Durability of reusable packaging

Technical paper

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Executive summary

The current lack of clear legal guidelines and harmonised standards for reusable packaging is creating a fragmented landscape. This means **systems are not interoperable**, leaving businesses grappling with uncertainty and struggling to compete with single-use alternatives. This void forces entrepreneurs in the reusable packaging sector to reinvent the wheel by designing packaging and systems from scratch. This results in a proliferation of diverse packaging formats, logistics chains, and washing lines operating differently, all leading to significant inefficiencies across the entire reusable packaging value chain.

To fix this, within the EU Packaging and Packaging Waste Regulation (PPWR)[1], the European Commission must **adopt secondary legislation** that is robust, effective, and truly transformative, by focusing on the following two key areas:

Set **minimum durability requirements** by establishing appropriate minimum rotation rates for reusable packaging. This paper includes recommendations on packaging break-even points (BEPs), i.e. the number of rotations that reusable packaging must achieve to equal or surpass the environmental impact of single-use alternatives. Such BEPs should be set for the most frequently used reusable packaging formats in transport packaging, grouped packaging, and sales packaging. This will help truly unlock the value of reusable packaging.

Mandate the development of **European harmonised standards** to determine related **test methods, measurements, and calculations** for reusable packaging durability as soon as possible. Standardised rigorous testing protocols should reflect the typical real-life conditions of use, considering the material and packaging types, as well as the context of use. They should be completed by robust hygiene requirements (such as in standardised washing facilities), and a well-integrated and maintained logistics system that ensures reusable packaging protection and proper handling throughout their entire lifecycle, to create economic incentives for returns, making the entire system more efficient and appealing.

Introduction

Europe is experiencing a packaging waste crisis. The amount of packaging that EU citizens throw away has risen by about 20%, by weight, in only a decade.[2] A solution to these wasteful practices is to **introduce and scale up well-functioning reuse systems**, where packaging is used multiple times before it becomes waste. The EU adopted new packaging rules last year, which include the mandatory use of reusable packaging for several economic operators by 2030.

Recital (63) of the EU's Packaging and Packaging Waste Regulation (PPWR)[3] states that to promote reusable packaging "it is necessary to clarify the notion of **reusable packaging** and ensure that it **is linked to the packaging design** [to] enable the **highest possible number of rotations**". The PPWR therefore acknowledges the need to develop European harmonised standards to "define reusable packaging criteria and formats, including minimum number of trips or rotations, standardised designs, as well as requirements for re-use systems, including hygiene requirements".

The European Commission will suggest minimum number of rotations for certain reusable packaging formats in secondary legislation by 12 February 2027. In this paper, ECOS provides an overview of the current legal situation regulating packaging in the EU and suggest recommendations for setting minimum durability requirements, including establishing appropriate minimum rotation requirements, testing durability of reusable packaging and relevant hygiene and logistical requirements.

Legislation – Single use, reusable, and break-even points

In most legislation, reusable options are defined, with single use being a residual category after the reusable ones. A clear aspect of the definition, across different legislation involves three concepts:

- **Longevity & durability** - being used several times for the foreseen function, without losing functionality.
- **Rotation** - the number of times that the product is supposed to be reused.
- **Break-event points** - the number of times a reusable package must be used and reused for its overall environmental (and sometimes economic) impact to become lower than a comparable single-use package. Beyond this point, each additional use of reusable packaging accrues environmental and economic benefits.

Packaging

The EU adopted the PPWR[4] on 19 December 2024.

- **Single use:** the PPWR defines "single-use packaging" as all packaging that "is not reusable packaging."[5]
- **Reusable:** Article 11 contains requirements packaging must fulfil to be considered reusable, including that packaging must have been "conceived and designed to accomplish as many rotations as possible* under normally predictable conditions of use."
    - *Article 11 mandates the European Commission must establish a minimum number of rotations for the most frequently used reusable packaging formats; "hygiene and other requirements such as logistics" should be considered.

During the political negotiations on the Commission's proposal, MEPs were divided about the need to set a minimum durability requirement for reusable packaging. While some opposed the idea, others suggested including specific requirements; one such requirement on durability would have ensured that break-even points can be reached. Another requirement would have introduced a minimum number of ten rotations for all reusable packaging to prevent false claims about reuse and avoid a situation where packaging which does only two or three rotations is wrongly considered as reuse.

Plastic packaging

Single use: The EU's Single-Use Plastic (SUP) Directive[6] recital (12) considers that (for the subcategory of plastic packaging) single-use means all packaging "that is not conceived, designed or placed on the market to accomplish, within its life span, multiple trips or rotations by being returned to a producer for refill or re-used for the same purpose for which it was conceived."

Reusable: The European Commission provides further explanations on how to distinguish reusable items from single-use items in its guidelines for the implementation of the SUP Directive[7]: "whether a product is conceived, designed and placed on the market for reuse, can be assessed by considering the product's expected functional life, i.e. whether it is intended and designed to be used several times before final disposal, without losing product functionality, physical capacity or quality, and whether consumers typically conceive, perceive and use it as a reusable product. Relevant product design characteristics include material composition, washability and reparability, which would allow multiple trips and rotations for the same purpose as for which the product was originally conceived."[8]

Plastic packaging intended to come into contact with food

Reusable: EU legislation on food contact materials (FCMs) includes **specific durability requirements for reusable plastic packaging** to prevent human health risks[9]. It should be guaranteed that "no increase in the migration of constituents of the material or article to the food would occur when subjected to subsequent use cycles of the articles in accordance with the instructions for intended use as described in documentation or labelling.[10]" It further on explains that "Such deterioration of plastic materials and articles is indicated by various signs, for example, by surface cracks and crazes, blisters, delamination, shrinkage or other deformation, and yellowing or other permanent discoloration or loss of gloss or transparency."[11]

Frequently used reusable packaging formats

The PPWR mandates the European Commission to establish design criteria for the most frequently used reusable packaging formats. Standards to harmonise reusable packaging formats and systems will lever a scale-up of reuse systems and enable system efficiencies and they are still needed. While packaging format can refer to the size and shape of a packaging type, in this case what is meant is packaging of similar design, regardless of its size.

The justification for **durability design criteria** is to clearly distinguish reusable packaging from single-use packaging to be able to promote its use. Obligations to use reusable packaging for certain economic operators could lead to false claims about reuse if the criteria are not set right.
In Article 29, the PPWR introduces re-use targets [12] for transport packaging, grouped packaging and sales packaging.

The PPWR introduces **re-use targets** for these **transport packaging formats**: "pallets, foldable plastic boxes, plastic crates, intermediate bulk containers, both rigid and flexible, or pails, drums and canisters."[13] It also introduces re-use targets for alcoholic and non-alcoholic **beverages** made available by final distributors to customers. While not specifically mentioned, the packaging formats concerned by these targets include reusable glass bottles, as well as reusable PET plastic bottles and plastic crates.

Finally, while no mandatory re-use targets are introduced for **takeaway packaging**, the HORECA sector is obliged to introduce the option of obtaining hot or cold beverages or ready-prepared food in reusable takeaway packaging. The packaging formats concerned by these targets are drinking cups and bowls.

Establishing appropriate minimum rotation requirements

The rationale for minimum durability design requirements (expressed as **minimum rotations or trips)** for reusable packaging is twofold.

On the one hand, the European Commission and some Members of the European Parliament sought to clearly **distinguish reusable packaging from single-use packaging** to prevent that obligations for using reusable packaging, stemming from the PPWR, or national legislation, are met by falsely declaring as reusable, packaging that barely withstand more than a single rotation in real life settings. **Implementation of reuse obligations could be circumvented in the absence of clear design requirements**. Such circumvention has, for instance, happened following the introduction of market restrictions[14] of single use plastic cutlery, plates and straws was circumvented by falsely labelling single-use items as reusable.

On the other hand, other stakeholders want to ensure that **reuse systems can achieve the environmental benefits compared to single-use packagi**ng. If packaging that is designed to achieve multiple rotations is only used once, it is almost always outperformed by packaging that is designed for a single use. However, the more trips and rotations reusable packaging achieves in a reuse system before it is lost or damaged, the better the environmental benefits.

In Life Cycle Assessments (LCAs), there is a specific number of rotations for which some or all environmental indicators turn positive in relation to the indicators for single-use packaging. This is **the break-even point (BEP), i.e. the number of rotations that reusable packaging must achieve to break even with single-use packaging[15].** It varies a lot depending on the indicators and assumptions on logistics, washing, end-of-life treatment, etc.

Setting a high minimum durability design requirement can, on the contrary, lead to design choices that can make it more difficult to achieve the break-even points. If reusable packaging must be very durable, it may mean this is only achievable using specific material and/or with an increased amount of packaging material (e.g. increase of wall thickness). This means that the rotations this packaging must achieve to break even with single-use packaging becomes higher. **The durability requirements of reusable packaging must therefore be adapted to the setting in which the reusable packaging format is used.** If it is likely that the reuse system achieves very high rotations, then the packaging should be more durable. If it is unlikely that the reuse system achieves more than a few rotations, then the packaging should be less durable.

Minimum durability requirements that are set too high may put well-functioning reuse systems at risk. Reuse systems are difficult to set up and the longer they run, the more optimised they typically are. The minimum durability criteria should therefore be considered as a minimum design criterion that all reuse systems using a specific reusable packaging format must fulfil but can, if it is appropriate, surpass.

Break-even points (BEPs)

Many studies have investigated the BEP of reusable packaging, but findings vary widely. Break-even points are typically determined through LCAs, which evaluate the environmental impacts across the entire life cycle of a product, from raw material extraction and manufacturing to use, washing (for reusables), transport, and end-of-life disposal or recycling.

This is partly due to the **absence of a standardised single-use reference point** as single-use products differ significantly in material composition, sourcing, wall thickness, and quality etc. Furthermore, reuse

system-specific variables such as local energy mix, transportation distance, washing technology, and infrastructure influence the outcome of LCAs/BEPs.

The number of reuses required to break even can vary significantly, ranging from as few as 3-6 uses for items like coffee cups or certain glass bottles, to dozens or even hundreds of uses, e.g. 30-63 uses for burger or pizza boxes, and up to 81 cycles for some plastic transport boxes.

Some studies suggest that for reusable meal containers, break-even points are relatively low (within their technical lifetime), but achieving these in practice requires high return rates (e.g. 92%).

A reusable glass bottle might become environmentally preferable to a single-use PET bottle after 3 cycles, while a 2L format bottle might need 20-25 cycles.

In some cases, if return rates are very low, e.g. less than three uses on average, reusable packaging might actually have a higher environmental impact than single-use alternatives. A high return rate for reusable packaging is critical. If packaging is not returned and reused frequently, it may never reach its break-even point, negating its environmental advantages.

Reusable transport packaging

Reusable transport packaging, e.g. pallets typically do not require much focus in regard to durability and BEP, as their inherent high value and closed-loop usage in itself ensures effective reuse with a minimal false reuse risk.

Reusable bottles and crates

Glass and PET refillable bottles in deposit return systems are among the best documented reuse formats. In markets such as Germany, Austria, and parts of Scandinavia, refillable bottles circulate in closed-loop systems and have done so for decades. These systems are supported by reverse logistics, standardised washing facilities, and economic incentives for returns. In many cases, they can serve as a benchmark for current and future reuse systems on takeaway and to-go packaging, although the logistical infrastructure and material composition likely differ. Hence, the BEP differs too.

Reusable glass bottles

In well-functioning systems with a high return rate glass bottles are typically reused **25-30 times** before either lost out of the system or being retired due to breakage[16]. They can, however, be reused many times more, if the right conditions within the system apply. **Life cycle assessments of glass bottles consistently indicate that the BEP is reached after approximately 2 to 3 reuse cycles compared to single-use glass**, primarily in terms of greenhouse gas emissions.[17] In optimised systems featuring short transport distances, high return rates, and energy-efficient washing powered by renewable energy, the BEP can be as low as 1 to 2 uses. When compared to larger single-use PET bottles, e.g. 2 litres, or beverage cartons, the BEP on reuseable glass bottles may extend to 20-25 reuse cycles, particularly when transport distances and washing infrastructure are less efficient[18][19].

Reusable and refillable PET bottles and plastic crates

Refillable PET bottles have a lower manufacturing impact than glass bottles due to their lighter weight and reduced energy requirements during production. Because of this, the initial environmental footprint of PET bottles is smaller. However, this also means that more cycles are needed to offset the impacts associated with production and eventual disposal. As a result, **refillable PET bottles typically have a higher BEP, often cited as 5 to 10 uses**. Refillable PET bottles are generally designed for 10–25 cycles.

Reusable transport crates

Commonly made from high-density polyethylene (HDPE) or polypropylene (PP) generally reach their BEP after 30 uses when compared to single-use alternatives. In real-world conditions, beverage crates often remain in use for 10–15 years, equating to hundreds of rotations. Some industry sources cite lifespans exceeding 500 uses, especially when crates are handled within closed systems with limited exposure to UV light and mechanical stress.

Reusable takeaway packaging

Reusable cups

Studies frequently indicate that the BEP of reusable plastic cups (like PP) is 7 to 20 as compared to disposable paper cups[20]. Some optimistic scenarios even suggest it can be as low as four if no products are lost and washing is done on-site.

Reusable bowls

As regards the food delivery sector, reusable plastic food containers in takeaways can offer a clear economic advantage over their single-use counterparts.[21] Reusable PP bowls require 13 uses to break even with single-use alternatives, with the return on investment being reached within 3-4 years.

Others

In event-based settings, where packaging is used intensively over short periods and often washed on-site, reuse systems can deliver environmental benefits with relatively few rotations. Life cycle assessments show that reusable PP cups can break even after 2–4 uses[22], when powered by green electricity and simultaneously achieving high return rates (+90%). However, when comparing reusable cups to a more lightweight and less resource-intensive single-use options, such as paper coffee cups without Polylactic acid (PLA) liners (although seldomly used), the BEP can be significantly higher in the range of 10–13 uses[23].

When addressing city-wide reuse systems with a heavier logistical infrastructure supporting the reuse value-chain, the BEPs score gets higher. Studies show that reuseable PP cups performs better than their single use alternatives at 3-10 rotations[24], while stainless steel cups will have to be reused 50-130 times before BEP is reached.

Medium-sized items such as bowls and sushi trays typically achieve BEP within 10 to 35 reuse cycles, with 10 cycles BEP assuming efficient washing processes and well-functioning return logistics and renewable energy-mix. In contrast, larger formats such as reusable pizza boxes may require 60 or more reuse cycles to offset the environmental impacts of single-use cardboard alternatives. This higher threshold is primarily attributed to the greater material input, weight, and transport-related emissions associated with these larger formats. As a result, without substantial improvements in design, material efficiency, and system optimisation, such formats may be less suitable for reuse under current conditions.

Break-even analysis on the reuse return rates for different reusable packaging formats

Product	Breakeven # rotations	Breakeven return rate
Burger boxes	30	97%
Pizza	63	98%
Bowls	13	92%
Sushi boxes	35	97%
Cups for cold drinks	6	83%
Cups for warm drinks	6	83%

Source: Eunomia Research & Consulting. Assessing Climate Impact: Reusable Systems Vs Single-use Takeaway Packaging - Eunomia, Table E1. (2023).

Testing durability of reusable packaging

When packaging is designed, it undergoes extensive **testing procedures** to verify it fulfils contractual or regulatory requirements. These can refer to, for instance, protection of the packaged good during transport, safe storage and shelf life of the packaged goods, chemical safety, ease of opening, filling and closing, washability, recyclability or degradability. Packaging manufacturers may carry out a variety of testing that can include laboratory experiments, subjective evaluations using representative customer panels or field testing to prove that the new packaging fulfils all requirements.

When **designing single-use packaging**, particularly for Extended Producer Responsibility (EPR)schemes, the focus is often on doing as much as possible with the least material by weight. This is not necessarily driven by environmental values, but by cost reduction. Lightweight and low-cost materials are preferable and hence the tendency to rely on paper and plastic. Prior to launch testing of this kind of packaging, a few factors are primarily taken into consideration:

- preservation of the packaging contents. This would include drop testing and vibration testing for packaging hard goods such as tech products; thermal insulation testing for takeaway packaging; shelf-life testing for consumables.
- customer perception. In some cases, a lightweight plastic would offer the same performance as a glass solution in e.g. packaging low-cost wines, however the customer value perception differs and therefore brands have remained in traditional glass.

When **designing reusable packaging**, testing would be used to confirm that it is functionally possible to reuse a piece of packaging over repeated cycles. Examples of tests carried out with this purpose include accelerated lifetime testing, e.g. scratch tests, wear tests, repeated use, repeated cleaning to test dishwashing resistance, or test to destruction. In some cases, such as for consumables in plastic packaging, microplastic release tests can also be carried out.

Nevertheless, such tests would not guarantee that this result would be repeatable in the real world. This would require a trial. The challenge with running a trial is that it can only happen once prototypes of the packaging have been produced and with infrastructure in place to introduce the trial with relevant information so people know what to do with the packaging after use.

Real world trials are important because conditions can differ from those found in controlled environments. Without large scale system change – in which 40% of all packaging within a market is switched to reusable, and/or some form of pooled packaging solution is implemented – they do not believe return rates would be higher than 80% which equates to 5 reuses.[25] These scenarios are ones in which the customer takes temporary custodianship of the packaging outside of a controlled environment. It could be safely assumed that, within a controlled or contained environment, e.g. a food

court, return rates would be higher, but this has not necessarily been the case. A Closed Loop Partners trial between Starbucks, PepsiCo and Coca-Cola reported a return rate of reusable packaging of less than five times[26].

It is therefore important to note that whilst durability testing or returnable packaging is important, real-world trials are vital to validate whether the solution is appropriate for the context of use. The trail (or a full roll-out) should evaluate the system design. In the example of a reusable cup at a festival, modelling the environment and considering typical human behaviour is key. Placement of return bins, use of messaging and education and financial incentivisation through deposits all help encourage returns and reduce cups being littered where they are at risk of damage, hence maximising the actual number of use cycles.

Establishing **standardised test procedures to determine the durability of reusable packaging under real-life conditions of use** is essential to support the introduction of minimum rotation requirements for different reusable packaging formats in EU secondary legislation.

Relevant logistical and hygiene requirements of reusable packaging

While packaging durability and low BEPs are prerequisites for achieving environmental benefits within reusable systems, these factors only represent part of the equation. **In practice, the real-world longevity of reusable packaging is to a great extent shaped by the quality of the logistical infrastructure and the consistency of product-handling throughout the value-chain.** Logistics is strictly interrelated with hygiene requirements which are essential for reusable packaging to ensure consumer safety and maintain product quality. A critical factor is the **time between usage and washing**. If packaging is not cleaned within an acceptable timeframe, especially under warm and/or humid conditions it becomes vulnerable to mould growth, microbial biofilm formation, permanent staining, and odour. These degradations reduce the functional lifespan of reusable packaging significantly. Once these forms of contamination set in, they are often irreversible despite industrial washing. As an example of a mitigative strategy to combat such issues the Aarhus REUSEABLE pilot project[27] in Denmark have implemented a maximum 48-hour threshold between deposit and washing. This internal regime was established to mitigate permanent staining of the cups, to ensure packaging would not be discarded based on logistical issues. Today, the project has a discard loss after use at less than 1%, where 85% of discarded products are due to a chemical coloration found in orange sodas.

The **washing process** itself is straightforward from a technical standpoint but has several critical parameters that must be met consistently. Industrial washing machines must operate at a temperature of 78°C, which is sufficient to eliminate microbial contamination. The packaging hereafter undergoes one of the most crucial stages of reconditioning of a reuseable product e.g. the drying process. PP cups and similar packaging types must be completely dry before being stacked or stored. This requires high-efficiency dryers that blow hot air through and around the items, typically with 90+ degrees air jets to eliminate any residual moisture.

Post-drying, it is equally important that reusable products are allowed to cool and rest at room temperature before stacking. If cups or bowls are stacked while still heated, trapped air will condense into moisture, leading to internal mould growth even after sanitation. This seemingly minor operational detail can have a major impact on product longevity.

Besides, packaging design features should support **washing and sanitisation,** e.g. for food containers by avoiding seams, or ensuring they are properly sealed, limiting hinges, using removable and replaceable gaskets, if they are needed, having internal smooth and rounded angles that are equal to or greater than 90°. These washability requirements will help minimise food or dirt accumulation, hence microorganism growth or allergen contamination.

Beyond the **cleaning cycle, interim storage and post-use handling** also affect the usability and wear resistance of reusable packaging. Best practices include storing items in ventilated, shaded environments using dedicated return crates that prevent crushing, contamination, and especially moisture buildup.

Transport and collection logistics further influence product performance and the system's environmental footprint. While studies have shown that transportation contributes only marginally to the total climate impact of reuse systems (especially when compared to production and washing), it remains operationally vital. Efficient logistics prevent bottlenecks in the return cycle, reduce holding times between use and wash, and help maintain hygienic conditions. This is particularly critical during large-scale or decentralised operations, such as city-wide programmes or high-volume festivals, where packaging turnover is high and infrastructure can become overwhelmed.

A reusable item designed to last 30 cycles may only survive one cycle **if the logistics system surrounding it is flawed**. Ensuring hygiene, and protective handling throughout the reuse lifecycle is essential to realising both the economic and ecological benefits of reuse. From temperature thresholds and drying protocols to crate design and collection frequency, every link in the chain matters.

Relevant chemical safety requirements of reusable packaging

Another relevant element is chemical safety. The impact of the reusable packaging on human health has not been thoroughly explored in terms of toxicological impact. In the Database on Migrating and Extractable Food Contact Chemicals (FCCmigex)[28], a search of "repeat-use plastic" food contact articles shows that plastic reusable articles are typically made of polymers like melamine resin, polycarbonate, polyamide, and polypropylene. The database also shows many food contact chemicals are detected in migrates and extracts of these polymers.

Section 2.1.6 of Annex V to Regulation (EU) No 10/2011 specifies that "If the material or article is intended to come into repeated contact with foods, the migration test(s) shall be carried out three times on a single sample using another portion of food simulant on each occasion. Its compliance shall be checked on the basis of the level of the migration found in the third test". This requirement must be revised on the basis of the new principles established by the PPWR.

Chemical safety in the context of reusable packaging is not yet comprehensively or holistically addressed at the EU level. The Food Contact Material regulation must be updated to reflect market developments, scientific knowledge, and reuse practices outlined in the PPWR. It is imperative that the Commission align the aims of reusable food contact packaging with the need for high levels of chemical safety in the FCM revision; with that update then the Commission should update standards related to chemical migration and detection in all food contact materials and packaging.

Plastic packaging for food products

The EU established safety restrictions for plastic packaging for food products[29]. The rules include migration limits and laboratory testing procedures. In 2025, the European Commission updated the rules to include migration testing procedures for reusable plastic packaging for food products[30]. The

migration tests should in this case be repeated three times on a single sample using another portion of food simulant on each occasion.

A European standard[31] gives advice on the selection of the most appropriate type of test, test conditions and test method for determining overall migration from plastic materials and articles into food. It is part of a larger standard series[32] on plastic materials and articles in contact with foodstuffs. They were however developed by the European Technical Committee CEN/TC 194 'Utensils in contact with food' before the adoption of EU regulatory requirements on plastic packaging for food products, which shall supersede test methods set in standardisation.

Most relevant existing standards for packaging formats

However, only few of the product tests developed by packaging manufacturers are standardised at international or European level. The following sections provide an **overview of the most relevant existing standards for packaging formats**. Standards harmonising reusable packaging formats and systems will reduce business uncertainty by limiting packaging and infrastructure diversity, thus providing clear framework conditions for investors and operators to develop interoperable reusable packaging systems, without stifling innovation and product differentiation. Standardisation can help create value chains of standard-compliant systems where packaging types and the infrastructure and logistics that support them are streamlined and interoperable. As such, standardisation will facilitate collaboration of value chain actors to yield more predictable economic outcomes[33] and it can be seen as a tool to reduce research and development costs by identifying best practices for reusable packaging.[34]

PR3 standards on reusable packaging

PR3 Standards are being developed as an international standard series covering the whole reusable packaging system.[35] They include six parts:

- container design.
- container washing, inspection, and packaging for distribution.
- marking and labelling of reusable containers, collection points, and signage.
- digital.
- systems operations and maintenance.
- collection points.

The PR3 washing standard is the first to be finalised, with publication expected on 28 July 2025. All standards will be accessible for free to support reusable packaging systems.

Reusable transport packaging

Pallets

A European standard[36] defines two quality classes of timber to be used in reusable pallets. The test is carried by visual inspection. While no indication of the life expectancy or the number of trips is provided by this standard, it could be used as a starting point to develop a durability test for reusable pallets

Foldable plastic boxes

An international standard series[37] specifies shapes and handling and management of reusable plastic boxes that are stackable, foldable or nestable. Another international standard series[38] exists for standardised reusable plastic boxes used by car manufacturers which includes test procedures for durability.

Reusable bottles and crates

Glass bottles

- An Austrian standard[39] specifies the requirements for a particular type of returnable glass bottle used for various non-alcoholic beverages, fruit juices and non-carbonated and carbonated water, to ensure it is suitable for industrial filling and processing methods like hot filling and pasteurisation.
- A British standard[40] specifies the design and dimensions, neck finish, capacity, internal pressure resistance, verticality, thermal shock resistance, and markings for glass bottles for beer and cider.

Reusable takeaway packaging

Takeaway packaging:

A European standard[41] for durability test ensures that utensils, made from plastics as well as ceramic, glass, glass ceramic, vitreous enamel and metal, can handle a minimum of 125 washing cycles.

Plastic packaging

A German specification[42] provides producers and distributors of reusable packaging, as well as final distributors and dishwashing service providers, with the initial necessary specifications for cleaning, as well as for measuring and evaluating results.

Reusable Cups:

- A Dutch standard[43] contains requirements and recommendations for the design of reusable cups, e.g. what type of material should be use), their cleaning and monitoring. It does not, however, prescribe any durability requirements or durability testing.
- A German standard introduces detailed requirements for commercial washing of reusable food packaging.[44]

Transport packaging

An international technical specification[45] describes cleaning and sanitation methods for reusable packaging used to transport, store and display food and non-food products. It includes a microbial safety test.

Plastic packaging for food products

A European standard[46] gives advice on the selection of the most appropriate type of test, test conditions and test method for determining overall migration from plastic materials and articles into food. It is part of a larger standard series[47] on plastic materials and articles in contact with foodstuffs. They were however developed by the European Technical Committee CEN/TC 194 'Utensils in contact with food' before the adoption of EU regulatory requirements on plastic packaging for food products, which shall supersede test methods set in standardisation.

Conclusions

Europe's escalating packaging waste crisis needs a transition towards well-functioning reuse systems, a shift supported by the EU's new packaging rules and the PPWR. The success of this transition hinges on the meticulous development and rigorous enforcement of clear, harmonised standards that effectively distinguish reusable packaging from its single-use counterparts and ensure its optimal environmental performance.

To ensure the deployment of durable reusable packaging and ensure Europe is at the forefront of innovation, the **EU urgently needs to develop secondary legislation** setting up **minimum rotation numbers for reusable packaging** for the PPWR and **mandate the drafting of European harmonised standards determining related test methods, measurements and calculations**.

It is pivotal to ensure that the decision related to the design of reusable packaging must be based on several factors. As the European Commission prepares to establish minimum rotation numbers for various reusable packaging formats, it is imperative that these are **grounded in robust life cycle assessments**. This will ensure that reusable packaging truly delivers environmental benefits, surpassing the "break-even point" where its overall impact becomes lower than that of single-use alternatives.

To prevent false claims of reuse and guarantee genuine sustainability, this technical report strongly recommends **robust durability testing protocols** through standardised methods that **simulate real-world conditions**, focusing on performance-based criteria, and supported by third-party verification.

Furthermore, durability is not solely a material property but a system-level outcome. Creating the necessary conditions for **high return rates is essential to maximise the environmental benefits of reusable packaging**. To this end, firstly, comprehensive **hygiene requirements** are paramount to ensure consumer safety and prevent contamination throughout the reuse cycle, necessitating harmonised standards, validated cleaning processes, and effective traceability systems. Secondly, efficient **logistical requirements** are crucial for the practical success of reuse, calling for standardised return systems that leverage the residual value of packaging, optimised collection and redistribution networks, and the strategic use of digital tools to enhance transparency and efficiency.

With clear and robust rotation targets, rigorous durability testing, stringent hygiene protocols, and streamlined logistics, the EU can effectively foster a truly circular packaging economy. Only through an integrated, well-maintained infrastructure, where all these elements are considered, can reusable systems reach their full potential in reducing single-use waste while delivering environmental value. This comprehensive approach will not only mitigate the escalating packaging waste crisis but also unlock significant environmental and economic benefits, paving the way for sustainable consumption patterns across Europe.

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