March 2023

Impact Assessment of reuse targets in proposed PPWR

Final report

Study commissioned by Cepi, ECMA, EPPA, FEFCO and Pro Carton

Content

Executive summary

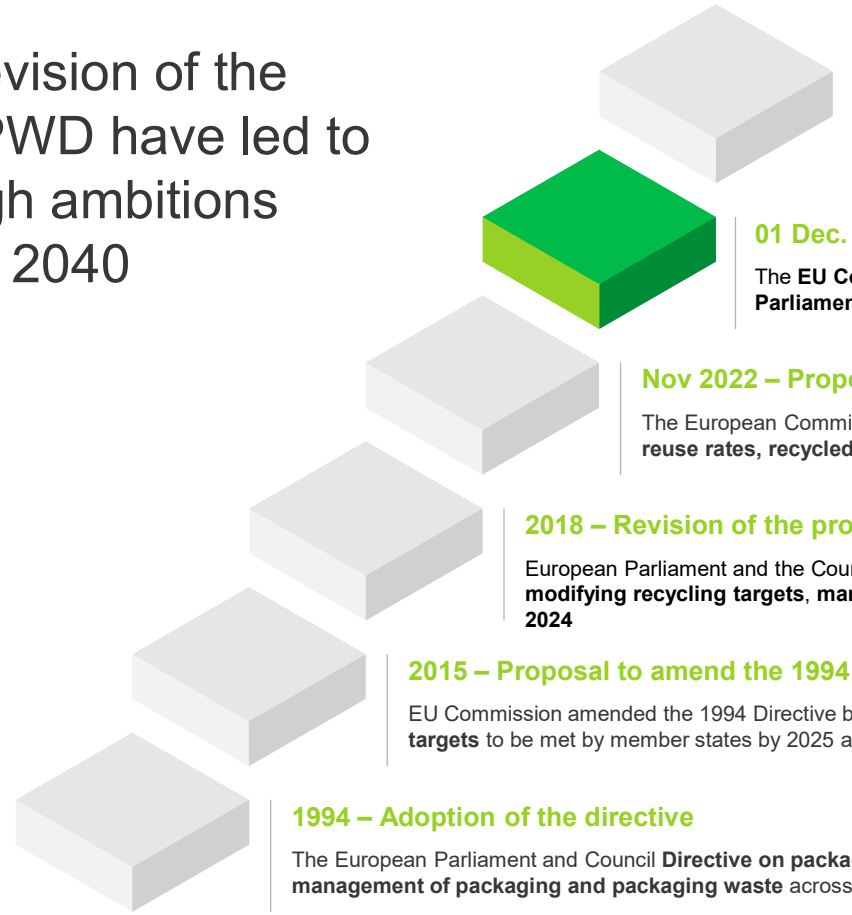
The policymakers around the world are rapidly increasing ambitions on circularity and shifting from a linear towards a more circular economy. One recent example of those actions is the proposal for the Packaging and Packaging Waste Regulation (PPWR) released on Nov 30, 2022. Key changes that will impact packaging industry, producers and users of packaging concern a proposed minimum share of recycled content in all plastic packaging, decreasing the total weight of packaging put on market per capita and – as a direct solution on the latter – introducing reusable packaging for several sectors

In this report the economic, environmental, and societal impact of applying the 2030 targets in PPWR have been investigated – for two use cases of shifting partly from single-use packaging to reuse solution. The outcome is multifaceted, meaning that reuse could be implemented where long transport, ineffective urban logistics and washing can be avoided, where many rotations (use cycles) can be guaranteed, and where companies and consumers do not have to invest in many different packaging set-ups or interrupt the supply chain by adding complexity

In both use cases, reuse will add costs to the system, as well as increase CO_2 emissions – in packaging itself and due to transport and energy consumption. Introducing reuse in foodservice takeaway and home delivery and e-commerce are likely to increase cost per use significantly as well as lead to higher emissions of CO_2. For food service packaging, cleaning might imply additional influence on the environment, due to additional water and energy consumption, and increased use of detergents. Further, high food safety standards may not be maintained. During operations, reuse packaging solutions necessitate large adaptations of infrastructure, additional investment in pack lines and a high degree of automation to make this a scalable solution

Content

Revision of the PPWD have led to high ambitions for 2040



2030 / 2040 – Target achievement

If passed by Parliament and Council of the European Union, **all member states are expected to comply with the regulatory measures and targets set out in the revised PPWR**

01 Dec. 2022 – 24 Apr 2023 – Proposal Feedback Period

The **EU Commission will accept feedback to the proposal presented to the European Parliament** and Council allowing stakeholder to share views

Nov 2022 – Proposal for a Regulation of the PPWD (PPWR)

The European Commission proposes a revision of the PPWD, which **sets 2030 and 2040 targets for reuse rates, recycled content in plastic packaging**, and more

2018 – Revision of the proposal

European Parliament and the Council reach a provisional agreement to revise the existing proposal, including **modifying recycling targets**, **mandating EPR schemes**, and **setting quantitative packaging reuse targets by 2024**

2015 – Proposal to amend the 1994 Directive

EU Commission amended the 1994 Directive by Directive 2018/852, **setting new material-specific reuse and recycling targets** to be met by member states by 2025 and 2030

1994 – Adoption of the directive

The European Parliament and Council **Directive on packaging and packaging waste (PPWD 94/62/EC)** was adopted to **standardize the management of packaging and packaging waste** across member states for a higher level of environmental protection

Source: Press search

In order to decrease avoidable environmental impact of packaging, the new EU PPWR focuses on three main dimensions

PPWR PROPOSAL

Ambition:
Reduce avoidable environmental impacts, leading to the loss of valuable resources

Reduce the generation of **packaging waste** per capita

Promote a circular economy for packaging in a cost-efficient way

Promote the uptake of recycled content in packaging

Source: EU Packaging and Packaging Waste Regulation proposal published on 30 November 2022

Major changes in the new Packaging & Packaging Waste Regulation related to consumer packaging

PPWR PROPOSAL

10-35%

of plastics must be made up of recycled content by 2030 depending on product type

Compostable plastics restricted

list of products that can be manufactured with compostable plastics limited to those with clear benefit

Uniform recycling classes

will be introduced across member states; labeling must reflect changes

10-20%

of takeaway containers must now be reusable by 2030 depending on container type

DRS mandate

Deposit returns systems (DRS) must be set up in each member state for beverage containers by Jan 1, 2029

Source: Press search; EU Packaging and Packaging Waste Regulation proposal published on 30 November 2022

In detail, the PPWR proposes new targets and requirements for 6 packaging dimensions

PPWR PROPOSAL

Focus of this report; details on regulation in next chapter

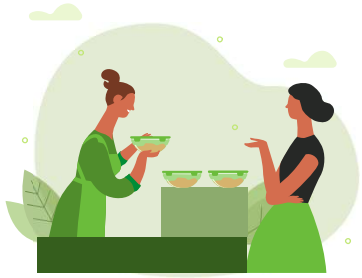
Regulation change for member states	Current	Proposed[1]	Proposal reference[2]
1. Increase in reuse and refill rate targets	No requirements for reusability for takeaway or e-commerce packaging	**New reusable packaging targets** for e.g., food, beverage, e-commerce, and transport packaging sectors	Article 10, 26
2. Increase in waste reduction / minimization targets and packaging format restrictions	No restrictions on products that can use compostable plastics	Obligation to **reduce packaging waste per capita** and **phase out avoidable/unnecessary packaging.** Conditions defined for **what is considered compostable packaging** (e.g., tea liners, coffee filters/pods, bio-waste bags)	Article 5, 8, 9, 22, 38
3. Defined recyclability requirements & fully recyclable packaging	Achieve reduction of the material that is not recyclable	**All packaging to be fully recyclable 2030.** Recyclability will be assessed against design for recycling criteria	Article 6
4. Increase in plastics recycled content targets	Required recycled content rate of 30% for PET bottles by SUP Directive 2019/904	**All plastic packaging** must contain up of **10-35% recycled content by 2030, 50-65% by 2040**	Article 7
5. Mandatory deposit return schemes (DRS)	Presence and model of DRS systems differ by member state	**Establish DRS** for single-use plastic and metal **beverages containers up to 3L size by Jan 1, 2029**	Article 44
6. Revised and standardized packaging labeling	Recycling classes differ by member states eco-modulation, no uniform labeling standard	**Must include compostability & reusability details**; include **new EU recycling classes in all member states**	Article 11, 12

1. Option 2 as defined in the Proposal, which is listed as most favorable by the EU Commission
2. Not exhaustive

Note: Overall packaging recycling rate targets will remain the same (65% for 2025 and 70% for 2030); pharmaceutical products are excluded from recyclability requirements

 Source: EU Packaging and Packaging Waste Regulation proposal published on 30 November 2022

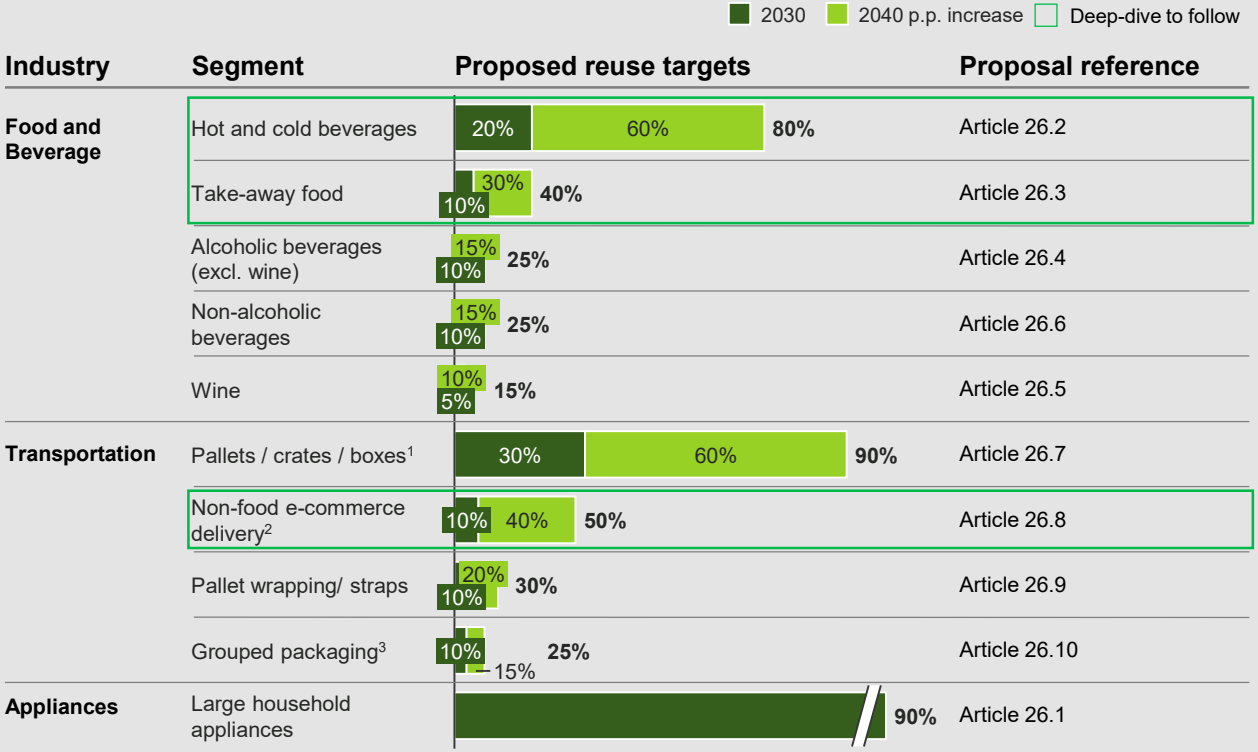
Content



Introduce and increase **the share of reusable packaging in different end-use areas**, meaning less single-use packaging and more reusable packaging solutions

Disclaimer: This report focuses on PPWR proposal as published on 30 November 2022

The concrete targets potentially to be set by the EU have large implications for different end-use sectors



1. Transport packaging in the form of pallets, plastic crates, foldable plastic boxes, pails and drums
2. Transport packaging for the transport and delivery of non-food items made available on the market for the first time via e-commerce
3. Grouped packaging in the form of boxes, excluding cardboard, used outside of sales packaging to group a certain number of products to create a stock-keeping unit

Source: EU Packaging and Packaging Waste Regulation proposal published on 30 November 2022

Reuse systems requirement in the PPWR touch on two of the four general types of reuse models

ILLUSTRATIVE

Focus of this report, deep dives

Home

On the go

1 Refill at home

Users refill their reusable container at home (e.g., with refills delivered through a subscription service)

Example: P&G — *Shampoo pouches and durable aluminum bottles for refill at home*

2 Return from home/premise

Packaging is picked up from home/premise by a pickup service (e.g., by a logistics company)

Example: Svenska Retursystem / Liviri — *The reusable foodservice packaging or a transport packaging is used by consumers or industrial players, then collected, cleaned, and redistributed for use by a central operator*

3 Refill on-the-go

Users refill their reusable container away from home (e.g., at an in-store dispensing system)

Example: Original Unverpackt — *Products are stored in dispenser systems and can be transferred to bags/ jars etc. customers have brought with them*

4 Return on the go

Users return the packaging at a store or drop-off point (e.g., in a deposit return machine or at mailing facilities)

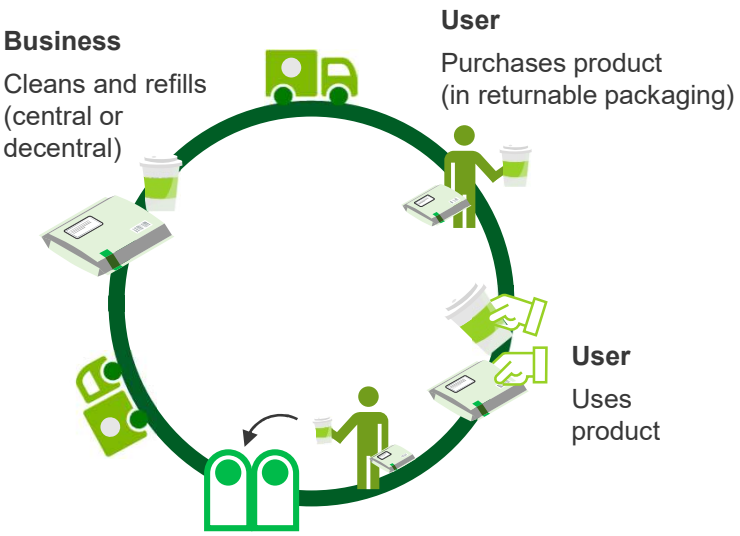
Example: RePack — *Customers can opt in for reusable packaging for foodservice or e-commerce orders and return them to a common drop-off point/facility*

Refill → Return

Source: Ellen MacArthur foundation "Reuse – rethinking packaging" (2019; https://emf.thirdlight.com/file/24/_A-BkCs_aXeX02_Am1z_J7vzLt/Reuse%20%E2%80%93%20rethinking%20packaging.pdf), McKinsey report "Reusable packaging: Key enablers for scaling" (28/10/2022; https://www.mckinsey.com/industries/paper-forest-products-and-packaging/our-insights/reusable-packaging-key-enablers-for-scaling)

Reuse models **differ in terms of packaging 'ownership'** and the requirement for the user/ consumer to leave home to **refill/ return** the packaging or for a business actor to have the packaging being **picked up by an operator**

4: Return on-the-go allows for reuse of packaging items for multiple customer visits/orders but require customer incentives to avoid losses



Suitable applications

- Retail and takeaway/foodservice outlets for e.g., food and beverages
- Transport packaging for, e.g., e-commerce

Requirements

- Local reverse logistics system that includes takeback, cleaning, storage and redistribution
- Deposit/reward scheme and local drop-off points to incentivize returns

Benefits/drawbacks

- Increased customer loyalty and dependency (if changed behavior)
- Increased business risk from, e.g., theft, lost packaging
- Increased risk from food contamination due to decline in food safety (also resulting from losing control over packaging items)

Market players

Coca-Cola, Jean Bouteille, cupclub, REBOX, plux, RECUP, fresh bowl, hepi circle, RETURNR, cozie, plaine products, Limeloop, revolv, RePacks

Source: Ellen MacArthur foundation “Reuse – rethinking packaging“ (2019; https://emf.thirdlight.com/file/24/_A-BkCs_aXeX02_Am1z_J7vzLt/Reuse%20%E2%80%93%20rethinking%20packaging.pdf), McKinsey report “Reusable packaging: Key enablers for scaling” (28/10/2022; https://www.mckinsey.com/industries/paper-forest-products-and-packaging/our-insights/reusable-packaging-key-enablers-for-scaling)

Content

The PPWR reuse targets will impact many end-use sectors – this report focuses on e-commerce and HORECA (foodservice)

PPWR PROPOSAL (PROPOSAL ONLY)

A B2C e-commerce packaging

Article 26.8: Economic operators using transport packaging for the **transport and delivery of nonfood items** made available on the market for the first time **via e-commerce** shall ensure that:

a. from 1 January 2030, **10%** of such packaging used is **reusable packaging** within a system for reuse

b. from 1 January 2040, **50%** of such packaging used is **reusable packaging** within a system for reuse

B Takeaway and home delivery foodservice packaging

Article 26.2: The final distributor making available… **cold or hot beverages** filled into a container…**for take-away** shall ensure that:

a. from 1 January 2030, **20%** of those beverages are made available in **reusable packaging** within a system for reuse or by enabling refill

b. from 1 January 2040, **80%** of those beverages are made available in **reusable packaging** within a system for reuse or by enabling refill

Article 26.3: A final distributor…in the **HORECA sector** and that is making available…**take-away ready-prepared food**, intended for immediate consumption…shall ensure that:

a. from 1 January 2030, **10%** of those products are made available in **reusable packaging** within a system for reuse or by enabling refill

b. from 1 January 2040, **40%** of those products are made available in **reusable packaging** within a system for reuse or by enabling refill

 Source: EU Packaging and Packaging Waste Regulation proposal published on 30 November 2022

Analyzing two specific use-cases provides an overview about impact on these relevant end-use sectors in specific member states

A E-commerce packaging in Germany

Replacing paper-based protective mailer bags and corrugated boxes…

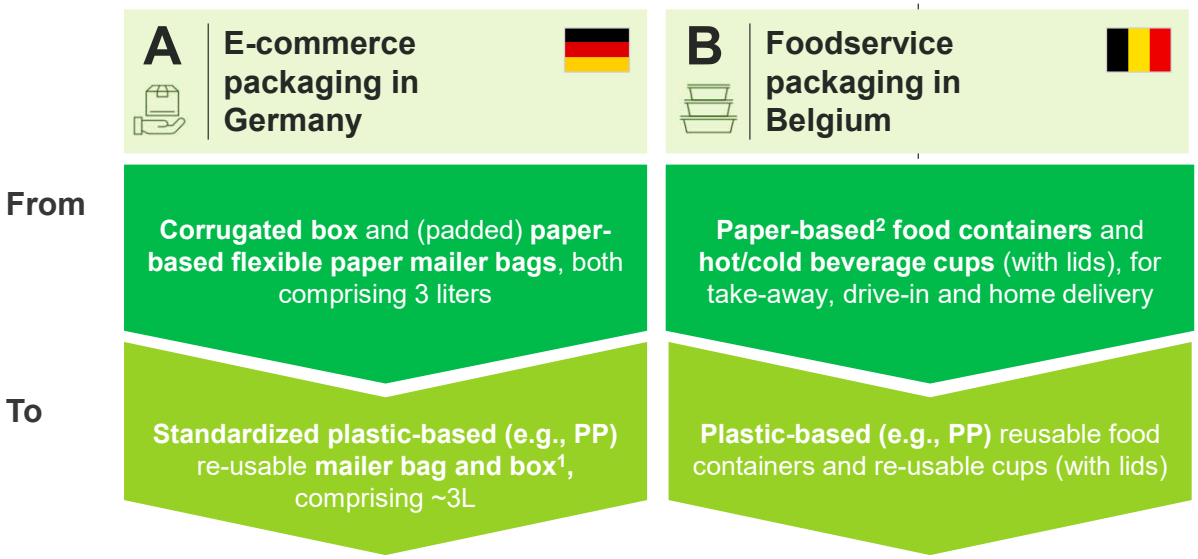
…by reusable protective plastic mailer bags and plastic boxes in polypropylene

B Foodservice packaging in Belgium

Replacing single-use paper-based food containers & cups…

… by reusable plastic-based food containers & cups in polypropylene

Each case implies a shift from paper-based single-use to reusable plastic-based packaging



1. Assuming a lightweight reusable box (i.e. 0,1kg)
2. Cups and containers, paper-based carton with thin plastic barrier (<10% of weight) according to EPPA takeaway foodservice LCA
3. PPWR proposal (116) mentions a 5% value of reusable packaging put on market can be reported by member states (for recycling rate calculation purposes. Further, the impact assessment part 1 (pp. 25-26) mentions 15 rotations for a coffee cup and footnote (388) refers to 25 rotations for a beverage container. Hence, 20 rotations are assumed a fair average
4. For case A (e-commerce packaging in Germany), 90% was considered as the recycling rate target for 2030. For case B (foodservice packaging in Belgium), recycling split was assumed as in EPPA takeaway foodservice LCA (30% recycling, 60% incineration and 10% landfill) for both single-use and reusable packaging

Source: EU Packaging and Packaging Waste Regulation proposal published on 30 November 2022, EPPA takeaway foodservice LCA, Bifa GHG Assessment, Expert interviews

Key base scenario assumptions

For all use cases, **20[3] rotations per reuse item were assumed,** therein considering losses due to theft/breakage etc.

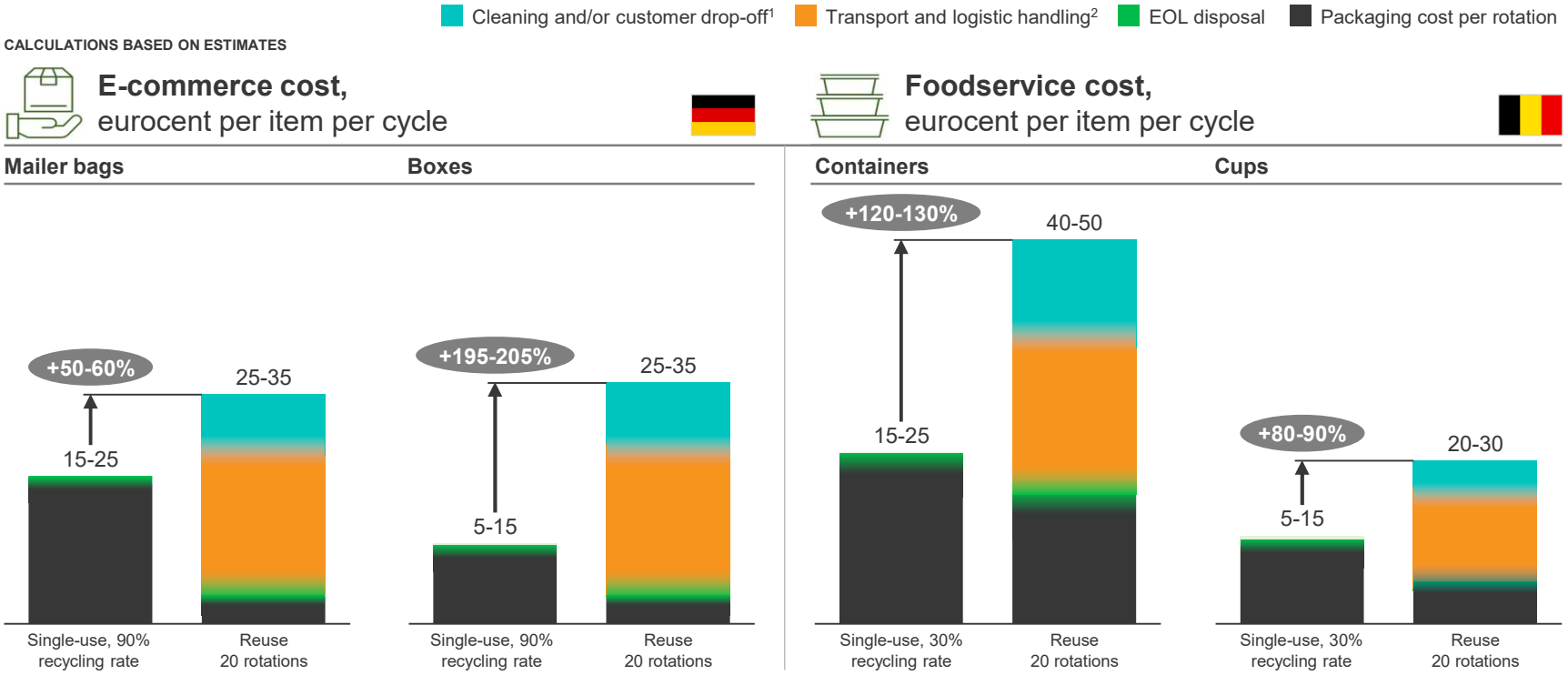
For impact calculations, **2022 prices, volumes, energy mix** was assumed and **2030 recycling rates[4]**, was applied

Within each use case, the **same product dimensions** were used for reusable items versus single-use alternative

The impact dimensions included are economic impact, environmental impact and societal impact

	Definition	Key inputs
Economic	Economic impact of reuse solutions vs. single-use paper-based alternative	• Sourcing cost of packaging (incl. EPR fees) • Reverse logistic cost (transport) • Handling cost (cleaning,..)
Environmental	Environmental impact (i.e., CO_2 emissions) tradeoff from reuse solution material and reuse system	• Material and packaging production emissions (plastic vs. paper) • Rotation scheme emissions (reversed logistics, water use, redistribution…)
Societal	Implication on key stake-holders (e.g., packaging producers, merchants, consumers) from intro-duction of reuse systems	• Influencing factors on packaging providers • Influencing factors on merchants • Key changes to consumers • Concerning factors for policy makers/regulators

Reusable solutions in both use cases imply higher overall cost per use



1. Only customer drop-off considered for e-commerce; 2. Including increased cost from distribution

Source: The potential impact of reusable packaging, McKinsey, April 4, 2023

[18] Other sources considered: EU Packaging and Packaging Waste Regulation proposal published on 30 November 2022, EPPA takeaway foodservice LCA, Bifa GHG Assessment, McKinsey – "Climate impact of plastics" (06/07/2022; https://www.mckinsey.com/industries/ chemicals/our-insights/climate-impact-of-plastics#/), SWDE, Schwarze Consulting, KIDV, Clean Mobility Collective – "Revealing The Secret Emissions Of E-Commerce " (07/2022; https://clean-mobility.org/wp-content/uploads/2022/07/Secret-Emissions-of-E-Commerce.pdf), Expert interviews, Government statistics and wage regulation, Product specification sheets, Statista, German Bundesanzeiger, HDE Handelsverband Deutschland

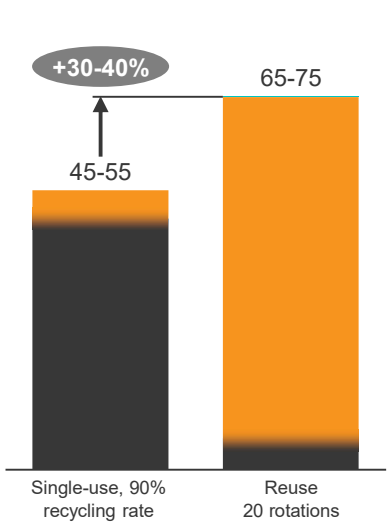
Reusable solutions are likely to yield higher CO_2 emissions

Cleaning and/or customer drop-off[1] | Transport and logistics handling, incl. distribution[2] | Packaging emissions incl. EOL

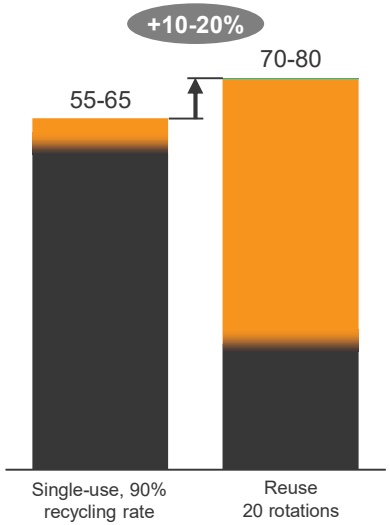
CALCULATIONS BASED ON ESTIMATES

E-commerce emissions, g CO_2 item per cycle

Mailer bags

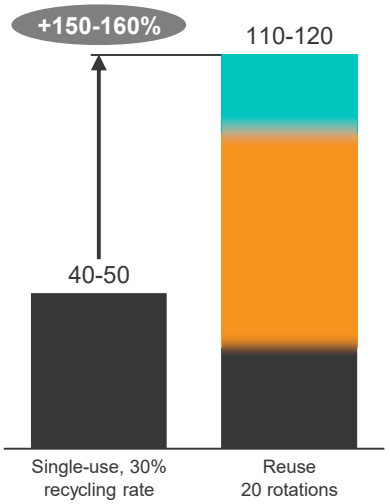


Boxes

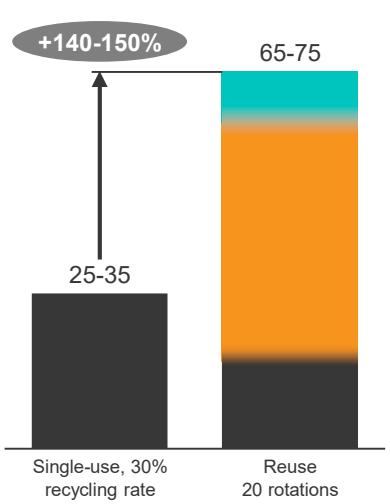


Foodservice emissions, g CO_2 per item per cycle

Containers



Cups



1. Only customer drop-off considered for e-commerce; 2. Including increased CO_2 emissions from distribution

Source: The potential impact of reusable packaging, McKinsey, April 4, 2023

Other sources considered: EU Packaging and Packaging Waste Regulation proposal published on 30 November 2022, EPPA takeaway foodservice LCA, Bifa GHG Assessment, McKinsey – "Climate impact of plastics" (06/07/2022; https://www.mckinsey.com/industries/ chemicals/our-insights/climate-impact-of-plastics#/), SWDE, Schwarze Consulting, KIDV, Clean Mobility Collective – "Revealing The Secret Emissions Of E-Commerce " (07/2022; https://clean-mobility.org/wp-content/uploads/2022/07/Secret-Emissions-of-E-Commerce.pdf), Expert interviews, Government statistics and wage regulation, Product specification sheets, Statista, German Bundesanzeiger, HDE Handelsverband Deutschland

Overarchingly, impact of reuse targets will depend a lot on the winning reuse model, execution and behaviour

HIGH LEVEL ESTIMATES

Deep dives follow

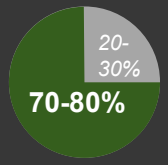
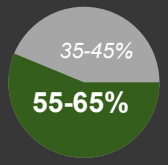
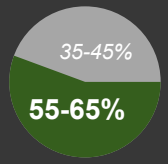
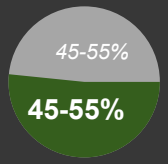
# of rotations	Today, many pilots on the market trialing reuse packaging are not able to report an average number of use cycles. Consumer behavior is crucial to maintain return rates (e.g., driven by theft), where many existing solutions only reach three to five rotations and some more mature solutions like B2B reusable crates are considered to be at about 24 rotations. The models show that successful reuse system operators have to prove beyond 20 uses to approach both, cost and environmental levels, of single-use paper packaging
City logistics and modal split for transport	In new reuse models, the packaging needs to get back to the system after every use cycle. In all described use cases, average distance to the operator facility could vary a lot, and add more emissions, costs and drawbacks compared to single-use with an existing infrastructure for recycling in place. In particular city logistics, which is more similar to last-mile deliveries, is driving CO_2 emissions and cost for both, e-commerce and foodservice packaging. The distance itself is not accelerating impact from city logistics. It is rather influenced by modal choice or general transport avoidance
True recycling rates	The single-use packaging that dominates the packaging business today is very effective in its whole value chain. However, the true/real recycling rates impacts its footprint. Paper-based packaging has 82% recycling rate in Europe, and plastic packaging about ~15% - according to several sources. Some end-uses, e.g., in foodservice, has higher share of packaging not sorted in recycling bins, and rather ends ups in the residual waste (for incineration)
Adoption speed of the market	Reuse will in most sectors, except beverage glass bottles, come with a change in operation mode for foodservice outlets and e-commerce players as well as for consumers. Many reuse trials in different markets of EU have taken place, where consumers can choose single-use and reuse as an option. The penetration levels for reuse have not yet reached desired levels

1. PPWR proposal (116) mentions a 5% value of reusable packaging put on market to be reported by member states (for recycling rate calculation purposes), implying 20 rotations. Further, the impact assessment part 1 (pp. 25-26) mentions 15 rotations for a coffee cup and footnote (388) refers to 25 rotations for a beverage container. Hence, 20 rotations are assumed a fair average

20 Source: VTT Technical Research Centre of Finland Ltd – " A critical view on packaging recycling and reuse in the European Circular Economy" (10/2022; https://www.fefco.org/sites/ default/files/files/White%20Paper_Final%20draft%20040422%20update%2015102022%281%29.pdf), TIME.com – " Reusable Packaging Is the Latest Eco-Friendly Trend. But Does It Actually Make a Difference?" (27/09/2021; https://time.com/6101846/is-reusable-packaging-sustainable/), Kearney – "No silver bullet" (2023; https://nosilverbullet.eu/wp-content/uploads/2023/02/No-silver-bullet%E2%80%93why-a-mix-of-solutions-is-required-to-achieve-circularity-in-Europe.pdf), Repack, Expert interviews

Transport is a key driver for both economic and environmental impact

Deep dive on next page

	Reusable e-commerce solutions	Reusable foodservice packaging
Transport-related emissions out of total CO_2 emissions		
Transport-related cost out of total system cost		

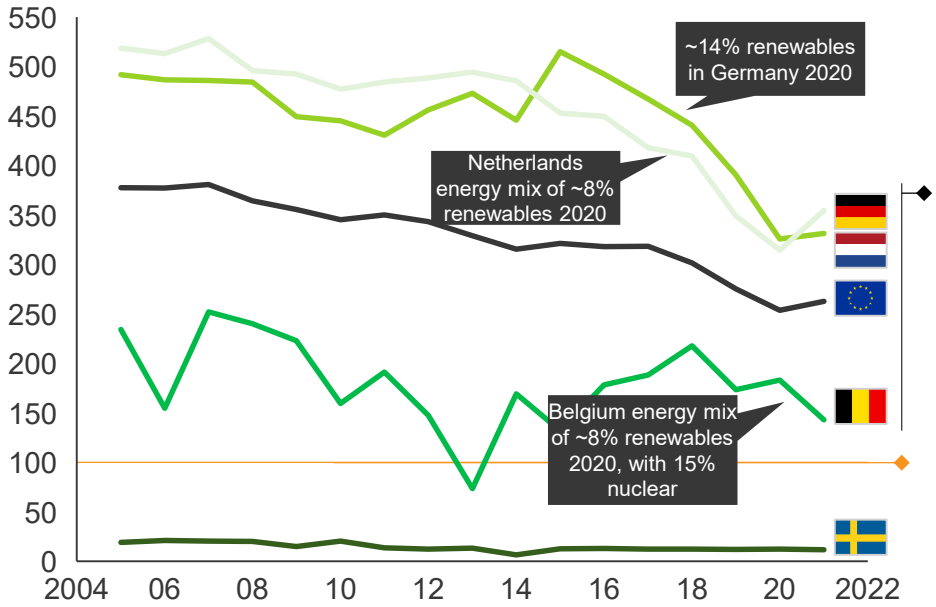
Transport is the main driver for both CO_2 emissions and cost, leading to several implications to implementing reuse models:

- Reusable packaging should only be implemented where **logistics are highly optimized** or with a **low-emission transport split**
- **Optimizing collection models** and **cleaning/ redistribution locations** is key to make a reuse system comparable in some dimensions
- Decreasing **carbon footprint of transport** is necessary to bring reusable packaging to lower level of CO_2 emissions

21 Source: EU Packaging and Packaging Waste Regulation proposal published on 30 November 2022, EPPA takeaway foodservice LCA, Bifa GHG Assessment, McKinsey – "Climate impact of plastics" (06/07/2022; https://www.mckinsey.com/industries/ chemicals/our-insights/climate-impact-of-plastics#/), SWDE, Schwarze Consulting, KIDV, Clean Mobility Collective – "Revealing The Secret Emissions Of E-Commerce " (07/2022; https://clean-mobility.org/wp-content/uploads/2022/07/Secret-Emissions-of-E-Commerce.pdf), Expert interviews, Government statistics and wage regulation, Product specification sheets, Statista, German Bundesanzeiger, HDE Handelsverband Deutschland

Deep dive: Change to ZEVs[1] for transport to potentially narrow single-use versus reusable gap, however only in low-carbon electricity countries

Carbon intensity of electricity, g CO_2/kWh



Implications on transport for reusables

Impact of potential lower CO_2 contribution of **greener transports** depends on the **national electricity mix**

Countries with higher carbon footprint for electricity must avoid additional transports to improve reuse rotation emissions

- Reuse solutions must therefore aim at lower transport distances, avoiding metropolitan transport, or eliminating transport all together

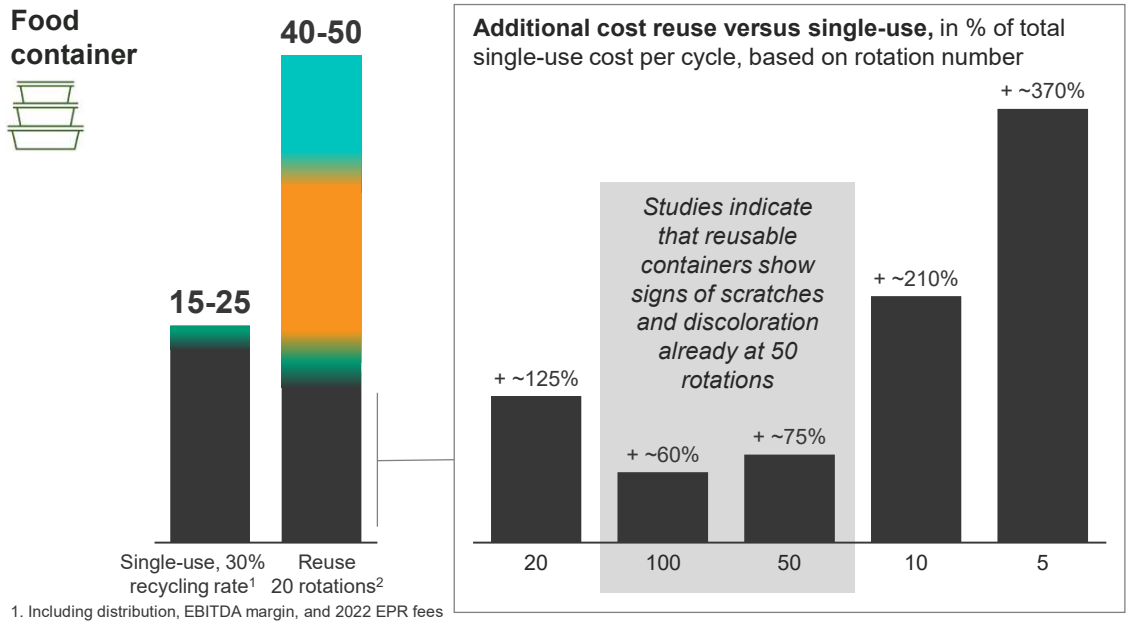
Countries with **low CO_2 emissions for electricity** could improve carbon footprint in reuse rotations going forward with introducing ZEVs (2030-2040)

1. Zero Emission Vehicles

 Source: European Environmental Agency, EIA, European commission

Sensitivity analysis: Packaging costs for reuse food containers decrease with number of rotations

CALCULATIONS BASED ON ESTIMATES — Cleaning (incl. customer drop-off); Transport and logistic handling (incl. distribution); EOL disposal; Packaging cost per rotation



1. Including distribution, EBITDA margin, and 2022 EPR fees
2. Including distribution and 15% EBITDA margin

Source: The potential impact of reusable packaging, McKinsey, April 4, 2023

Actual rotation number as a main driver:

Packaging and disposal cost are distributed over the product's lifecycle. An **increasing number of rotations will bring the additional cost for reusable solutions** for these products to a lower and attractive level. However, **costs will still not be competitive with the single-use paper-based solutions** for a realistic number of rotations

Increasing rotations could be achieved through:

a. More durable material (higher cost)
b. Optimized storage conditions
c. Optimized transport
d. Clear incentives/deposits for the end-consumer
e. Reducing time from filling to cleaning

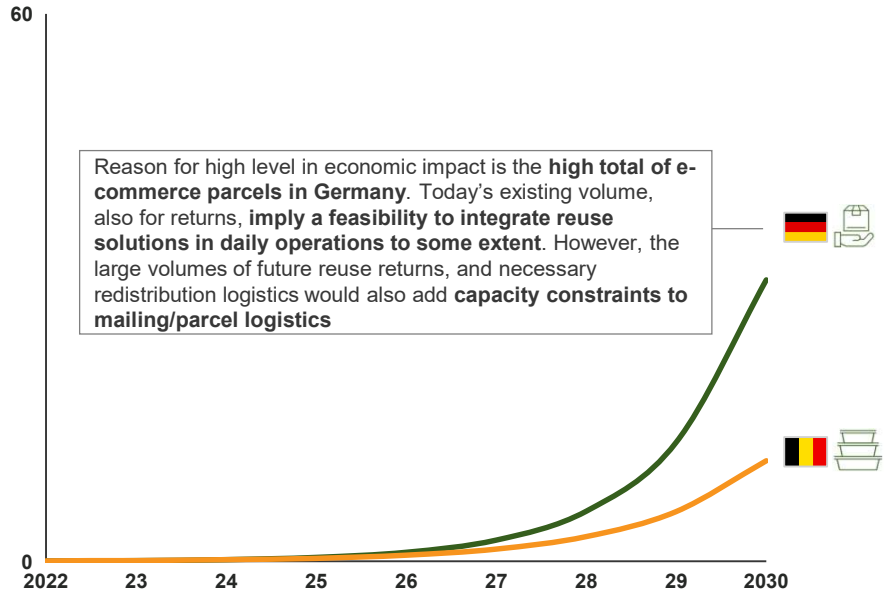
Source: EU Packaging and Packaging Waste Regulation proposal published on 30 November 2022, EPPA takeaway foodservice LCA, Bifa GHG Assessment, McKinsey – "Climate impact of plastics" (06/07/2022; https://www.mckinsey.com/industries/ chemicals/our-insights/climate-impact-of-plastics#/), SWDE, Schwarze Consulting, KIDV, Clean Mobility Collective – "Revealing The Secret Emissions Of E-Commerce " (07/2022; https://clean-mobility.org/wp-content/uploads/2022/07/Secret-Emissions-of-E-Commerce.pdf), Expert interviews, Government statistics and wage regulation, Product specification sheets, Statista, German Bundesanzeiger, HDE Handelsverband Deutschland

Summing this up to national impact of each reuse case, changing to reuse to increase costs by EUR ~40mn by 2030 and add ~7kt of CO_2

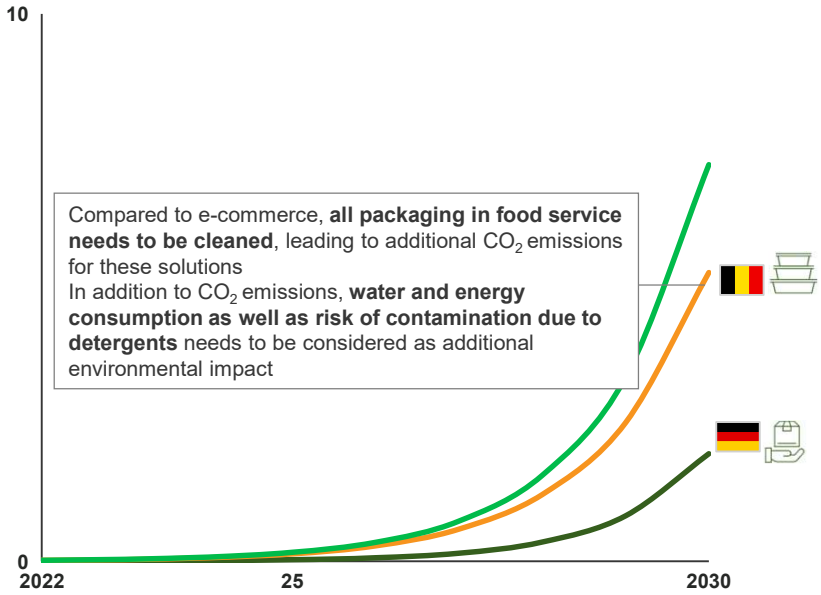
CALCULATIONS BASED ON ESTIMATES

E-commerce HORECA Net addition

Economic impact of reusables, EUR mn



Environmental impact of reusables, kt CO_2



Source: EU Packaging and Packaging Waste Regulation proposal published on 30 November 2022, EPPA takeaway foodservice LCA, Bifa GHG Assessment, McKinsey – "Climate impact of plastics" (06/07/2022; https://www.mckinsey.com/industries/ chemicals/our-insights/climate-impact-of-plastics#/), SWDE, Schwarze Consulting, KIDV, Clean Mobility Collective – "Revealing The Secret Emissions Of E-Commerce " (07/2022; https://clean-mobility.org/wp-content/uploads/2022/07/Secret-Emissions-of-E-Commerce.pdf), Expert interviews, Government statistics and wage regulation, Product specification sheets, Statista, German Bundesanzeiger, HDE Handelsverband Deutschland

Content

A: In e-commerce reuse case, single-use paper-based mailer bags and corrugated boxes are replaced by reusable mailer bags and boxes

A: Packing 10% of e-commerce deliveries in reuse boxes and bags may lead to additional 2.5-3kt CO_2 emissions & EUR 60-70mn cost in 2030

2.5-3kt

Additional CO_2 emissions

EUR 60-70mn

Direct cost to the overall system

EUR >90mn

Additional one-time cost

Adaptation cost

Will appear for the e-commerce players and logistics providers to integrate the heavier (and standardized) boxes into the procedures and lines

Additional volumes

Of reuse packaging will be needed to keep the system running since boxes will not be directly returned

Logistics challenges

Will appear depending on the reuse business model, to collect all parcel volumes packed in reusable solutions – return handling is already in place but empty reuse returns will be a driver of emissions and cost

Inefficiencies due to overpackaging

Standardized reusable boxes will lead to overpackaging and inefficiencies in loading and logistics

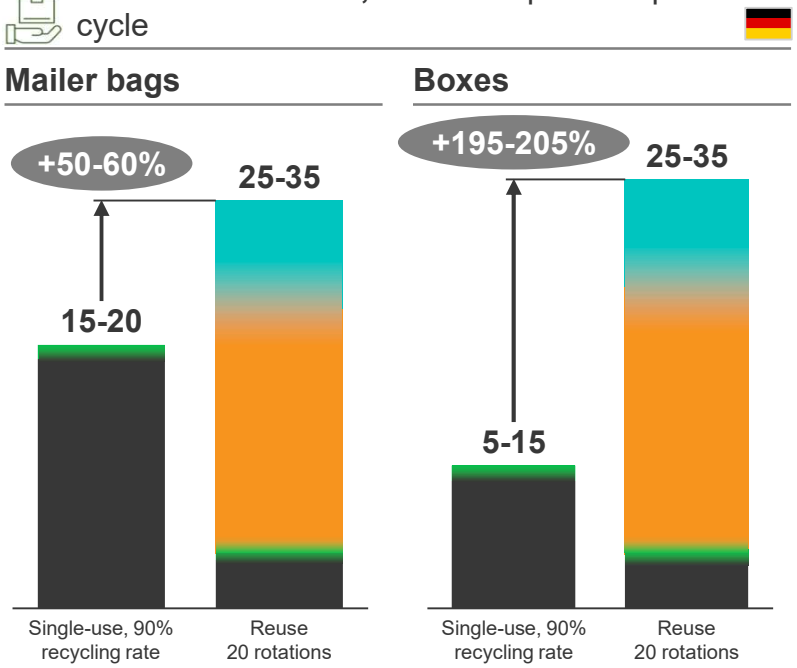
Source: EU Packaging and Packaging Waste Regulation proposal published on 30 November 2022, EPPA takeaway foodservice LCA, Bifa GHG Assessment, McKinsey – "Climate impact of plastics" (06/07/2022; https://www.mckinsey.com/industries/ chemicals/our-insights/climate-impact-of-plastics#/), SWDE, Schwarze Consulting, KIDV, Clean Mobility Collective – "Revealing The Secret Emissions Of E-Commerce " (07/2022; https://clean-mobility.org/wp-content/uploads/2022/07/Secret-Emissions-of-E-Commerce.pdf), Expert interviews, Government statistics and wage regulation, Product specification sheets, Statista, German Bundesanzeiger, HDE Handelsverband Deutschland

A: For e-commerce boxes, we see a high-cost delta in favor of single-use parcel packaging

CALCULATIONS BASED ON ESTIMATES

E-commerce costs, eurocents per item per cycle

Customer drop-off | Transport and logistic handling[1] | EOL disposal | Packaging cost per rotation



Key drivers for difference between solutions

The most significant driver for both cases (mailer bags and boxes) is transport and logistics, which could potentially be reduced with shipping optimization. However, it will be challenging to reach economic feasibility for e-commerce boxes

- Furthermore, given focus on Germany with relatively large country size and distances, long transport routes could further increase CO_2 emissions due to transport
- Cross-border shipping with additional potential to drive costs up
- All e-commerce reusables might have to be cleaned (and/or regularly maintained or inspected) to reach 20 rotations, adding additional cost for handling

Customer drop-off at postal facilities is a significant driver**,** specially when looking at results for the **mailer bags case.** Costs might decrease with different transport split or combining trips with other errands

Given 20 rotations, cost impact from packaging itself is lower for the reuse-cases. However, depending on the **durability of material** and/or a **higher theft/loss rate, rotation numbers could further decrease.** Currently, a rather lightweight reusable box (i.e. 0,1kg) is taken into account. In order to reach 20 rotations, a more durable solution could be necessary. Economic feasibility might further worsen for the reuse alternatives

1. Including cost increase from distribution

Source: The potential impact of reusable packaging, McKinsey, April 4, 2023

Other sources considered: EU Packaging and Packaging Waste Regulation proposal published on 30 November 2022, EPPA takeaway foodservice LCA, Bifa GHG Assessment, McKinsey – "Climate impact of plastics" (06/07/2022; https://www.mckinsey.com/industries/ chemicals/our-insights/climate-impact-of-plastics#/), SWDE, Schwarze Consulting, KIDV, Clean Mobility Collective – "Revealing The Secret Emissions Of E-Commerce " (07/2022; https://clean-mobility.org/wp-content/uploads/2022/07/Secret-Emissions-of-E-Commerce.pdf), Expert interviews, Government statistics and wage regulation, Product specification sheets, Statista, German Bundesanzeiger, HDE Handelsverband Deutschland

A: Further one-time cost could amount to EUR >90mn for implementation of reuse solutions

Additional cost drivers, one-time (system installation)

Stakeholder		Impact[1]
Merchant	**IT development cost (incl. updates):** Cost for adjusting IT systems, needed for implementing improved logistics and ordering flow for reusable packaging	EUR **50-100mn** + **5-10mn**
	Training: Employee training cost on overlying safety along with process procedures for handling new reusable container	EUR **0.25-1mn**
Reusable system operator	**Investment cost for machines and personnel:** Initial cost of setting up logistics center, launching sorting machines etc. to receive packages sent back by customer prior to send out to e-commerce stores	EUR **30-50mn** per logistics center
	User and ecommerce player educational campaigns: Cost of educating e-commerce stores on changes due to reuse packaging, and how to better optimize	EUR **5mn**
	IT development cost: R&D investments for developing IT system cost	EUR **0.1-0.2mn**

Key one-time cost drivers

Key challenge of implementing reusables will be **need for infra-structure, space** (i.e., warehouses) **and logistic/transport capacity**

E-commerce players will have additional challenge to **first-time integrate reusable solutions**. Efforts will be to integrate the reusables **into daily operations of each player**

Reusable system operators will face the challenge to **educate both, end-consumer and e-commerce merchants**, on how to integrate the reusable system into daily life. Only if education succeeds and consumers are willing to change habits, re-usable alternatives might reach PPWR targets

1. Total, if not indicated otherwise

Source: EU Packaging and Packaging Waste Regulation proposal published on 30 November 2022, EPPA takeaway foodservice LCA, Bifa GHG Assessment, McKinsey – "Climate impact of plastics" (06/07/2022; https://www.mckinsey.com/industries/ chemicals/our-insights/climate-impact-of-plastics#/), SWDE, Schwarze Consulting, KIDV, Clean Mobility Collective – "Revealing The Secret Emissions Of E-Commerce " (07/2022; https://clean-mobility.org/wp-content/uploads/2022/07/Secret-Emissions-of-E-Commerce.pdf), Expert interviews, Government statistics and wage regulation, Product specification sheets, Statista, German Bundesanzeiger, HDE Handelsverband Deutschland

A: Further cost drivers impact the economic feasibility of the e-commerce reuse case

Impact on reuse solution cost: Neglectable ○ to ● Major

Additional cost drivers, not quantified

Stakeholder		Impact
Merchant	**Increased cost of logistics adjustment and implementation:** Increased cost for e-commerce merchants to adjust logistic processes and flows to accommodate for new reusable parcels (regular handling is included in handling cost) and storage space	
	Educational cost: Cost to use online advertising space for educational purposes for end-consumers	
Reusable system operator	**Increased cost for extra material to cover stagnant returns and packaging in circulation:** Cost to cover demands with increased inventory, as a result of stagnant returns (i.e., customers waiting to return packages) and circulation	
	IT system running cost: Cost to initially implement IT system for tracking and distributing	
	Design cost: Initial cost to design containers suitable for multiple e-commerce trips needs significant effort	
	Substituting all pieces: Ramp-up cost to produce all necessary amounts of reusable items, and one-time efforts to replace parcels in a relative short time span, once regulation comes into effect	
	Brand owner acclimatization cost: Cost to tailor and fit boxes to big-brand requirements, with labelling, design, SKU size fit, etc.	
	Cleaning cost: E-commerce boxes have to be cleaned regularly (and frequently checked for their quality and usability)	

Further cost drivers

For e-commerce merchants, integrating the standardized mailer bags and boxes will cause **necessity to remodel warehouses**, in particular, since they might have to hold up both – single-use and reuse system – at the same time

Reusable system operators will also have to cover first-time investment into reusable items as well as to source **additional boxes to cover stagnant returns**, circulation, theft rate, etc., also imposing additional **insecurity of planning and financing** to reusable system operators. Consumers might not return e-commerce bags and boxes in time to hold-up the system

Source: EU Packaging and Packaging Waste Regulation proposal published on 30 November 2022, EPPA takeaway foodservice LCA, Bifa GHG Assessment, McKinsey – "Climate impact of plastics" (06/07/2022; https://www.mckinsey.com/industries/ chemicals/our-insights/climate-impact-of-plastics#/), SWDE, Schwarze Consulting, KIDV, Clean Mobility Collective – "Revealing The Secret Emissions Of E-Commerce " (07/2022; https://clean-mobility.org/wp-content/uploads/2022/07/Secret-Emissions-of-E-Commerce.pdf), Expert interviews, Government statistics and wage regulation, Product specification sheets, Statista, German Bundesanzeiger, HDE Handelsverband Deutschland

A: Packaging, transport and storage facilities contribute to the CO_2 footprint of the e-commerce reuse case

Packaging-related

During **production and recycling of the single-use or reuse box and mailer bag**, CO_2 emissions are caused by the raw material generation and the manufacturing of the box/bag

Transport-related

Additional **CO_2 emissions occur during transport**, including initial distribution (for single-use as well), collection from postal facilities and redistribution from operator facility to the e-commerce merchant

Storage-related

Warehouses which are needed in a reuse case to **inspect and redistribute[1] reusable bags and boxes** to e-commerce merchants, cause additional CO_2 emissions, compared to a single-use solution

Further, these warehouses need to be upheld **to provide enough stock of reusable solutions** since e-commerce consumers might not return the items in time to ensure circulation

1. Cleaning is not included in the assessment but might be necessary to reach high rotations – adding addition costs and CO_2 emissions

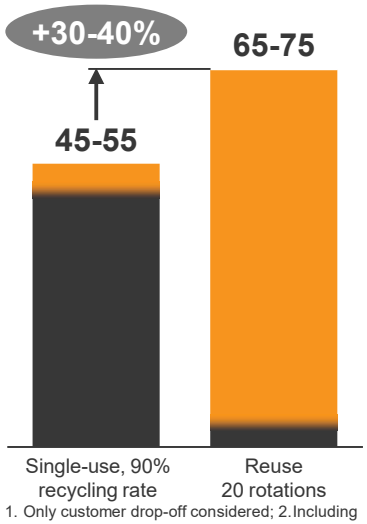
A: In e-commerce, the same drivers are present on the emissions side, with transport being the most substantial contributor

CALCULATIONS BASED ON ESTIMATES

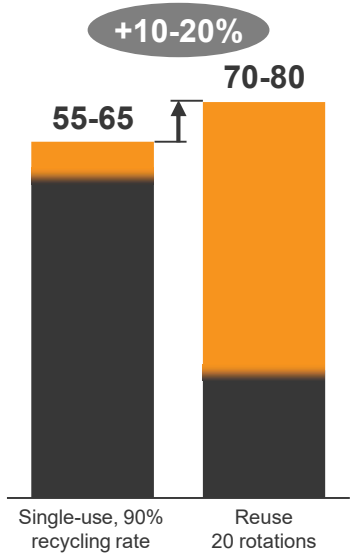
Customer drop-off | Transport and logistic handling, incl distribution[2] | Packaging emissions incl. EOL

E-commerce emissions, g CO_2 item per cycle

Mailer bags



Boxes



Key drivers for difference between solutions

The most significant driver for reusable alternative in both e-commerce packaging items is transport

- Based on current mode of transport of 95% land transport in Germany, future innovations and industry changes may drive down share of transport emissions (e.g., fleet mix with higher share of ZEVs running on green electricity, or utilizing more rail transport)
- However, similarly to the cost case, cross boarder shipping might further increase emissions due to longer distances
- Similarly, inefficiencies in loading due to overpackaging might increase CO_2 emissions, depending on variety of sizes available
- Currently, a rather lightweight reusable box (i.e. 0,1kg) is taken into account. Considering a heavier (and more durable) item would add additional emissions for transport and the packaging itself
- E-commerce reusables cleaning might be necessary to reach 20 rotations, adding additional CO_2 emissions

Customer drop-off is currently not a major driver, considering reverse logistics utilizing drop-off in postal facilities (on average ~500 meters from all homes) – potential to increase if different drop-off mode is utilized

Similarly to the cost element, **emissions from packaging itself** has the potential to **increase if 20 rotations are not reached** (e.g., for a lightweight solution) – or further drive down if lifetime of reuse solution is extended

1. Only customer drop-off considered; 2.Including increase from distribution

Source: The potential impact of reusable packaging, McKinsey, April 4, 2023

Other sources considered: EU Packaging and Packaging Waste Regulation proposal published on 30 November 2022, EPPA takeaway foodservice LCA, Bifa GHG Assessment, McKinsey – "Climate impact of plastics" (06/07/2022; https://www.mckinsey.com/industries/ chemicals/our-insights/climate-impact-of-plastics#/), SWDE, Schwarze Consulting, KIDV, Clean Mobility Collective – "Revealing The Secret Emissions Of E-Commerce " (07/2022; https://clean-mobility.org /wp-content/uploads/2022/07/Secret-Emissions-of-E-Commerce.pdf), Expert interviews, Government statistics and wage regulation, Product specification sheets, Statista, German Bundesanzeiger, HDE Handelsverband Deutschland

A: Societal impact for e-commerce reuse is linked to high volumes of returns, implying bottlenecks in operations and logistics (1/2)

Potential societal impact: Negative — Positive

E-commerce in Germany

	Stakeholder	Areas of impact		Description
Societal impact	**Producer/ operator of reuse solution** The company producing reuse & the operator	Logistics covering whole country		Reuse logistics will have to cover rural and urban areas. However, sufficient coverage might only be feasible in urban areas, where postal facilities are widely spread and close by
		Insecurity of demand		Large buildup of extra volumes will be necessary in first years of implementation although not knowing total demands
		Shortage of employees		In e-commerce, the last-mile operation is already part of standard operations. However, central operators need additional trucks, truck drivers and personnel in handling
		Access to space		Parcel/mailing providers will need to support reuse solutions/operators since they will receive large volumes of shipped bag mailer bags & reuse boxes and need to store them in their warehouses
	Producers of single-use solutions The company producing single-use	Sudden drop in demand		Ramp-up of reuse will be a major shift for producers (of paper-based) single-use parcels, where e-commerce has driven demand for last years
		Need to layoff people		Lower demand will incur lower employments at paper- and plastic-based packaging manufacturing sites
		Focus and development		Manufacturers need to take strategic decision whether e-commerce as a segment is a future market for them or shift business
	Merchant/ economic operator The e-commerce player *(to be continued)*	Increased cost for packaging		E-commerce is a low margin business. With increasing cost for packaging, merchants will need to cut down elsewhere (leading to lower quality, deteriorating employment conditions,…) or increase the cost for consumers
		Space management		Merchants will need additional space for storing reuse items, even more with higher number of different sizes/types. Further, additional space for pick and pack of orders might be needed (also due to different sizes/boxes vs. mailer bags)
		Operational issues		Merchants will need to shift their current packaging lines to new reuse solutions, incl. new filling machines etc.

A: Societal impact for e-commerce reuse is linked to high volumes of returns, implying bottlenecks in operations and logistics (2/2)

Potential societal impact: Negative — Positive

E-commerce in Germany

	Stakeholder	Areas of impact	Description
Societal impact	**Merchants** *(continued)*	Data management	Many data points will be transferred to all relevant stakeholders (risk as of GDPR), including sensitive data on customers/consumers
	Customers/ end-consumer The person buying goods for delivery	Less convenient	Shifting from using and recycling of boxes from “thin materials” to having to store bulky boxes and return after use
		Hygienic issues	Keep reusables at home despite being dirty or contaminated add hassle
		Operating hurdles	Due to a lack of training and education, consumers might not be able to understand processes and reuse items get lost or are forgotten
		Cost for return	Depending on the business model, consumers might have to bear additional cost for returning the reusables
	Society and policymakers	Increase in fossil consumption	Reuse solutions will increase plastic use, energy consumption and transportation which leads to the risk of increasing fossil consumption and emissions
		Increase of imports	Large share of reuse items produced outside of EU will shift employment in packaging to other regions which profit from a rapid transition
		Data collection and compliance	Regulators have to follow-up on progress of the reuse targets in order to identify when and how reuse is better than single-use
		Unknown key drivers to success	Subsidies, governmental campaigns, bans, taxes, etc., need to be assessed closely and only implemented when leading to real impact
		Governance	Regulators will have to manage and control the reuse targets from an authority perspective to evaluate that benefits are larger than drawbacks
		Employment increase	Reuse operation will add numerous jobs to the market (but it comes with higher costs)

Content

B: Foodservice case focuses on replacing single-use paper-based food containers and cups by reusables

In the end, different business models could win – including solutions where boxes are cleaned at premise

Transport to cleaning and distribution facilities leads to additional cost and CO_2 emissions

Reversed vending machines might impose certain hygienic risks and additional distances to be covered by consumers

1. Different business models could be applicable (e.g., cleaning at premise). For this impact calculation, a business model with central collection point was considered (not suggesting this business model to win in Belgium)

B: Introducing reuse packaging in Belgian foodservice will lead to 5-5.5kt additional CO_2 and EUR 20-30mn cost in 2030

5-5.5kt

Additional CO_2 emissions

EUR 20-30 mn

Additional cost to the overall system

EUR >20 mn

Additional one-time cost

Logistic challenges

Will appear due to additional transport for collection and redistribution of reusable items, with potentially different reuse providers

Hygienic and food safety risks

Will arise due to returns of contaminated cups and containers. High hygiene standards in HORECA cannot be upheld with reusable solutions

Handling and implementation efforts

Of reuse containers and cups, in cafés, restaurants and QSR, due to integration of IT, storage of reusable solutions and consumer education

37 Source: EU Packaging and Packaging Waste Regulation proposal published on 30 November 2022, EPPA takeaway foodservice LCA, Bifa GHG Assessment, McKinsey – "Climate impact of plastics" (06/07/2022; https://www.mckinsey.com/industries/ chemicals/our-insights/climate-impact-of-plastics#/), SWDE, Schwarze Consulting, KIDV, Clean Mobility Collective – "Revealing The Secret Emissions Of E-Commerce " (07/2022; https://clean-mobility.org/wp-content/uploads/2022/07/Secret-Emissions-of-E-Commerce.pdf), Expert interviews, Government statistics and wage regulation, Product specification sheets, Statista, German Bundesanzeiger, HDE Handelsverband Deutschland

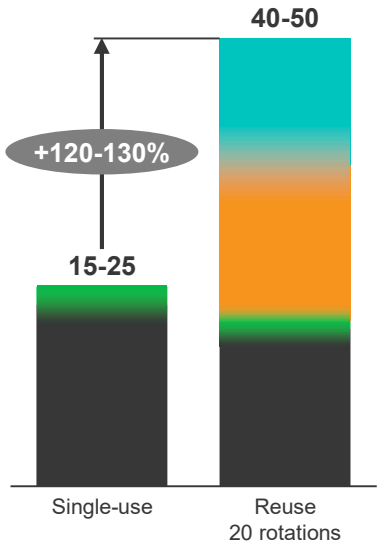
B: Reuse alternatives in the Belgian HORECA sector ~80-130% more expensive than single-use due to increased transportation costs

CALCULATIONS BASED ON ESTIMATES

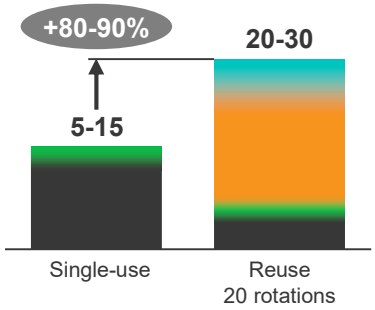
Cleaning (incl. customer drop-off) | Transport and logistic handling[1] | EOL disposal | Packaging cost per rotation

HORECA costs, eurocents per item per cycle

Containers



Cups



Key drivers for difference between solutions

The most significant driver for both foodservice packaging solutions is transport and logistics, which could potentially be reduced with shipping optimization, e.g., through optimizing volumes and ensuring optimal loading through easy stacking

– Furthermore, given focus on Belgium with relatively small footprint, transport cost could decrease when further spreading cleaning facilities. Locating them close to major metropolitan areas will shorten the shipping distance

Customer drop-off is a significant driver, specially for the containers case. Cost may decrease if **modal split for consumer transport changes**. **Combining trips with other errands**, or dropping off more containers at the same time will also add to lower costs

Packaging cost per cycle currently projected lower for reuse case. However, packaging cost split over lifetime might increase, as items in foodservice are likely to get scratched and damaged, with the additional impact of hygienic concerns. Potentially, more durable solutions are to be implemented seeing lower reuse rates – driving the packaging cost per rotation up

30% recycling, 60% incineration and 10% landfill considered for both single use and multiple use

1. Including distribution

Source: The potential impact of reusable packaging, McKinsey, April 4, 2023

38 Other sources considered: EU Packaging and Packaging Waste Regulation proposal published on 30 November 2022, EPPA takeaway foodservice LCA, Bifa GHG Assessment, McKinsey – "Climate impact of plastics" (06/07/2022; https://www.mckinsey.com/industries/ chemicals/our-insights/climate-impact-of-plastics#/), SWDE, Schwarze Consulting, KIDV, Clean Mobility Collective – "Revealing The Secret Emissions Of E-Commerce " (07/2022; https://clean-mobility.org/wp-content/uploads/2022/07/Secret-Emissions-of-E-Commerce.pdf), Expert interviews, Government statistics and wage regulation, Product specification sheets, Statista, German Bundesanzeiger, HDE Handelsverband Deutschland

B: Further one-time cost could amount to EUR >20mn for implementation of reuse solutions

Additional cost drivers, one-time (system installation)

Stakeholder		Impact[1]
Merchant	**IT development cost (incl. updates):** Cost for developing IT systems, needed for implementing deposit in the cashier system and POS system, along with training costs for employees	EUR **15-20mn** + **~2mn**
	Training: Employee training cost on overlying health and safety along with process procedures for handling new reusable container	EUR **2-5mn**
Reusable system operator	**Consumer and merchant educational campaigns:** Cost of implementation for educating cafés/restaurants and end-consumers	EUR **~1mn**
	IT development cost: R&D investments for developing IT system cost	EUR **0.1-0.2mn**

Key one-time cost drivers

Cafés, restaurants and other HORECA merchants will have additional efforts for **first-time integration of reusable solutions**. Main challenge will be to integrate the reusables **into daily operations of employees** and **integrate the system into each merchant's IT**

Reusable system operators will face the challenge to **educate both, end-consumer and merchants**, on how to integrate the reusable system into daily life. Only if education succeeds and solutions appear convenient, re-usable alternatives can reach PPWR targets

1. Total, if not indicated otherwise

Source: EU Packaging and Packaging Waste Regulation proposal published on 30 November 2022, EPPA takeaway foodservice LCA, Bifa GHG Assessment, McKinsey – "Climate impact of plastics" (06/07/2022; https://www.mckinsey.com/industries/ chemicals/our-insights/climate-impact-of-plastics#/), SWDE, Schwarze Consulting, KIDV, Clean Mobility Collective – "Revealing The Secret Emissions Of E-Commerce " (07/2022; https://clean-mobility.org/wp-content/uploads/2022/07/Secret-Emissions-of-E-Commerce.pdf), Expert interviews, Government statistics and wage regulation, Product specification sheets, Statista, German Bundesanzeiger, HDE Handelsverband Deutschland

B: Additional cost drivers impact the economic feasibility of reuse case implementation

Impact on reuse solution cost: Neglectable to Major

Additional cost drivers, not quantified

Stakeholder		Impact
Merchant	**Handling and inconvenience cost:** Increased time from employees required for receiving, storing, stacking and managing reusable container costs. Reusable systems, furthermore, likely introduce fewer suppliers, decreasing room to bargain	
	Increased initial delivery costs: Increased cost for either delivery due to new weight/volume constraints, as well as higher cost paid for distribution to supplier	
Reusable system operator	**Increased cost for extra material to cover stagnant returns:** Cost to cover demands with increased inventory, as a result of stagnant returns (i.e., customers waiting to return containers and cups)	
	IT system running cost: Cost to initially implement tracking and distributing IT system for handling	
	Design cost: Initial cost to design containers suitable for multiple restaurants, significant effort across brands	
	Substituting all pieces: One-time logistical challenge to replace a significant volume of containers in a relative short time span, once regulation comes into effect	
	Brand owner acclimatization cost: Cost to tailor and fit boxes to big brand requirements, with labelling, design, portion size fit, etc.	
Consumer	**Increased delivery fees:** Implicit increase in cost of delivery through third party food delivery services, e.g., UberEats, Foodora, Wolt - due to limited capacity and increased weight	
Regulator	**Increased cost for meeting water and electricity demand:** Increased cost for governments to meet water supply and sanitation demand. Depending on transportation and shipping mix, potentially significant cost increase to develop improved electricity infrastructure to support vehicles (BEVs) and increased consumption from cleaning centers	

Further cost drivers

In addition to first-time investment into reusable items, reusable system operators will also have to source **additional boxes to cover stagnant returns,** also imposing additional **insecurity of planning and financing** to them. Consumers might not return the food containers and cups in the required amount of time and additional (yet unknown) stock needs to be available

In addition, merchants will experience **inconvenience and handling cost** to receive and store the reusable items, as well as to **integrate them into their food preparation procedure**

Source: EU Packaging and Packaging Waste Regulation proposal published on 30 November 2022, EPPA takeaway foodservice LCA, Bifa GHG Assessment, McKinsey – "Climate impact of plastics" (06/07/2022; https://www.mckinsey.com/industries/ chemicals/our-insights/climate-impact-of-plastics#/), SWDE, Schwarze Consulting, KIDV, Clean Mobility Collective – "Revealing The Secret Emissions Of E-Commerce " (07/2022; https://clean-mobility.org/wp-content/uploads/2022/07/Secret-Emissions-of-E-Commerce.pdf), Expert interviews, Government statistics and wage regulation, Product specification sheets, Statista, German Bundesanzeiger, HDE Handelsverband Deutschland

B: Environmental impact is largely driven by transport and cleaning

Packaging-related

During **production and disposal of the single-use or reuse cup and food container,** CO_2 emissions are caused by the raw material generation and the manufacturing of item

Transport-related

Additional **CO_2 emissions occur during transport**, including initial distribution (for single-use as well), collection from collection points and redistribution from operator facility to the merchants (café/restaurant/QSR)

Storage-related

Warehouses needed in a reuse case to **clean, inspect and redistribute reusable cups and containers** to merchants, cause additional CO_2 emissions, compared to a single-use solution

Further, these warehouses need to be upheld **to provide enough stock of reusable solutions** since end-consumers might not return the items in time

Washing-related

Cleaning of reusable food containers and cups **causes additional CO_2 emissions**

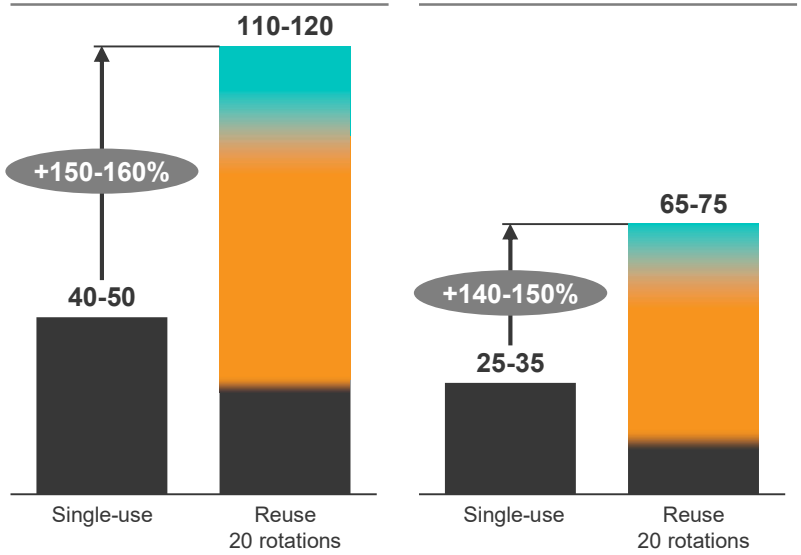
Further, cleaning also leads to additional **water consumption, energy usage and contamination by detergents**

B: Apart from increased costs, reuse alternatives in the HORECA sector further add ~155% CO_2 emissions compared to single-use alternatives

CALCULATIONS BASED ON ESTIMATES

Cleaning (incl. customer drop-off) | Transport and logistic handling[1] | Packaging emissions

HORECA emissions, g CO_2 per item per cycle



Key drivers for difference between solutions

Transport stays the sole largest driver for CO_2 emissions as well, however, can potentially see changes:

- A reduction in emissions from transport might be seen for more optimized routes, ideal shipping volumes (e.g., through easily stackable items) or more cleaning and distribution centers close to major hot spots/metropolitan areas
- An increase in emissions might be observed for non-optimal and multi-stop reverse logistics. If items are branded, but cleaned off-premise – transport routes might further increase

Customer drop-off is a significant driver, specially for the containers case – eventually to **decrease with green transport choice,** combining trips with other errands, or dropping off more containers simultaneously, as well as using electric cars fueled on green electricity

Packaging emissions currently projected are lower for reuse case. However, packaging emissions per rotation might increase, given **durability requirement of items** and requirements to exhibit minimum to no signs of prior usage

30% recycling, 60% incineration and 10% landfill considered for both single use and multiple use

1. Including increase from distribution Source: The potential impact of reusable packaging, McKinsey, April 4, 2023

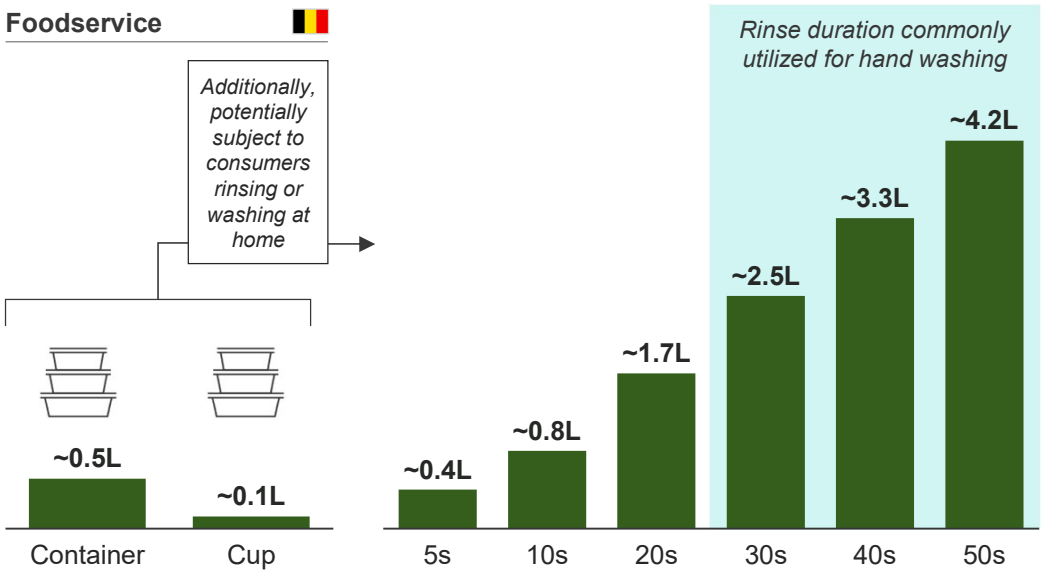
42 Other sources considered: EU Packaging and Packaging Waste Regulation proposal published on 30 November 2022, EPPA takeaway foodservice LCA, Bifa GHG Assessment, McKinsey – "Climate impact of plastics" (06/07/2022; https://www.mckinsey.com/industries/ chemicals/our-insights/climate-impact-of-plastics#/), SWDE, Schwarze Consulting, KIDV, Clean Mobility Collective – "Revealing The Secret Emissions Of E-Commerce " (07/2022; https://clean-mobility.org/wp-content/uploads/2022/07/Secret-Emissions-of-E-Commerce.pdf), Expert interviews, Government statistics and wage regulation, Product specification sheets, Statista, German Bundesanzeiger, HDE Handelsverband Deutschland

B: Up to 0.5L water per cycle consumed for central cleaning – even higher water usage due to at home rinsing and production

CALCULATIONS BASED ON ESTIMATES

Water use from central cleaning, in liters per item per cycle

Potential additional water use from at home rinsing, in liters based on rinse time in seconds



Implications

From central cleaning, **15-20mn liters of water consumption is added by 2030.** In addition, central cleaning increases overall energy consumption of reusables

However, even higher amount of water will be utilized based on:

- **Consumers rinsing or washing containers at home**
- **Packaging production,** where water is needed (level of water consumption depending on production's geographical location)

43 Source: EU Packaging and Packaging Waste Regulation proposal published on 30 November 2022, EPPA takeaway foodservice LCA, Bifa GHG Assessment, McKinsey – "Climate impact of plastics" (06/07/2022; https://www.mckinsey.com/industries/ chemicals/our-insights/climate-impact-of-plastics#/), SWDE, Schwarze Consulting, KIDV, Clean Mobility Collective – "Revealing The Secret Emissions Of E-Commerce " (07/2022; https://clean-mobility.org/wp-content/uploads/2022/07/Secret-Emissions-of-E-Commerce.pdf), Expert interviews, Government statistics and wage regulation, Product specification sheets, Statista, German Bundesanzeiger, HDE Handelsverband Deutschland

B: Societal impact for foodservice reuse is mainly linked to complexity of standard containers and the new behavior needed (1/2)

Potential societal impact: Negative — Positive

Foodservice in Belgium

	Stakeholder	Areas of impact	Description
Societal impact	**Producer/ operator of reuse solution** The company producing reuse & the operator	**Logistics covering whole country**	Reuse logistics will have to cover rural and urban areas. However, sufficient coverage might only be feasible in urban areas. Further, cleaning facilities (when necessary) will evolve where rents for facilities are affordable or where shortest distances can be achieved
		Insecurity of demand	Large buildup of extra volumes will be necessary in first years of implementation (due to items staying at consumer), reducing positive impact
		Shortage of employees	High need of personnel in cleaning and collection in short time period will drive cost
		Access to space	Collection points need to be established where space is available, close enough to consumer and where they can be kept clean
	Producers of single-use solutions The company producing single-use	**Sudden drop in demand**	Investments are needed to shift to a new reuse/refill product segment of paper-based packaging or – if not taking this business opportunity – see declining demand
		Need to layoff people	Lower demand may lead to reduced employment numbers
		Focus and development	Shift will cause insecurity in local community near current paper mills/sites producing single-use items
	Merchants/ economic operator The café/ restaurant/QSR	**Increased cost for packaging**	With increasing cost for packaging, merchants will need to cut down elsewhere (leading to lower quality of food, deteriorating employment conditions, smaller meal sizes, reduced customer service, others)
		Space management	Merchants will need additional space for storing reuse items. In particular, since location is key for many merchants (in particular in popular locations), space might be limited already today
		Operational issues	New operating procedures have to be implemented in kitchens, eventually even imposing a retrofit of the premise

(to be continued)

B: Societal impact for foodservice reuse is mainly linked to complexity of standard containers and the new behavior needed (2/2)

Potential societal impact: Negative — Positive

Foodservice in Belgium

	Stakeholder	Areas of impact	Description
Societal impact	**Merchants** *(continued)*	**Data management**	Many data points will be transferred to all relevant stakeholders (risk as of GDPR), including sensitive data on customers/consumers
		Food safety	Merchants cannot control packaging and, therefore, cannot guarantee for prior contamination of containers/cups
	Customers/ end-consumer The person buying food for takeaway or delivery	**Less convenient**	Shifting from a habit of recycle materials to store and return more rigid and voluminous
		Hygienic issues	Reusables will be kept in bags, offices, and households, as well as in collection points, imposing hygienic risks
		Operating hurdles	Due to a lack of training and education, consumers might not be able to understand processes, reuse items might be returned to other (wrong) provider. Reuse items might get lost or are forgotten
	Society and policymakers	**Increase in fossil consumption**	Reuse solutions will increase plastic use, energy consumption and transportation which leads to the risk of increasing fossil consumption and emissions
		Increase of imports	Large share of reuse items produced outside of EU will shift employment in packaging to other regions which profit from a rapid transition
		Data collection and compliance	Regulators have to follow-up on progress (advantages and disadvantages) of the reuse targets in order to identify when and how reuse is better than single-use
		Unknown key drivers to success	Subsidies, governmental campaigns, bans, taxes, etc., need to be assessed closely and only implemented when leading to real impact
		Governance	Regulators will have to manage and control the reuse targets from an authority perspective to evaluate that benefits are larger than drawbacks
		Employment increase	Reuse will add more manual jobs initially but it will lead to the loss of more qualified job in industry, and it comes with higher costs

Content

APPENDIX

A: E-commerce: Several parameters were included to derive economic impact of reuse targets (1/2)

Included in calculation | Additional one-time cost | Included in qualitative assessment

Stakeholder	Economic dimension	Assessment	Description
Merchant cost, E-commerce provider	**Packaging cost**	Included in calculation	Total packaging cost increase per item, broken down into number of rotations
	Handling and inconvenience cost	Included in calculation	Increased time from employees required for receiving, storing, stacking and managing reusable packaging costs. Reusable systems furthermore likely introduce more suppliers, decreasing room to bargain
	Increased initial delivery costs	Included in calculation	Cost increase shipping from e-commerce warehouse to customer, as a result of increased packaging weight
	IT development cost (incl. updates)	Additional one-time cost	Cost for adjusting IT systems, needed for implementing improved logistics and ordering flow for reusable packages
	Training	Additional one-time cost	Employee training cost on overlying safety along with process procedures for handling new reusable container
	Educational cost	Included in qualitative assessment	Cost to use in-store or online advertising space for educational purposes for end-consumers
	Increased cost of logistics adjustment and implementation	Included in qualitative assessment	Increased cost for e-commerce merchants to adjust logistic processes and flows to accommodate for new reusable parcels (regular handling is included in handling cost)
Reusable system operators' cost *(to be continued)*	**Shipping/transport cost**	Included in calculation	Shipping from mailboxes to redistribution centers, and shipping to merchants again
	Handling and inconvenience cost	Included in calculation	Cost for handling at the operator's facility (included in overall handling, in addition, rent for facility)
	Loss of containers cost	Included in calculation	Loss, theft and damage of containers accounted for by the reduction of maximum rotation cycles in reuse systems
	Disposal cost	Included in calculation	Cost for recycling, incineration or landfilling for containers which have either reached their maximum rotation cycles or have been damaged

A: E-commerce: Several parameters were included to derive economic impact of reuse targets (2/2)

Included in calculation | Additional one-time cost | Included in qualitative assessment

Stakeholder	Economic dimension	Assessment	Description
Reusable system operators' cost *(continued)*	**Margin, including SG&A**		Operating margin, cost to inform and train users and customers on the implementation of the system, marketing and other SG&A
	Investment cost for machines and personnel		Initial cost of setting up logistics center, launching sorting machines etc. to receive packages sent back by customer prior to send out to e-commerce stores
	Increased cost for extra material to cover stagnant returns		Cost to cover demands with increased inventory, as a result of stagnant returns (i.e., customers waiting to return packages)
	User and ecommerce player educational campaigns		Cost of educating e-commerce stores on changes to reuse packaging, and how to better optimize
	IT development cost		R&D investments for developing IT system cost
	IT system running cost		Cost to initially implement tracking and distributing IT system for handling
	Design cost		Initial cost to design containers suitable for multiple restaurants, significant combined effort across brands
	Substituing all pieces		One-time logistical challenge to replace parcels in a relative short time span
	Brand owner acclimatization cost		Cost to tailor and fit boxes to big-brand requirements, with labelling, design, SKU size fit, et cetera
Consumer cost	**Return shipping**		Increased cost for customer, on average, to return containers to drop off point with the sole purpose of return (i.e., small share of added trips to customers daily schedule, not accounting for "passing by" returns)
	Increased delivery fees		Implicit increased in cost for postal shipping, passed onto consumer from merchant, due to limited capacity and increased weight

B: Foodservice packaging: Several parameters were included to derive economic impact of reuse targets (1/2)

Included in calculation | Additional one-time cost | Included in qualitative assessment

Stakeholder	Economic dimension	Assessment	Description
Merchant cost	**Packaging cost**		Total packaging cost increase per item, broken down into number of rotations
	Handling and inconvenience cost		Increased time from employees required for receiving, storing, stacking and managing reusable container costs. Reusable systems furthermore likely introduce fewer suppliers, decreasing room to bargain
	Increased initial delivery costs		Increased cost for either delivery due to new weight/volume constraints, as well as higher cost paid for distribution to supplier
	IT development cost (incl. updates)		Cost for developing IT systems, needed for implementing deposit in the cashier system and POS system, along with training costs for employees
	Training		Employee training cost on overlying health and safety along with process procedures for handling new reusable container
Reusable system operators' cost *(to be continued)*	**Collection points / Reversed vending machine operating cost**		Cost to implement and maintain collection points, in which users can drop down reused container, including rent of space
	Shipping/transport cost		Shipping from collection points to cleaning centers, and shipping out again
	Cleaning and handling cost		Cost of cleaning and sanitizing containers in a central location incl rent
	Loss of containers cost		Loss, theft and damage of containers accounted for by the reduction of maximum rotation cycles in reuse use systems
	Disposal cost[1]		Cost for recycling, incineration or landfilling for containers which have either reached their maximum rotation cycles or have been damaged
	Margin, including SG&A		Operating margin, cost to inform and train users and customers on the implementation of the system, marketing and other SG&A - 25% on top of costs
	Investment cost for machines and personnel		Initial cost for dishwasher machines and other cleaning solutions written down over ~5 years

1. Additional disposal cost might apply if other materials are utilized for reusable food containers or cups (e.g., tritan)

B: Foodservice packaging: Several parameters were included to derive economic impact of reuse targets (2/2)

Included in calculation | Additional one-time cost | Included in qualitative assessment

Stakeholder	Economic dimension	Assessment	Description
Reusable system operators' cost *(continued)*	**Increased cost for extra material to cover stagnant returns**		Cost to cover demands with increased inventory, as a result of stagnant returns (i.e., customers waiting to return containers and cups)
	User and restaurant educational campaigns		Cost of implementation for educating restaurants and users
	IT development cost		R&D investments for developing IT system cost
	IT system running cost		Cost to initially implement tracking and distributing IT system for handling
	Design cost		Initial cost to design containers suitable for multiple restaurants, significant combined effort across brands
	Substituing all pieces		One-time logistical challenge to replace a significant volume of containers in a relative short time span
	Brand owner acclimatization cost		Cost to tailor and fit boxes to big-brand requirements, with labelling, design, portion size fit, et cetera
Consumer cost	**Return shipping**		Increased cost for customer, in average, to return containers to drop off point with the sole purpose of return (i.e., added trip to customers daily schedule, not accounting for "passing by" returns)
	Increased delivery fees		Implicit increased in cost of delivery through third party food delivery services, e.g., UberEats, Foodora, Wolt - due to limited capacity and increased weight
Regulatory cost	**Increased cost for meeting water and electricity demand**		Increased cost for governments to meet water supply and sanitation demand. Depending on transportation and shipping mix, potentially significant cost increase to develop improved electricity infrastructure to support vehicles (BEVs) and increased consumption from cleaning centers

Cepi is the European association representing the paper industry. We offer a wide range of renewable and recyclable wood-based fibre solutions to EU citizens: from packaging to textile, hygiene and tissue products, printing and graphic papers as well as speciality papers, but also bio-chemicals for food and pharmaceuticals, bio-composites and bioenergy. https://www.cepi.org/

The European Carton Makers Association brings together folding carton converters, cartonboard mills, national associations and suppliers to the folding carton industry. ECMA represents over 500 carton producers with a current workforce of 60,000+ located across nearly all countries in the European Economic Area – this equates to over 80% of the €12.2 bill European folding carton market. https://www.ecma.org/

The European Paper Packaging Alliance is a non-for-profit food and foodservice packaging association. The priorities of the Alliance are to find concrete solutions to increase recycling and to reduce carbon emissions of food and foodservice packaging without compromising food safety and human health protection. More information is available here. https://www.eppa-eu.org/

FEFCO (European Federation of Corrugated Board Manufacturers) represents the interests of the European Corrugated Board Manufacturers. Headquartered in Brussels, FEFCO has 16 Association members, all European national corrugated packaging organisations. The role of the Federation is to investigate economic, financial, technical and policy issues of interest to the corrugated packaging Industry, to analyse all factors which may influence the industry, and to promote and develop its reputation. https://www.fefco.org/

Pro Carton, the European Association of Carton and Cartonboard manufacturers, is a non-profit organisation representing over 40 cartonboard mills in 13 different European countries and North America, supplying more than 90% of Europe's demand, as well as the carton converting industry across Europe. https://www.procarton.com/