claims or statements, such as ‘nature’s friend’, or images evoking sustainability (such as the use of green colours or imagery from nature). In some cases, additional claims are made regarding the carbon footprint of the product.

We consider that use of such statements and images contributes to an overall impression of circularity and/or ‘sustainability’ of the product, which may lead consumers to think that such bottles are not harmful to the environment or even have a positive impact on the environment.

Circular imagery may imply the ‘closed-loop’ circularity of PET-based bottles which, as discussed in the sections above, is not currently being achieved within the PET-based beverage bottle industry and is not feasible for future. Moreover, like all single-use packaging, PET-based bottles – even when made with recycled plastic and recycled at end of life – still have a considerable impact on the environment.

Single-use beverage bottles are not carbon neutral

In addition to claims about recyclability and recycled content, some beverage bottles present claims that the bottle is carbon neutral. While the incorporation of recycled content in a product generally reduces the CO2 footprint of the product as compared to the use of virgin materials, PET-based bottles are not carbon neutral products. The use of rPET still generates a material amount of emissions, as do other aspects of the manufacturing and distribution process. We therefore believe that such claims are made on the basis of the purchase of carbon offsets, which is not scientifically accepted way to ‘neutralise’ CO2 emissions.[17] [18]

Single-use beverage bottles are not environmentally beneficial

The combined effect of these claims and design elements may give consumers the impression that their choice to consume the product is environmentally neutral, or even environmentally beneficial. Ultimately, while recycled content and recycling waste help to comparatively reduce the overall environmental impact of a product relative to alternatives, there is no such thing as environmentally neutral or beneficial consumption of single-use packaging. Even if it were technically possible for PET-based bottles to contain 100% recycled content and be 100% recyclable, their consumption would not have ‘zero’ impact on the environment and certainly not a positive impact.

Examples here include:

- **Imagery of circular green arrows**
- **“Zero CO2 impact”**
- **“Respect nature”**
- **“Let’s recycle together”**

[17] ECOS (2023). Climate neutrality: only as strong as the weakest definition. Available online: https://ecostandard.org/news_events/climate-neutrality-only-as-strong-as-the-weakest-definition/

[18] ECOS (2023). EU targets greenwashing with Empowering Consumers Directive that bans misleading climate claims based on offsetting. Available online: https://ecostandard.org/news_events/eu-targets-greenwashing-with-empowering-consumers-directive-that-bans-misleading-climate-claims-based-on-offsetting/

Limitations to LCAs

Limitations to LCAs

Life cycle assessment (LCA) is a tool commonly used to assess the environmental impacts of products such as beverage bottles. The findings may be used by companies and other commercial entities in various ways, including to inform internal decisions made about which type of packaging to use, to market a specific type of packaging to clients and also to influence policymakers (for example, to adopt legislation favourable to one type of packaging over another). For example, manufacturers of PET-based bottles may cite LCA results when marketing their products to consumer goods brands. Additionally, consumer goods brands may use LCA data in calculating and reporting the carbon footprint of their products. While LCA is a powerful tool when used correctly, understanding the limitations of LCAs is key to ensure the findings are not accidentally misused or misconstrued.

There are not many LCAs that assess the environmental impacts of PET-based bottles made with 100% recycled PET, as it only recently become technically possible to achieve this.

However, there is growing interest from companies in showcasing these products, and as such, we can expect LCAs modelling 100% recycled PET in PET-based bottles to be more frequently commissioned and relied on. In this light, we reflect on some potential issues with using LCAs to promote 100% recycled PET in PET-based bottles.

Many LCAs are not made publicly available for review. This can present an obstacle to independent assessments of the validity of conclusions drawn from them.

However, a recent illustrative case concerning '100% recycled content' PET-based bottles can be found in a study conducted by IFEU on behalf of MEG Weißenfels, a manufacturer of bottles for Lidl in Germany.[19] This study compares Lidl's disposable 100% rPET bottle with reusable PET and glass bottles and was used as the basis of the claim that its disposable bottle has a lower carbon footprint than these alternatives. This study serves as an example of ways in which LCA methodologies may not be fit for purpose in handling '100% recycled content' products, even when considering the PET bottle body only.

Studies may not account for system losses

The IFEU study was conducted within the framework of the German deposit system, which boasts an impressive 98.5% return rate. Nevertheless, the study lacks transparency regarding how a 98.5% collection rate translates into bottles with 100% recycled content. Detailed discussions on the losses within the recycling system, which reduce the available material for bottle integration, are conspicuously absent. Any additional material needed would likely have to be sourced from bottles outside the beverage bottle system, thereby rendering these bottles unavailable for other purposes and resulting in a net increase in the demand for virgin PET. Despite the system's high level of optimisation, accounting for such losses, though not dramatically altering the results, would bolster the study's credibility. This accounting would also assist readers in assessing the potential for such a system to be expanded. It is paramount that key aspects like these undergo broader scrutiny, even if the peer reviewers acknowledge access to certain confidential data.

[19] IFEU (2023). Ökobilanz der PET-Einweg-Kreislaufflasche der MEG. Available online: https://www.ifeu.de/publikation/oekobilanz-der-pet-einweg-kreislaufflasche-der-meg/

Limitations to LCAs

Studies often don't account for degradation of PET

The study cited above also fails to address how it accounts for the degradation of PET polymer over time. Infinitely recycling PET-based beverage bottles while maintaining high quality is currently unattainable. Consequently, the system likely relies on used bottles from outside the system, which are likely to contain significantly more virgin material. As it is currently impossible to test for recycled content, it remains unclear to what extent the system depends on external materials.

Findings can be generalised where not appropriate

It is also essential to note that the study explicitly restricts the application of its findings to a specific context and should not be extrapolated to all one-way bottles available in the market or be used in broader policy discussions comparing the advantages of different container types. Its validity is limited to the particular circumstances it addresses. The study unequivocally states, "… it is not possible for all market participants to use 100% recycled PET on the German market."[20] This caveat is further emphasised by the peer review panel.

Regrettably, this nuance is somewhat overlooked in the subsequent marketing and communication of the study, where it fails to acknowledge that the results are not transferable to the entirety of Germany.[21] Moreover, although the study explicitly states that only the bottle itself contains '100% recycled content,' the marketing does not clearly address the issue of non-recycled caps and labels. This serves to underscore the ongoing challenges associated with the communication of research findings once they are made available to the public.

[20] Translated from German
[21] https://diekreislaufflasche.de/

Summary & Recommendations

Summary & recommendations

Summary

In this report, we have explored the current state of PET-based bottle recycling in Europe, as well as its potential for improvement, alongside analysis of common claims made to consumers on bottle labels.

While it is clear that rates of plastic recycling for PET bottle bodies are improving in Europe and are likely to further improve in future years, it is also clear that a fully circular system for PET-based bottles does not exist at present and is not possible in theory. The idea of used bottles simply becoming new bottles over and over again may be appealing to companies and consumers alike, but it does not reflect the outcomes for PET-based bottles in Europe, especially when all components are considered, and even when just PET bottle bodies are taken into account.

As outlined in 'Claims to Consumers', recycling claims made to consumers are, in some cases, factually inaccurate. More broadly, we consider that claims made to consumers, and the way these claims are presented, portray an unrealistic idea of plastic recycling, and risk suggesting to consumers that purchasing beverages in PET-based bottles can be impact-free or even an 'environmentally friendly' choice. This is not the case. Using recycled plastic is generally to be preferred over virgin plastic, in particular from a GHG emissions perspective. Recycling plastic at end of life is also less harmful to the environment than other waste management alternatives (or indeed, leakage in the environment).

On the whole, both use of recycled content and increasing the rates of recycling are clear necessary objectives for the PET beverage bottle supply chain. Nevertheless, these single use products have a substantial environmental impact which is only reduced by recycling and recycled content inclusion, not eliminated. In our view, these claims risk implying otherwise.

It is essential that consumers have access to clear information about the environmental impact of products to facilitate a transition to sustainable models of production and consumption. The importance of this has been recognised in the EU, with progress on two legislative files (the Green Claims Directive and Empowering Consumers for the Green Transition) intending to address the issue underway.

Plastic production and consumption are widely acknowledged to have reached unsustainable levels, threatening attainment of climate objectives and creating an ever-growing waste, toxicity and pollution problem, with consequences for health, human rights and biodiversity. Plastic packaging is the largest single application of plastics, most of it single-use and destined for the food and beverage sector. In this context, it is important that the public is not misled about the environmental impact of plastic packaging, or led to believe that recycling offers a simple fix to these impacts.

Companies should address these practices to avoid misleading consumers and potentially breaching consumer protection law. Specific legislative provisions establishing a common framework on consumer communications on this topic, as currently envisaged in the European Commission's Packaging and Packaging Waste Regulation proposal, can provide further clarity and harmonisation across the EU. Below we set out key recommendations to companies regarding these claims, highlighting aspects of the PPWR that align with these recommendations.

Summary & recommendations

Recommendations

Consumers should have access to clear instructions on how to dispose of packaging for recycling adapted to their market.

In order to facilitate consumer engagement with recycling, it is important that consumers are made aware (1) a product can be disposed of for recycling and (2) the steps that they should take when disposing of the product to maximise the probability that it will be recycled. To achieve this, it is far clearer and more helpful to consumers if companies provide information on how to dispose of products and packaging in their markets, as opposed to making 'recyclable' or '100% recyclable' claims.

Schemes such as the UK's 'On-Pack Recycling Label' or the Nordic 'pictogram' system seek to provide this kind of information without risking misleading consumers. The intention of the PPWR proposal seems to point towards a common marking system for engagement with DRS and other separate collection containers. To further facilitate the provision of this information to consumers, a clear marking system should be adopted in the PPWR, with common requirements for all producers within specific market.

The term 'recyclable' should not be used in claims.

As noted in 'Claims to Consumers,' the term 'recyclable' has no fixed meaning in law and may be interpreted differently by different groups (e.g., companies and consumers). Moreover, recycling outcomes depend on a large number of factors, many of which lie outside the direct control of companies making such claims. Claims of '100% recyclability' are even more ambiguous and we consider that the ways they are most likely to be interpreted by consumers do not live up to the factual reality of the recycling system. 'Recyclability' claims are not necessary where consumers are provided with clear instructions on how to dispose of products, as we propose above.

The PPWR proposal contains a provision which says:

"Without prejudice to requirements concerning other harmonised EU labels, economic operators ***shall not*** *provide or display labels, marks, symbols or* ***inscriptions that are likely to mislead or confuse consumers or other end users with respect to the sustainability requirements for packaging, other packaging characteristics or packaging waste management options,*** *for which harmonised labelling has been laid down in this Regulation."*

If harmonised labelling for product disposal is introduced through the PPWR, as we note above appears likely, it is possible that the kind of claims and imagery related to recycling currently used by companies to market PET-based bottles would be prohibited (in addition to any existing legislation that use of such claims may breach). As we have demonstrated, they may mislead consumers on a number of relevant issues.

Summary & recommendations

Recommendations

A standardised and transparent method for communicating recycled content should be used.

In order to avoid misleading consumers, claims about recycled content should be precise, accurate and verifiable.

'100% recycled' claims should not be made on products that contain multiple components unless each of those components is made from recycled content. Where only one component is made from recycled content, the main claim should reflect this, and not rely on asterisks and 'small print' elsewhere on packaging to make the necessary caveats. Companies should also refrain from making claims that specify a particular plastic resin type (e.g., PET) – while technically accurate, such claims are still likely to mislead consumers who cannot be expected to know which types of plastics the various components of beverage bottles are made from.

Recycled content claims should only be made with respect to post-consumer recycled content and not pre-consumer waste. Companies are already incentivised to make use of pre-consumer waste for efficiency and cost savings, and we consider consumers are highly likely to assume that by 'recycled,' companies mean material that has been used previously, passed through the waste management system and a recycling process.

Finally, companies should be able to verify claims through the use of independent certification schemes. Claims to consumers regarding recycled content should not be permitted where they rely on mass balance approaches that allocate recycled content to a product and do not accurately reflect the proportions of recycled content in each output. Consumers should reasonably be able to expect that claims of recycled content made on products reflect the individual products that they purchase.

The PPWR proposal again indicates that this will be addressed in Article 11(3) which will require recycled content labelling per plastic packaging unit to meet the provisions of a subsequent implementing act. This implementing act should lay down harmonised rules covering methods of calculation for recycled content claims, clarifying that only robust and transparent methods are permitted, as well as requirements as to the language and form that such claims can take.

Summary & recommendations

Recommendations

Beverage bottles should not be marketed using language or imagery that states or implies circularity, sustainability and/or climate neutrality.

As clearly demonstrated in this report, a fully circular system for PET-based beverage bottle recycling in Europe does not exist in reality and is not possible. The use of 'circular' or 'chasing arrows' imagery that is so common on beverage bottles may reinforce the idea that the environmental impact of single-use plastic packaging can be neutralised through the use of recycled content and recycling, which is not the case. Such imagery has been repeatedly highlighted as potentially misleading to consumers[22] and in some cases, images could be confused for logos attached to particular schemes. Moreover, use of circular imagery serves no concrete purpose where clear disposal instructions are provided to maximise the chances of a product being effectively recycled. As such, this kind of imagery should not be used unless it forms part of an official/public scheme, and its meaning can be easily ascertained by consumers.

Furthermore, any language or images – whether included in on-label claims or in other public materials – that evoke the 'infinite recyclability' of PET or suggest that PET-based bottles can be infinitely recycled should not be used by companies since this risks suggesting the existence of a "fully circular system" for these products.

As noted in UNEP and Consumer International's report *"Can I recycle this?"* – "the overall sustainability of a product will also depend on the actual content of the product. Labels that only apply to the packaging can give a halo effect to the product, which could then be seen as a misleading claim about the overall sustainability of the product." Even when beverage bottles contain recycled content and are recycled after use, they are still products with a substantial negative impact on the environment, both as a result of their packaging and contents. As such, they should not be marketed using language that states or implies sustainability and/or climate neutrality, or imagery that achieves the same effect.[23]

[22] UNEP, Consumers International and One Planet Network, "Can I recycle this?" A Global mapping and assessment of standards, labels and claims on plastic packaging", 2020 and ECOS and Rethink Plastic alliance, "Too good to be true? A study of green claims on plastic products" 2021: "The use of chasing arrows is potentially misleading since those symbols can be used to describe different product characteristics. For example, they can inform about the type of polymer used, a contribution to a producer responsibility scheme (Green dot), or to indicate that products should be disposed of (although without clear instructions on how to do it)."

[23] UNEP, Consumers International and One Planet Network (2020). "Can I recycle this?" A Global mapping and assessment of standards, labels and claims on plastic packaging. Available online: https://www.oneplanetnetwork.org/knowledge-centre/resources/can-i-recycle-global-mapping-and-assessment-standards-labels-and-claims

Appendix

Definitions of ‘recyclable’

Definition of ‘recyclable’ according to the proposed Packaging and Packaging Waste Regulation (PPWR), Article 6, paragraph 2.

2. Packaging shall be considered recyclable where it complies with the following:

(a) it is designed for recycling;

(b) it is effectively and efficiently separately collected in accordance with Article 43(1) and (2);

(c) it is sorted into defined waste streams without affecting the recyclability of other waste streams;

(d) it can be recycled so that the resulting secondary raw materials are of sufficient quality to substitute the primary raw materials;

(e) it can be recycled at scale.

Definition of recyclable according to the New Plastics Economy Global Commitment (Ellen MacArthur Foundation).

“A packaging or packaging component is recyclable if its successful post-consumer collection, sorting, and recycling is proven to work in practice and at scale, with ‘at scale’ meaning that a recycling rate of at least 30% is achieved.

An additional condition requires that the main packaging components, together representing >95% of the entire packaging weight, must meet these criteria, and that the minor components comprising the remainder of the packaging weight must be compatible with the recycling process and not hinder the recyclability of the main components.”