

Facilitating the Adoption of Takeaway Reuse Systems

Cost Assessment of Moving from Single-use Packaging to a Takeaway Reuse System and Assessment of the Necessary Policy Measures

September 2024



Report For



Zero Waste Europe (ZWE) is the European network of communities, local leaders, experts, and change agents working towards a better use of resources and the elimination of waste in our society. We advocate for sustainable systems; for the redesign of our relationship with resources; and for a global shift towards environmental justice, accelerating a just transition towards zero waste for the benefit of people and the planet.

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Cover image credit: *New European Reuse Alliance and its members*

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Fernando Rodríguez-Mata, Director General at the New European Reuse Alliance

As pioneers of a future where reusable packaging becomes mainstream, we need to create a level playing field with single-use alternatives. This starts by acknowledging the hidden and externalised costs of the latter, often disregarded by policymakers and local authorities. Then, we must adequately apply the polluter-pays principle, making producers responsible for bearing the full costs of the end-of-life of the packaging they place on the market. This report is unique in shedding light on the costs associated with both reusable and disposable containers for six of the most common types of takeaway packaging. The results are unambiguous: we need policies that provide the conditions and incentives to transition to well-designed reuse systems, unlocking their full environmental and economic potential.



Marta Longhurst, Plastics Initiative, Ellen MacArthur Foundation

Reuse plays a crucial role in achieving a circular economy, presenting one of the biggest opportunities to reduce plastic pollution whilst delivering benefits to the economy and creating jobs across the value chain. We were pleased to provide input to this report by sharing our perspective and reviewing the findings. It contributes further evidence that reuse solutions replacing single use packaging in the takeaway food sector can reduce GHGs emissions and outlines a variety of policy interventions which are essential to making the economics work. This report should give further confidence to businesses, policy makers and financial institutions to drive action and scale reusable takeaway packaging further and faster to realise the benefits these solutions bring.



Louise Lerche-Gredal, Managing Director at Plastic Change

Plastic is deeply rooted in modern life's consumerism and convenience culture. The massive consumption of plastic has led to plastic pollution affecting our environment, biodiversity, climate and health. The only way to mitigate the consequences from plastic is to reduce the demand for plastic. When we move from single use to reuse of our products, we reduce the need to extract new resources from the planet and we reduce the negative consequences from increasing plastic production. However, as the report points out, we need to factor in the hidden cost of single use and we need political intervention if we want to maximise the environmental and economic benefits of reuse systems.

Executive Summary

While food and drinks packaging can play important roles in keeping food safe for consumers and preventing food waste, the growth in consumption of single-use packaging over the last decades has resulted large scale environmental impacts from resource extraction, use of raw materials, and associated carbon emissions, as well as the littering of packaging items. According to European Commission data, the amount of total packaging waste (i.e., for all packaged products) consumed in the EU rose by 16.4 million tonnes from 2010 to 2021 – an increase of 24.2 %.¹ As Zero Waste Europe recently stated the problem²:

“... despite huge legislative and financial efforts, recycling, as necessary as it is, has proven vastly insufficient to address the problem. In times of energy and resource scarcity, efficient prevention and reuse measures are the only options that preserve the value of materials and reduce waste and costs for public authorities whilst spurring innovation and entrepreneurship.

Take-away food and drink is one of the sectors where packaging waste has increased the most, making it both a pressing problem to solve and an opportunity to seize for many stakeholders.”

Throughout the EU, there is growing interest in reducing packaging waste from takeaway food and drinks by replacing single-use packaging with reusable and refillable alternatives. However, we are yet to see reuse packaging systems embraced by the takeaway food and drink industry at large. Indeed, reuse is not yet mainstream and such systems are not achieving significant market penetration (meaning the proportion of sales of takeaway packing that are included within a reuse packaging system).

The requirements outlined in the adopted Packaging and Packaging Waste Regulation (PPWR) have the potential to drive further adoption of reuse packaging systems across Europe. Under this regulation, final distributors of takeaway food and beverages are required to provide consumers with a choice between reusable packaging within a reuse system and single-use takeaway packaging.³ The PPWR also includes a requirement that, from 2030, final distributors shall endeavour to offer 10% of takeaway food and beverage products in reusable packaging formats. However, as the requirement is only “to endeavour” to do this, it is not a binding target. The PPWR also states that incentivising food and drink vendors to provide reusable packaging is a means of contributing towards the attainment of EU packaging reduction targets (the PPWR requires Member States to reduce the volume of packaging waste per capita by 5% by 2030, 10% by 2035, and 15% by 2040, based on 2018 levels). The more ambitious Member States and cities may choose to go beyond the requirements of the PPWR in driving larger scale adoption of reuse packaging systems to accelerate positive environmental outcomes.

This report explores the costs associated with single-use and reusable takeaway packaging and investigates the policy instruments likely to drive higher levels of market adoption of reuse packaging systems. Specifically, the study compares the costs, to takeaway vendors and wider society, related to single-use packaging with the costs related to adopting a reuse packaging system. In the context of this report, ‘wider society’ also includes members of the public who, while not takeaway consumers or vendors, are nonetheless impacted by the costs of single-use packaging and reuse packaging systems.

¹ Packaging waste statistics, Europe website, accessed 02/09/2025, https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Packaging_waste_statistics

² Zero Waste Europe (2023), Blueprint for harmonising the implementation of takeaway food and drinks packaging in Europe, available at: <https://zerowasteurope.eu/wp-content/uploads/2023/10/RSVP-Reuse-Blueprint-October-2023.pdf>

³ The adopted PPWR text includes obligations for both reuse and refill. While these are related, they are distinct concepts and refill would not be part of a reuse packaging system as understood in this report. For this reason, refill is not considered in this report.

It then compares the costs of equivalent single-use (including both paper and plastic) and reusable packaging formats. Given that the outcomes of these comparisons depend upon some key cost assumptions, the study also examines the sensitivities around these assumptions. The study examines whether the cost differences between single-use and reuse packaging systems serve as a barrier or incentive to market adoption. Finally, the report concludes with suggested additional policy measures that individual Member States, regions and cities could implement to facilitate the transition to reuse. The study focussed on six packaging formats: bowls, boxes for pizza, burgers and sushi, and cups for warm and cold drinks for the European cities of Aarhus (Denmark) and Berlin (Germany). The results are assumed to be applicable to many other similar European cities.

Key Findings

In a steady state of operation with market penetration at ~85% (what this report calls an 'evolved scenario') and no supporting fiscal policy measures in place, a reuse packaging system is likely to cost takeaway vendors, and therefore takeaway consumers, more than the single-use option. The difference in net cost varies by format, with some formats that are easier to wash and transport (such as cups) being close to cost-neutral on the reuse option, and others (such as pizza boxes) costing significantly more.

However, single-use is only relatively low cost because the environmental externalities associated with it are not currently priced in – these being the costs of litter clean-up, litter disamenity and carbon impacts. These externality costs are borne by society as a whole, and so are paid by a wider group of citizens than takeaway vendors. As the externality costs of single-use packaging are greater than the increased costs to vendors of switching to a reuse packaging system, the cost benefits for society as a whole of making the switch outweigh the increase in cost for vendors.

Policy interventions are needed to incentivise and facilitate the adoption of effective reuse packaging systems that can deliver both environmental and economic benefits to society. As adopting reuse is necessary in order to reduce consumption of single-use takeaway packaging and the associated negative environmental impacts, it is reasonable to take the environmental costs borne by society into account when designing the required policy interventions. This can be done by using fiscal instruments such as taxes, levies or adjusted Extended Producer Responsibility (EPR) fees to modify single-use packaging costs to internalise the current externalities (i.e., litter clean-up, litter disamenity and carbon impacts), thereby creating a more level playing field for reusable packaging to compete with single-use packaging.

Germany has in place fiscal policy measures in the form of EPR fees on single-use packaging. The results of this study show that such fees are likely to increase the cost of single-use takeaway packaging for some formats (such as cups and bowls) to the extent that a reuse packaging system for takeaway packaging is expected to have a comparatively lower cost to vendors – and therefore to consumers. It is interesting to note that although EPR fees in Germany have been shown to likely result in lower reuse packaging system costs than single-use, we are yet to see reuse systems in Germany achieving high levels of market penetration. This perhaps indicates that the impact of these types of fiscal interventions on vendor costs are on their own insufficient to facilitate high levels of market penetration of reuse packaging systems.

To optimise the performance of reuse packaging systems, and to ensure they are efficient and convenient to use for both takeaway vendors and consumers, policy should also focus on setting system objectives, such as minimum return and rotation rates, minimum requirements on collection point coverage, minimum and maximum deposit/penalty levels, a requirement that funds from unredeemed penalties/deposits stay within the reuse packaging system and guarantees around the hygiene safety of the system. Pursuing objectives like these would help to ensure interoperability across regions and would simplify engagement for both vendors and consumers.

At first, as reuse packaging systems are trialled, rolled-out and subsequently improved upon, and while market penetration is relatively low at ~20% (what this report calls an 'evolving scenario'), such objectives would need to be agreed between governments and industry on a voluntary basis. However, as systems developed and achieved greater market penetration, it would become appropriate to set objectives in legislation as minimum standards and requirements.

While fiscal measures targeting single-use takeaway packaging are necessary in the early stages of a reuse packaging system, it is uncertain whether they alone are enough to achieve an evolved scenario, and so legislating mandatory, time bound targets – with meaningful sanctions if the targets are missed – may be necessary to achieve ~85% market penetration and the highest possible levels of reuse. Subsequently, if and only if the targets are not met, then it may be necessary to introduce measures prohibiting placing single-use takeaway packaging on the market. It would be important to communicate clearly to industry that, in the first instance, mandatory targets would be introduced if desired levels of performance were not achieved and then, in the second instance, that single-use bans would be introduced if the targets were not met. This would incentivise all actors in the system to work towards high market penetration of reusable packaging.

Other supporting measures unlikely to have a significant effect on market penetration alone but which are useful examples of good practice that should be included in all policy scenarios include bans on single-use takeaway packaging for 'dine in' consumption, a mandate that the default packaging option for serving takeaway food and beverages should be reusable packaging and requirements for minimum levels of staff vendor training on reuse.

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1.0 Introduction



1.1 Background

Throughout the EU, there is a growing movement to reduce packaging waste from takeaway food and drinks by replacing single-use packaging with reusable and refillable alternatives. This has led to a many new businesses models offering reuseable packaging alternatives to single-use packaging across Europe, as well as a number of voluntary reuse packaging systems within the takeaway food and drink industry.⁴

For instance, reCIRCLE has established reuse networks in Belgium, Denmark, Estonia, France, Germany and Switzerland in which consumers pay a deposit on takeaway containers / cups, and then have a choice to either redeem the deposit or receive a clean container / cup when they return their used item to a reCIRCLE network partner.⁵ Another example is SwapBox, a Netherlands based business providing takeaway food and drinks packaging for both one-off events and on an ongoing rental basis, and operating a centralised washing plant.⁶

Meanwhile, there are examples of high-profile takeaway vendors taking steps towards solutions which, although not reuse packaging systems (i.e., logistical networks to manage the centralised collection, washing and distribution of packaging), are indicative of growing industry appetite to pursue reuse solutions. For instance, by 2025, Starbucks plans to implement the Cup-Share initiative across all its stores in Europe, the Middle East and Africa, which will include a surcharge on paper cups, a discount for customers who bring their own refillable cups and the provision of in-store reusable options.⁷ McDonald's is also trialling reusable containers in its French restaurants.⁸

However, despite such initiatives, we are yet to see reuse packaging systems embraced by the takeaway food and drink industry at large. Indeed, the industry is yet to achieve meaningful market penetration (i.e., the proportion of sales of takeaway packaging that are included within a reuse packaging system) or high levels of consumer participation.⁹

The requirements outlined in the text of the adopted **Packaging and Packaging Waste Regulation (PPWR)** (awaiting final formal approval by the EU Council) have the potential to drive further adoption of reuse packaging systems across Europe.¹⁰ According to the PPWR, by 36 months after the regulation has entered into force, the final distributors of takeaway food and beverages shall provide consumers with the option of using reusable packaging that can be returned "**within a system for re-use**"¹¹. This means that, for takeaway food and beverages, consumers would have a choice between reusable and single-use takeaway packaging, and that the reusable option must be part of a system that, through an incentive and adequate logistics, enables the packaging to be returned by the consumer and reused. The PPWR also determines that the takeaway food and drinks offered in reusable packaging must not be

⁴ These initiatives are being implemented by businesses such as Vytal, ReCup, Swapbox and reCIRCLE, as well as many others.

⁵ ReCIRCLE website, accessed 03/09/2024, <https://www.recircle.eu/europa/>

⁶ SwapBox website, accessed 03/09/2024, <https://www.swap-box.com/>

⁷ Starbucks (2021). Starbucks To Offer Reusable Cup-Share Program In All Europe, Middle East and Africa Stores By 2025. Available at: <https://stories.starbucks.com/emea/stories/2021/emea-cup-share-program-2025/>

⁸ Independent (2022). Macron's loving it: French PM hails McDonald's reusables as EU goes after single-use plastics. Available at: <https://www.independent.co.uk/climate-change/news/mcdonalds-reusable-containers-eu-law-b2236933.html>

⁹ Defined as the amount of a product or service that is sold to customers compared to the estimated total market for that product or service.

¹⁰ European Parliament (2024), European Parliament legislative resolution of 24 April 2024 on the proposal for a regulation of the European Parliament and of the Council on packaging and packaging waste, amending Regulation (EU) 2019/1020 and Directive (EU) 2019/904, and repealing Directive 94/62/EC (COM(2022)0677 – C9-0400/2022 – 2022/0396(COD)), https://www.europarl.europa.eu/doceo/document/TA-9-2024-0318_EN.pdf

¹¹ The PPWR defines a system for re-use as "organisational, technical or financial arrangements, together with incentives, that allow the re-use either in a closed loop or open loop system. It includes deposit and return systems, when they ensure that packaging is collected for re-use."

sold at higher cost, and must be sold in no less favourable condition, than takeaway food and drinks sold in single-use packaging.

The PPWR text further includes a requirement that, from 2030, final distributors shall endeavour to offer 10% of takeaway food and beverage products in **reusable packaging formats** (calculated as 10% of either the total number of units of sales or the total volume). However, as the requirement is to **“endeavour”** to do this, it is not a binding target. In addition, the PPWR includes a requirement for EU Member States to reduce the volume of packaging waste per capita by 5% by 2030, 10% by 2035 and 15% by 2040 (based on 2018 levels).

The report **Assessing Climate Impact: Reusable Systems vs. Single-use Takeaway Packaging**, produced by Eunomia and published by Zero Waste Europe¹², has previously demonstrated that there are environmental benefits from moving from single-use packaging to a reuse system. For Member States and individual cities wishing to realise these benefits, it is important to understand the conditions that are likely to enable large scale uptake of reuse systems. This report therefore explores the costs associated with single-use and reusable takeaway packaging, and the policy measures that are likely to facilitate higher levels of market adoption of reuse packaging systems.

Aim of this Study

The aim of this study is to contribute to the evidence base regarding the financial implications of adopting reuse packaging systems, and to identify policy measures that could support the successful implementation of such systems.

The study compares the costs, to takeaway vendors and to wider society (i.e., **also including members of the public who, while not takeaway consumers or vendors, are nonetheless impacted by the costs of single-use packaging and reuse packaging systems**), related to single-use packaging with the costs related to adopting a reuse packaging system.

It then compares the costs of **equivalent single-use** (including **both paper and plastic packaging formats**) **and reusable packaging formats within a reuse packaging system**. As the results of these comparisons depend upon some key cost assumptions, the study also explores sensitivities around these assumptions.

Finally, the study examines whether the cost differences between single-use packaging and reuse packaging systems serve as a barrier or incentive to market adoption. The report goes on to explore policy measures that individual Member States, regions and cities could implement to facilitate the transition to reuse.

¹² Zero Waste Europe (2023) Assessing the Climate Impact of Reusable Systems vs. Single Use Takeaway Packaging. Available at: <https://zerowasteurope.eu/wp-content/uploads/2023/09/Assessing-the-Climate-Impact-Reusable-systems-vs.-Single-Use-Takeaway-Packaging-v-2.2-1.pdf>

1.2 Description of the Reuse Packaging System

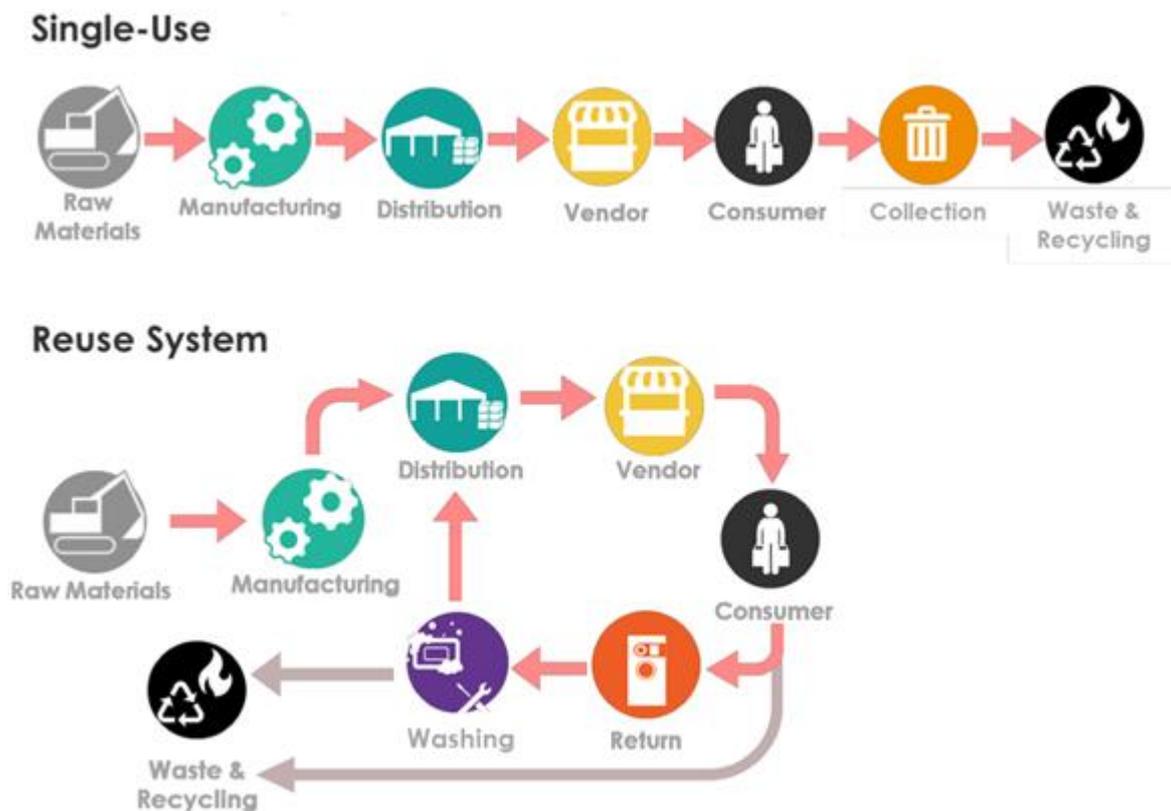
The adopted PPWR text defines 'systems for reuse' as "organisational, technical or financial arrangements, together with incentives, that allow reuse either in a closed loop or open loop system and includes deposit and return systems that ensure that packaging is collected for reuse". Systems for reuse can be centralised (with a central governance) or decentralised (without a central governance). They can also be an open (with shared ownership of the packaging) or closed (without shared ownership of the packaging).

For the purpose of this study, a reuse packaging system is defined as a logistical network to manage the centralised collection, washing, and distribution of takeaway packaging

The system under examination in this research is the centralised system currently being piloted by the municipality of Aarhus and TOMRA. The three-year pilot initially focuses on creating a reuse system for takeaway cups, with the plan to expand the system to cover all types of takeaway packaging. The TOMRA system is designed as an open system, which means packaging from different packaging providers can be returned 24/7 to a shared infrastructure of automated collection points throughout a city. Consumers pay a deposit when purchasing takeaway food or drink that is reimbursed to the consumer in full when the packaging is returned to a collection point.

The trial is the first of its kind and inspired Zero Waste Europe (ZWE) to explore the potential of adopting such a concept across European cities, such as Berlin. Berlin was used as a case study in this report to assess the costs of operating a similar system as the one trialled in Aarhus.

Figure 1-1: Lifecycle of Single-use Model and Reuse Packaging System



This study does not intend to differentiate between models or systems of packaging reuse, or which models or systems should be employed under various circumstances. Instead, we selected a system that, although entailing higher costs than other potential systems, is arguably more convenient for vendors and consumers, as shown below.

Key aspects of the reuse packaging system examined in this report include:

- Incentivised return (via deposits or non-return penalties) of reuse packaging via Reverse Vending Machines (RVMs).
- An RVM network that makes return convenient, with RVMs located in city centres, public spaces and perhaps on premises for some vendors.
- Centralised washing (reconditioning) of reuse packaging but localised at a city level.

2.0 Scope and Key Assumptions of the Cost Modelling



2.1 Scope of the Cost Modelling

To assess the costs of adopting a reuse system for takeaway packaging compared with the costs associated with single-use packaging, this report separately considers the net costs incurred by **the vendor** and by **wider society**.

The scope of the net costs incurred by the vendor are intended to reflect the costs that would be incurred by a takeaway vendor. The net costs are the costs of paying for the reuse packaging system minus the costs that would have been incurred by using single-use packaging.

The reuse system operator would charge takeaway vendors for the reuse service and would incur their own costs of operation. These costs includes CAPEX and OPEX costs to the packaging producer and to the system. OPEX ("operating expenditures") represents the costs associated with running a company's daily operations. On the other hand, CAPEX ("capital expenditures") refers to the funds spent on acquiring long-term tangible assets that will be utilised over a period of time.

CAPEX costs to the system operator have been annualised by depreciating over reasonable periods of time and an interest rate has been applied. A system operator margin has also been applied to all costs of reuse, as it is assumed that this cost margin would be passed on to the vendor.

This study models a steady state of OPEX and CAPEX in an "evolved" state of a reuse packaging system, meaning that the scaling of the reuse operation is using estimates of 85% market penetration. It is important to note that the costs of earlier "evolving" reuse packaging systems have not been examined in this report. There are many factors that may be different in early phases of trialling and evolving reuse systems, such as less efficient economies of scale and efficient uses of assets, which would in all likelihood mean that the costs of reuse packaging systems in early phases would be higher than those estimated in this report.

The costs that would be incurred by the takeaway vendor are summarised in Table 2-1. Note that for single-use packaging only the upfront packaging and disposal costs are relevant.

Table 2-1: Costs to Vendor within Scope

Upfront packaging costs (CAPEX)	Single-use container price and reuse container price per serving
Quality losses (OPEX)	Cost of replacing damaged reuse containers
Items not returned (OPEX)	The deposit/penalty received from consumers of non-returned items, minus the cost of replacing non-returned items
Transportation of items (CAPEX & OPEX)	Fuel/energy, driver wages and vehicle rental (including maintenance) costs
Scheme management (CAPEX & OPEX)	IT system cost and Scheme Manager wages

RVM purchase (CAPEX)	Cost of the RVM and bag purchase
RVM maintenance and services (OPEX)	Cost of cleaning agents, energy, spare parts and maintenance staff wages
RVM credit card charges (OPEX)	Credit card charge per transaction
Wash plant (CAPEX & OPEX)	Fuel/energy, cleaning agents, operational and management staff wages and cost of sorting and cleaning equipment purchase (including maintenance)
Disposal (OPEX)	Costs/revenue for disposal/recycling of single-use containers disposed of on-premise and for reuse containers disposed of in the wash plant

In the context of this study, the costs that would be incurred by wider society include the cost of litter collection, waste disposal, the social cost of carbon (the estimated cost associated with the negative impacts of climate change, allocated to a single tonne of CO₂) and litter disamenity (which is defined as the theoretical value that people would be willing to pay to reduce the level of litter by a specified amount).

In a comparative study such as this, a **functional unit** is the unit of measure by which two products are assessed. This should ensure that comparisons are made on a fair, like-for-like basis. The functional unit of the cost modelling is here defined as:

Providing a consumer with one serving of takeaway food or drink

This definition applies to six packaging formats, shown in Figure and listed below:

- Bowls
- Boxes for pizza
- Boxes for burgers
- Boxes for sushi
- Cups for warm drinks
- Cups for cold drinks

Figure 2-1: Examples of Single-use and Reusable Packaging



The geographical scope of the cost modelling is limited to two European cities: Aarhus (Denmark) and Berlin (Germany).

The aim of this project is to demonstrate the costs of single-use packaging and a reuse packaging system, without any supporting fiscal policy measures in place. However, in Berlin, policy interventions such as EPR fees on single-use takeaway packaging are currently in place. The potential impact that EPR fees in Berlin could have on the cost of a single-use takeaway packaging system is therefore considered in section 3.1.2.

Figure Table 2-2 shows, for both cities, the total number of units of single-use packaging placed on the market (POM). Figure 2-3 shows, again for both cities, the composition of packaging formats POM and the material composition of each format. Berlin is roughly ten times larger than Aarhus in terms of units of packaging POM. The data summarised in these figures are derived from data provided by Future Market Insights (FMI) – a research and business intelligence provider.¹³

¹³ Future Market Insights. Available at: <https://www.futuremarketinsights.com/>

Figure 2-2: Number of Units of Single-use Packaging POM Per Year in Each City, Split by Packaging Format

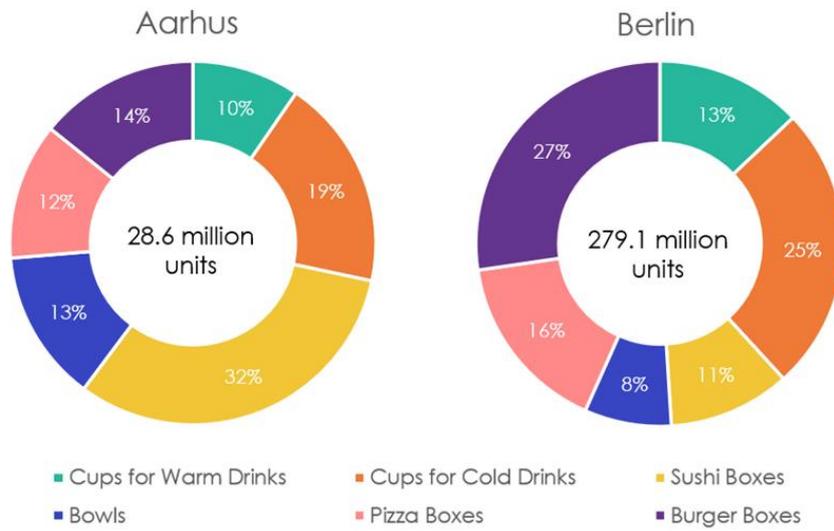
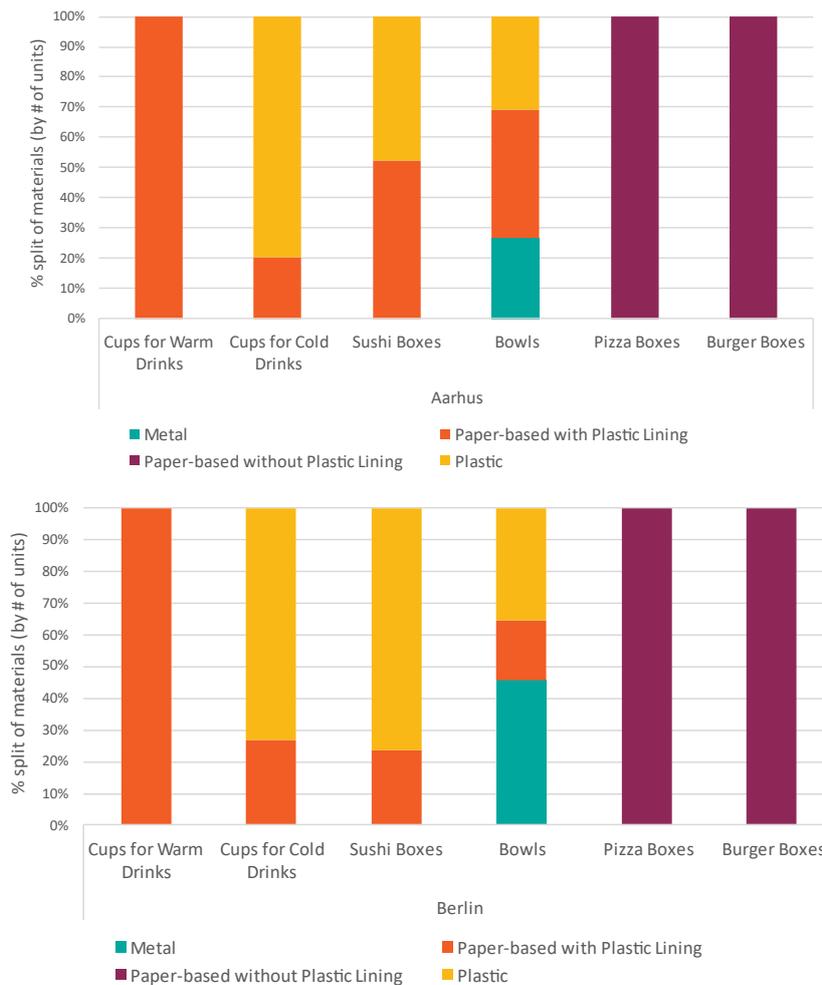


Figure 2-3: Material Composition of Single-use Packaging Formats in Each City



2.2 Key Assumptions

The cost comparison of reusable vs single-use packaging relies on a few key assumptions that significantly impact the results. Assumptions are often required to model aspects for which data is lacking, resulting in uncertainty. It is therefore crucial that studies are transparent about the assumptions that have been made, and that those assumptions are tested through sensitivity assessments.

The study represents a 2030 scenario, based on a version of the pilot in Aarhus, that has been optimised by design to achieve low environmental impacts. Table 2-2 outlines the key assumptions related to the modelled reuse packaging system.

Table 2-2: Key Assumptions and Metrics

	98% system return rate and a 1% scrappage rate.
	A deposit/penalty that is twice as high as the upfront price of the reusable packaging unit. Cups can be purchased for €0.50 with a deposit/penalty of €1.00, and all other formats can be purchased for €1.00 with a deposit/penalty of €2.00.
	A charge for using a credit or debit card at the reverse vending machine (RVM) has been included, assuming items are on average returned two-at-a-time ¹⁴ .
	A reuse packaging system that has achieved a market penetration rate of 85% (this means that the scheme would need to supply 67,000 and 650,000 servings per day ¹⁵ in reusable containers in Aarhus and Berlin, respectively).
	Electricity costs of €0.36 and €0.56/kWh in Denmark and Germany, respectively.

The only significant reduction in costs for the vendor considered in this assessment is the elimination of costs for purchasing single-use packaging. There is a significant degree of uncertainty regarding the costs of single-use packaging, as there is a wide range of costs per unit incurred by different types of vendors. For example, small independent vendors would pay significantly more for a unit of packaging than large multi-national chains. The values chosen in this study are provided in Table 2-3. It should be noted that these costs do not account for the cost of EPR fees on single-use packaging. Fiscal measures such as these are currently in place across Europe including throughout Germany (including Berlin). Therefore, the impact that EPR fees could have on the cost of single-use packaging in Berlin is explored in Section 3.1.2.

Table 2-3: Cost per unit of single-use packaging (Euro cents, ¢)

Cup for Warm Drink	Cup for Cold Drink	Bowl	Sushi Box	Pizza Box	Hamburger Box
9	7	18	18	26	16

¹⁴ Data provided by pilot reuse scheme trials shows that, on average, consumers return 1.7 items per transaction (for example returning a cup for a cold drink at the same time as returning a burger box).

¹⁵ These figures are based on the total annual number of servings for all formats per city (reported previously) multiplied by the market penetration rate and then divided by 365.

To reflect the uncertainties of costs per unit that vendors may incur, sensitivity analysis across a range of values has been conducted and the results of this are shown in section 3.1.1.of this report.

The model also includes an estimated cost to the vendor for the collection and disposal of single-use packaging that is disposed of on-premises. This has been calculated using the relevant gate fees for each country, assuming that 90% is sent to energy recovery facilities and 10% is sent for recycling. This equates to ~€200/tonne in Berlin and ~€60/tonne in Aarhus, with the gate fees charged by incinerators much lower in the latter. An additional €100/tonne has been assumed for the collection charge. The resulting charge has been applied to 30% of the total packaging POM, the fraction of which is assumed to be consumed on-premises¹⁶ (the rest being consumed off-premises and the disposal of which, therefore, is not a cost to the vendor).

¹⁶ This percentage is based on fraction of dine-in consumption reported on page 10 of the Kearney (2023) *No Silver Bullet: Why the right mix of solutions will achieve circularity in Europe's informal eating out (IEO) sector* report.

3.0 Costs of a Reuse Packaging System vs Single-use Packaging

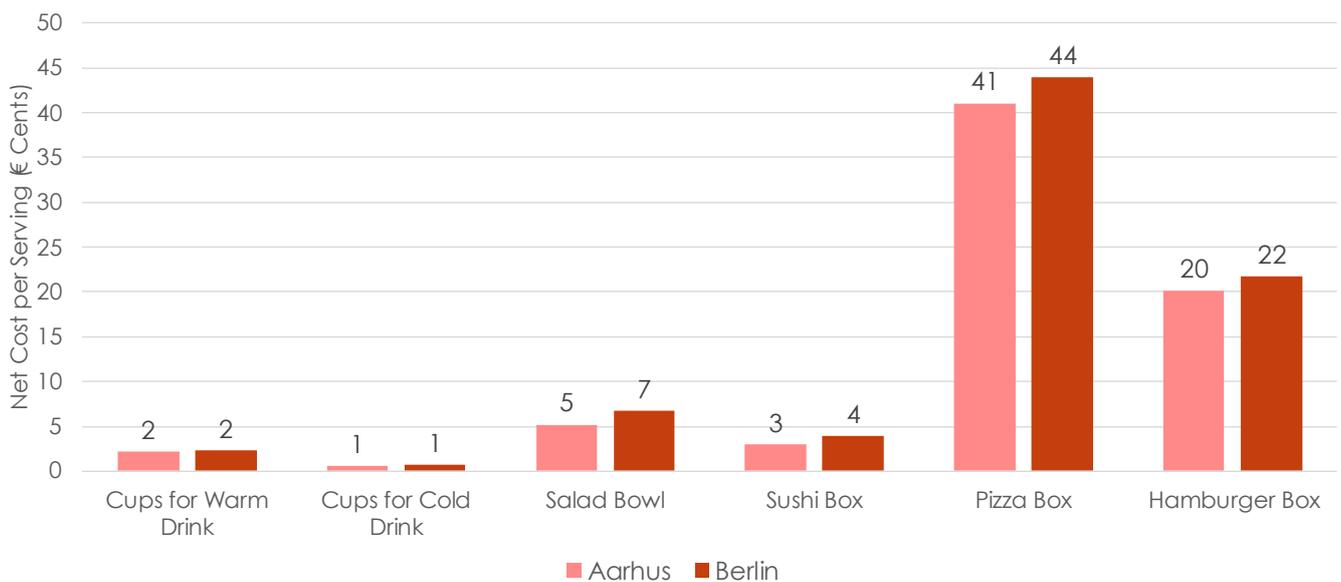


3.1 Reuse Packaging System vs Single-use Packaging: Comparative Costs to Vendors

Implementing the modelled packaging reuse system, without any supporting fiscal policy measures, would result in a total net cost to the vendor for both Aarhus and Berlin in a mixed format system. However, it is important to note that there are considerable uncertainties in this finding, especially regarding the costs of single-use items avoided (as explored in the following sections), and that results vary considerably by format. While the direction of the overall results (i.e., a net cost rather than a net saving) is very likely for some formats, there is a low level of confidence regarding specific figures and some formats demonstrate the potential for near-neutral net costs.

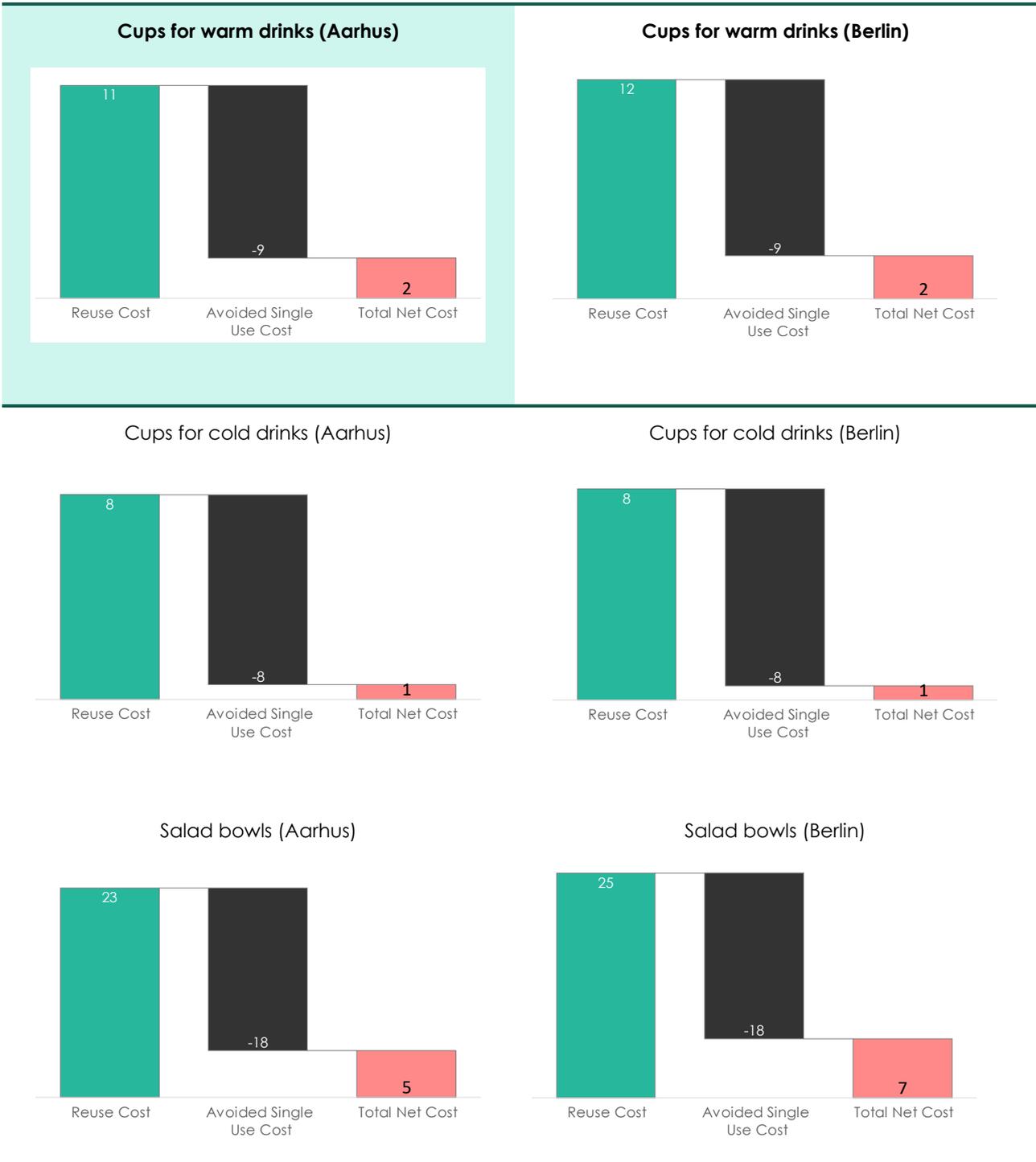
The net cost of a reuse packaging system varies significantly between the types of packaging format. Figure 3.1 shows the net costs (i.e., the cost of adopting a reuse packaging system minus the costs avoided by moving away from single-use packaging) of all packaging formats separately, for packaging reuse systems in both Aarhus and Berlin. As noted above, the costs modelled here do not account for any fiscal policy measures, such as EPR fees on single-use packaging as currently implemented in Berlin. Pizza boxes, and burger boxes to a lesser extent, demonstrate a higher net cost than the other formats as they are the least efficient to wash and transport. On the other hand, cups, bowls and sushi boxes have a relatively low net cost and come out as almost cost neutral.

Figure 3-1: Net Costs of Reusable Packaging by Format in Aarhus and Berlin

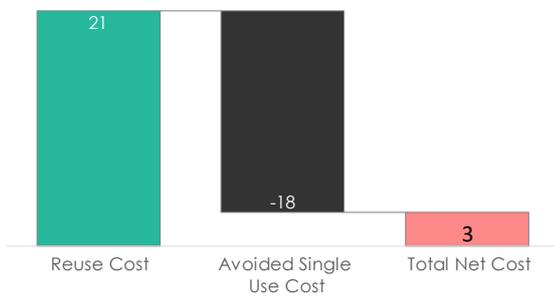


The net cost of each packaging format is determined by two opposing factors: the cost to vendors of a serving within the reuse packaging format and the avoided cost of single-use packaging. The waterfall charts presented in Figure Figure 3-2 demonstrate how the pink 'Net Cost' bars (the same as those in Figure 3-1 above) are a result of both the 'Reuse Cost' and 'Avoided Single Use Cost'. The importance of understanding both the reuse and single-use cost is well demonstrated by cups for warm drinks and sushi boxes **Error! Reference source not found.**: while both have a similar net cost, the cost of reusing sushi boxes would likely be much higher than the cost of reusing warm drink cups; however, this higher cost is offset by the greater savings from avoiding single-use sushi boxes.

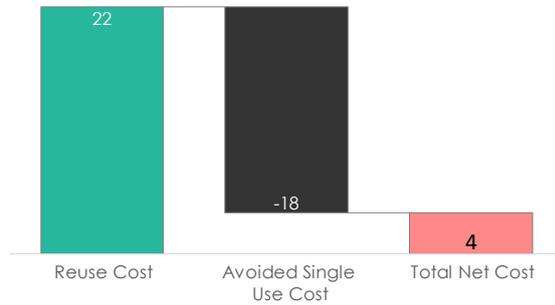
Figure 3-2: All Costs of Reuse Compared with Avoided Single-use Costs for Individual Formats – unit is cost per serving in euro cents (¢) for all charts



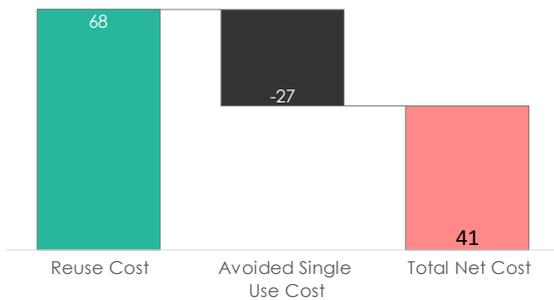
Sushi box (Aarhus)



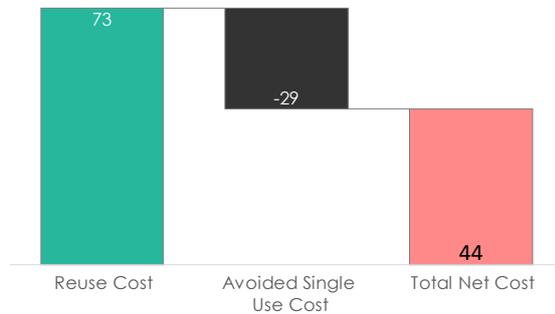
Sushi box (Berlin)



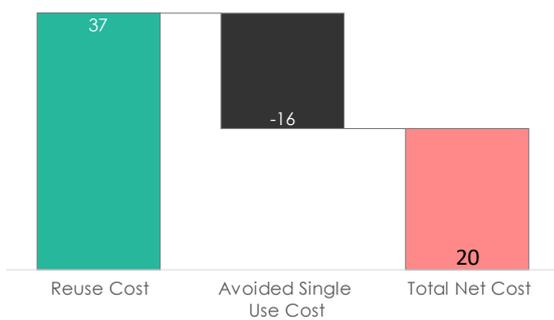
Pizza box (Aarhus)



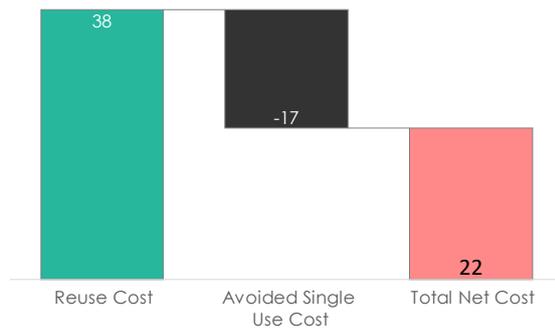
Pizza box (Berlin)



Burger box (Aarhus)



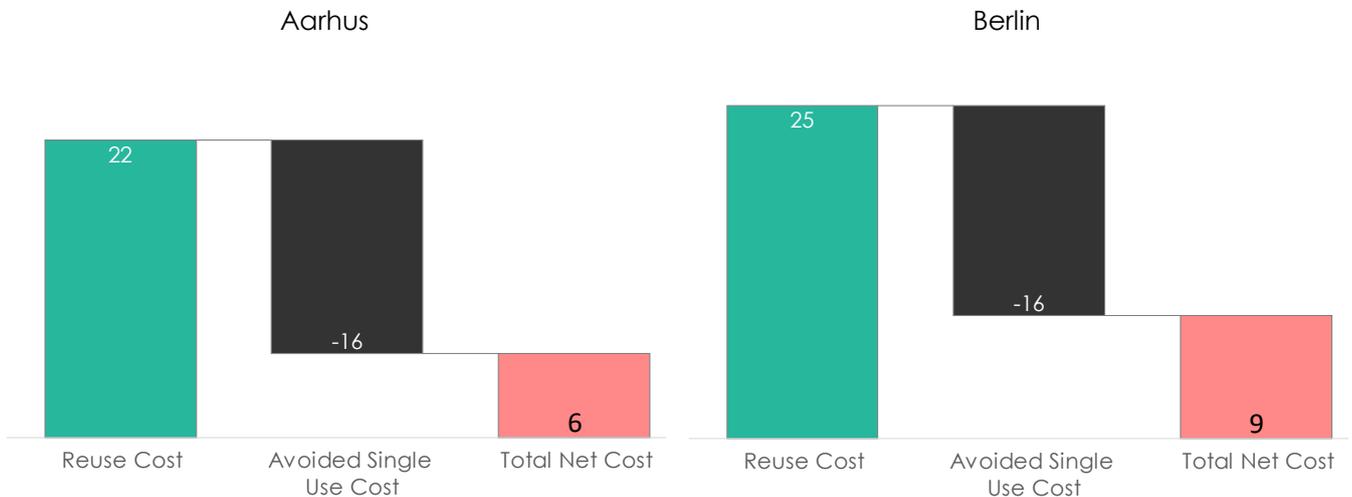
Burger box (Berlin)



When considering a city-wide reuse packaging system for all six formats, the average net cost of such a system would very likely be positive. From a vendor-perspective, only a small fraction of vendors will sell food and drink in all six formats, however, it is useful to understand the impacts of a mixed-format system to provide an indication of what the whole system might cost at a city level. Figure 3-3 shows the results of a mixed-format system, without any fiscal policy measures, for Aarhus and Berlin. These results are highly sensitive to the relative market share of different packaging (provided in Figure 2-2). For example,

if the share of pizza boxes (a high-net cost format) has been underestimated, then the average net cost of an 'average serving' in a mixed-format system will be higher than the values in Figure 3-3.

Figure 3-3: All Costs of Reuse Compared with Avoided Single-use Costs for a Mixed-Format System – unit is cost per serving in euro cents (¢) for all charts



While the findings for Berlin and Aarhus are similar, it appears that the cost of implementing the modelled reuse packaging system – which does not take into consideration any supporting fiscal policy measures – is lower in Aarhus than in Berlin. The most significant variable impacting the relative cost per serving in Aarhus and Berlin is the unit cost of electricity (€0.36 and €0.56/kWh in Denmark and Germany, respectively). Given that in a reuse packaging system packaging needs to be washed at a wash plant, which uses a significant amount of electricity for water heating, and that electric vans are used to redistribute the packaging, the cost of electricity is a key cost variable in this study.

Key finding: When not supported with any fiscal policy measures, adopting the modelled reuse packaging system would likely result in a net cost to vendors, compared with the single-use option. The difference in net cost varies by format, with some formats (such as cups) being close to cost-neutral and other formats (such as pizza boxes) resulting in larger net costs to vendors. As these findings are for the costs to the vendor only, they do not include the external costs currently borne by wider society. These additional costs are examined in section 3.1.2. Furthermore, these findings are dependent on a number of key assumptions which are explored in section 3.1.1.

3.1.1 Key Sensitivities and Uncertainties

3.1.1.1 Cost of Single-use Packaging

As shown in the results discussed above, the costs saved by vendors from no longer needing to purchase single-use packaging influences the total net costs of a reuse packaging system. The higher the cost to vendors of single-use items, the lower the net costs of reuse; conversely, the lower the cost of single-use packaging, the higher the net costs of reuse.

Estimates for the costs of single-use packaging to vendors are difficult to derive as this information can be deemed commercially sensitive. For example, McDonald's, one of the top global fast food chains, does

not make information on the cost of producing its packaging publicly available.¹⁷ Where information was available, research found that different vendors are likely to incur different costs for single-use packaging, with high-volume vendors (e.g., multi-national chains) likely to incur significantly lower costs per unit than low-volume vendors (e.g., independent businesses). A report by Road Side Retailer estimated that, in 2014, the cost for a single-use cup, stirrer and napkin to vendors was £0.16, while it has been estimated that the cost of a single-use cup, lid and stirrer to Starbucks is \$0.08 (USD).^{18,19} It should be noted that the cost of single-use packaging could be even lower if vendors manufacture their own packaging.

The costs used to determine the net cost results are presented in Table 3-1, with the addition of a high and low-cost range per unit for each format. It should be noted that these costs exclude any fiscal policy measures, such as EPR fees on single-use packaging. The high-cost estimate is based on FMI data and independently researched values, while the low-cost estimate is based on vendors manufacturing their own packaging. While there is still significant uncertainty in these ranges, we believe that they are reasonable estimates of what a low-volume vendor (high cost) and a high-volume vendor (low cost) might pay per unit of single-use packaging.

Table 3-1: Cost Per Unit of Single-use Packaging, Including High and Low Range (Euro Cents, ¢)

	Cups for Warm Drink	Cups for Cold Drink	Salad Bowl	Sushi Box	Pizza Box	Hamburger Box
Central Case	9	7	18	18	26	16
Low-cost	6	5	12	12	17	11
High-cost	17	18	22	29	33	18

Figure 3-4 shows the net costs of the modelled reuse packaging system for each packaging format, with net cost ranges (depicted by black error bars) given to account for the range of single-use packaging costs. The estimates of range in Figure 3-4 demonstrate that the price vendors currently pay for single-use packaging significantly impacts the net cost of a reuse packaging system. At the upper limit of the ranges, where reuse net costs are higher, it will be more difficult to incentivise high-volume vendors to move away from single-use packaging. However, for cups and sushi boxes, the fact that the lower limit of the range is at a negative net cost shows that a reuse packaging system could already be a cheaper alternative to single-use packaging.

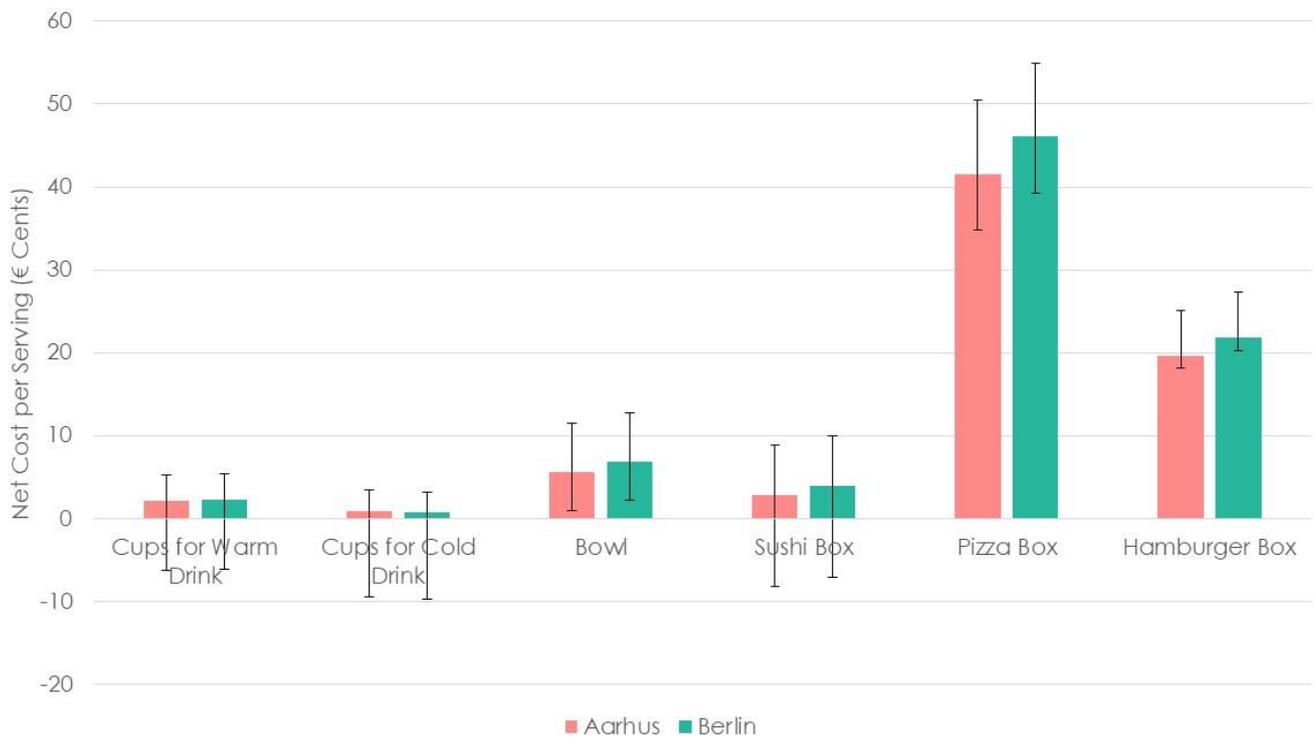
¹⁷ McDonalds (2018). How much does it cost to produce one piece of packaging? Available at:

<https://www.mcdonalds.com/gb/en-gb/help/fag/how-much-does-it-cost-to-produce-one-piece-of-packaging.html>

¹⁸ Medium (2019). Starbucks' cost for a coffee is \$1. Unless you sit. Available at: <https://georgebenarova.medium.com/starbucks-cost-for-a-coffee-is-1-unless-you-sit-4eb1153c1ee2>

¹⁹ Roadside Retail (2014). The real cost of a cup of coffee. Available at: <http://www.roadsideretail.com/2013/11/the-real-cost-of-cup-of-coffee.html>

Figure 3-4: Net Costs of Reuse, by Format, Accounting for Range of Single-use Costs



Key finding: There is considerable uncertainty on the vendor costs of single-use packaging, with virtually no market transparency on this matter. However, it seems reasonable to conclude that, for all formats, high-volume large businesses are likely to have lower single-use packaging costs – when EPR fees on single-use packaging are not considered – and that therefore the net cost of a reuse packaging system is likely to be greater for these entities. At the opposite end of the scale, small business vendors might experience some net cost savings from a reuse packaging system for cups and sushi boxes.

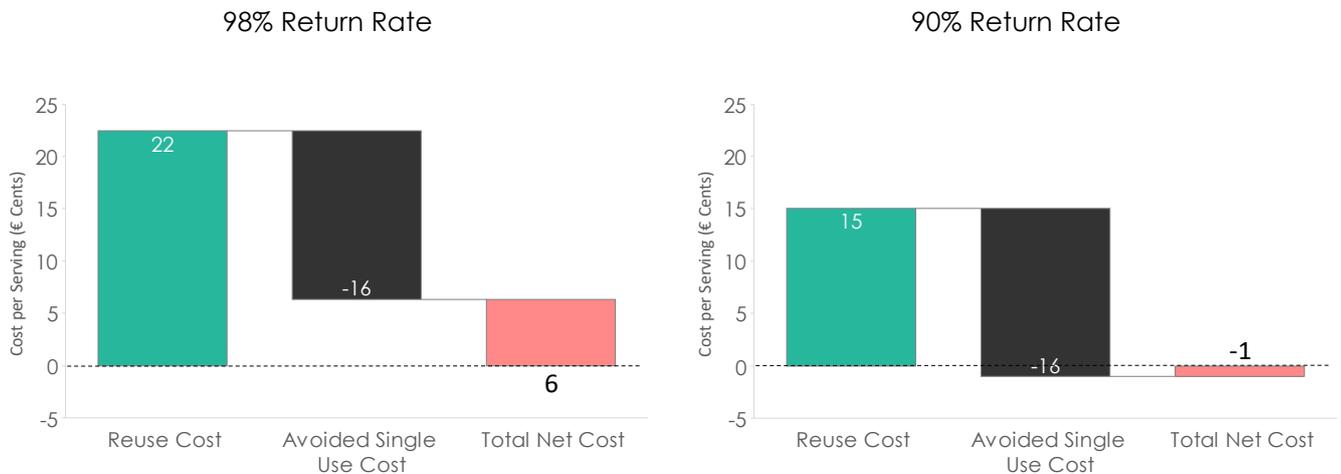
3.1.1.2 Return Rate

As this study has set the deposit/penalty as twice as high as the cost of reusable packaging, lower return rates result in reuse having a more favourable net cost. Where reusable packaging items are not returned, the reuse scheme operator will see a profit if the deposit/penalty value is set sufficiently high.

Figure 3-5 demonstrates the significance of this, showing that by moving down from a 98% to a 90% return rate, a reuse packaging system could on average go from a net cost to a net saving. In this way, cost performance is contrary to environment performance, as a low return rate has a negative impact on the relative environmental performance of a reuse packaging system.

To mitigate the risks around lower return rates making a reuse packaging system more cost competitive, policy measures such as the introduction of objectives for system would be necessary (e.g., standards and targets). The policy instruments that could be deployed in order to facilitate the adoption of reuse packaging systems are explored in section 4.0.

Figure 3-5: Net Costs of Reuse in Aarhus, for Bowls, at 98% (Left) and 90% (Right) Return Rates



Key finding: Policy measures such as the introduction of objectives (e.g., standards and targets) for a reuse packaging system would need to be introduced to mitigate the risk of lower return rates making a reuse packaging system more cost competitive. The policy instruments that could be deployed to facilitate the adoption of reuse packaging systems are explored in section 4.0.

3.1.1.3 Deposit/Penalty Value

The deposit/penalty value influences the net cost of a reuse packaging system, as the higher the value the more money the system operator receives whenever a container is not returned (all else being equal). Another factor is that the deposit/penalty value is a key determinant of the return rate achieved (among other determinants), and a higher deposit/penalty should also increase the return rate, and therefore reduce how frequently a deposit/penalty is claimed.

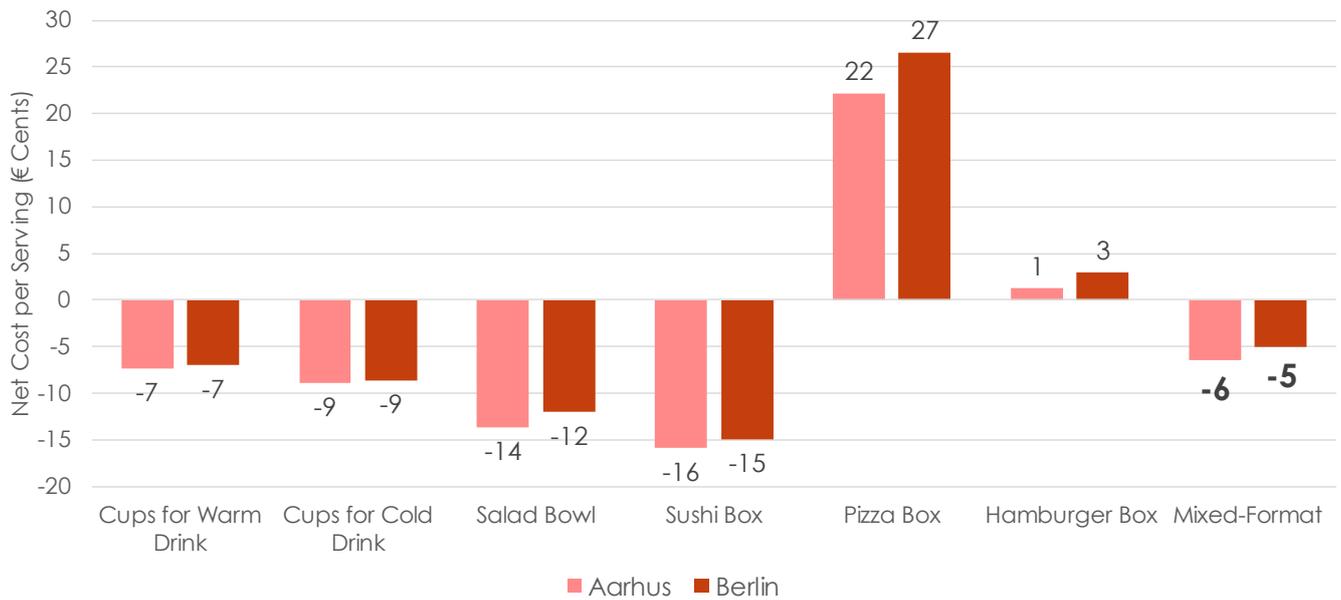
For this study, a sensitivity analysis has been conducted, holding the return rate steady at 98% but increasing the deposit/penalty values five-fold as follows:

- €5 for cups
- €10 for all other formats

Figure Figure 3-6 shows the net cost for each format using the higher deposit/penalty values (keeping all else equal). When comparing these to the results using the lower penalty values (see section 3.1), it is clear that this decision significantly impacts the findings, with all formats other than burger and pizza boxes demonstrating significant net savings to vendors, and burger boxes being much closer to cost neutral, with the higher deposit/penalty values. It is notable that this holds true even at the relatively high return rate of 98%, where a €5 deposit/penalty would still result in an average payment of €0.10 per serving – this is already only slightly lower than the cost of reuse for a cup for warm drink (€0.11), before even considering the avoided costs of the single-use packaging itself (€0.09) (see section 3.1).

This is not intended as evidence that deposits/penalties should be increased for the sake of achieving price parity, or that they need to be increased to achieve a 98% return rate. Rather, it is intended to demonstrate that, if it were necessary to increase the deposit/penalty to achieve a higher return rate, then it would reduce the net costs of reuse compared with single-use.

Figure 3-6: Net Costs of Reusable Packaging by Format in Aarhus and Berlin, with Higher Deposit/Penalty Values



Key finding: Increasing the deposit/penalty value to €5 for cups and €10 for all other formats improves the cost performance of reuse, resulting in savings for vendors on most formats. However, the deposit/penalty should not simply be raised indiscriminately to make a reuse packaging system work; it should only be raised as need to achieve required return rates, in combination with other efforts such as consumer engagement.

3.1.1.4 Reuse Packaging System Economies of Scale

For many, if not all, reuse packaging systems, operating at a large scale is key to economic feasibility.^{20 21} While there have been several pilot studies for reusable takeaway packaging, there are no known examples (within Europe) of such systems operating at a scale equivalent to that of single-use packaging.

The results of this study show that (besides the unit price of electricity) the reuse packaging systems modelled for Aarhus and Berlin do not demonstrate significant differences, despite the Berlin system being almost ten times larger than the Aarhus system. According to the assumptions made, the economics of scale of the larger city do not significantly impact the results, as the Aarhus system is already a large-scale operation. Reasons for the similarity across both cities include:

- Both systems are of a sufficient size to fully utilise multiple wash plants (i.e., plants with three industrial washing lines per plant).
- While there are fixed costs, such as the salary of a single scheme manager (which would be more cost-efficient in Berlin given that there would be almost ten times the number of staff in total, while still needing only one manager), these have a minimal impact on the overall results (<1%).

²⁰ Zero Waste Europe (2023) *The Economics of Reuse Systems*. Available at: <https://zerowasteurope.eu/wp-content/uploads/2023/06/2023-SB-ZWE-The-economics-of-reuse-systems.pdf>

²¹ Ellen McArthur Foundation (2023) *Unlocking a Reuse Revolution: Scaling Returnable Packaging*. Available at: <https://www.ellenmacarthurfoundation.org/scaling-returnable-packaging/overview>

- For transport, it has been assumed that the larger scale of the Berlin scheme could enable collections to operate 24 hours a day (as opposed to eight hours a day in Aarhus), and that therefore fewer vans would need to be leased per container collected. However, the resulting cost differential between the two represents a relatively small share of the total costs (~2%).

If the reuse packaging system can be set up at similar efficiencies for Berlin and Aarhus, this raises the question of how the net cost would be affected when setting up similar reuse packaging systems in much smaller cities. When answering this question, it is worthwhile considering which costs will scale in line with the number of units in the system:

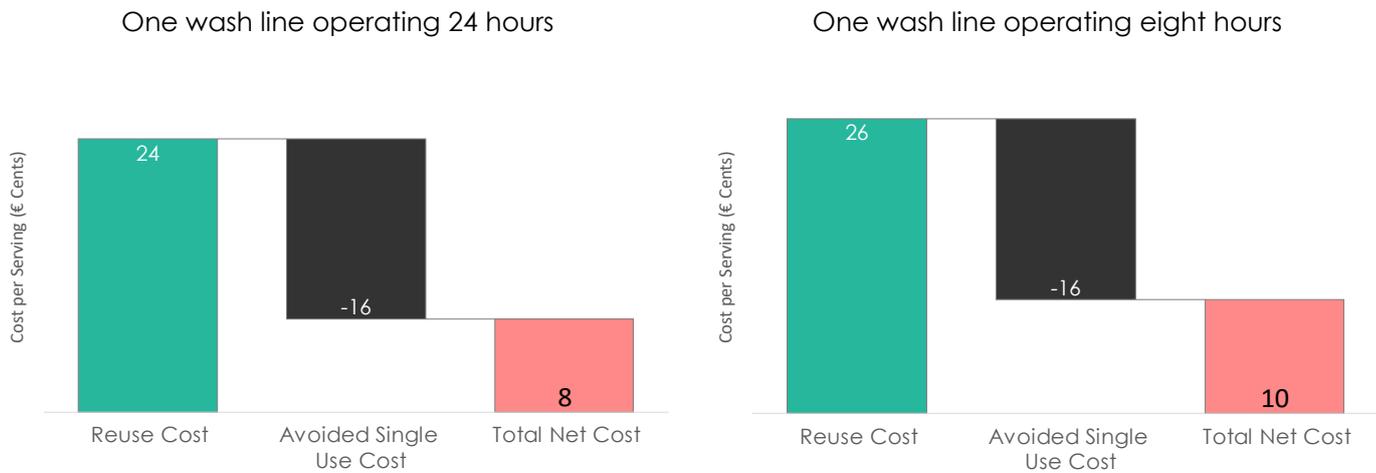
- Electricity, water and detergent used by the wash plant will decrease in line with the number of units. However, if the throughput is insufficient to fulfil a 24-hour operation of at least one wash line then there may be additional energy required for start-up and close-down.
- The cost of operational wash plant staff will decrease in line with the number of units. However, if the throughput is insufficient to fulfil at least one 8-hour shift on one wash line, then costs may increase as staff will be underutilised.
- Electricity and staff costs for transport for collection and redistribution of units will decrease in line with the number of units. However, if the throughput is insufficient to maximise the capacity of at least one-truck then this would start to impact costs as the truck rental and driver costs may be underutilised.

This non-exhaustive list demonstrates that, while the most significant costs (those listed above) could be reduced proportionately to the number of units, there will be minimum thresholds below which costs will increase. Building on the examples provided above, it is possible to calculate how the net costs are impacted as these thresholds are crossed, and to relate this to a 'minimum city size' for similar reuse packaging systems:

- The capacity of one 24-hour wash line could be fulfilled by a reusable packaging system in which ~17,000 servings per day are washed, which is also enough to fulfil the capacity of more than one Full Time Equivalent (FTE) van driver for collections and redistribution. As shown in Figure 3-7(left), if the model is scaled to match the capacity of one 24-hour wash line, the net cost increases by €0.02 (from the Aarhus model). The cost increases in this scenario are due to marginally less efficient use of transport and to increased building rent costs.
- Following the same logic, Figure 3-7 (right) shows that the net costs increase by €0.04 (from the Aarhus model) if the system is only large enough to fulfil the capacity of one wash line operating for eight hours a day. The cost increases in this scenario are due to even less efficient use of transport (the capacity would no longer be sufficient to fill one van per day) and to underutilised capital of the washing line machinery (as each line will have washed three times fewer items over their lifetime).

If the size of the system were to be reduced further, then costs would increase quickly as the impacts discussed above would be exacerbated and wash plant staff (one of the main costs in the system) would be underutilised.

Figure 3-7: Net Costs for Scaled-down Reuse Packaging Systems (Based on Aarhus Model)



Assuming consistent rates of takeaway consumption and an 85% market penetration rate, the two examples provided in Figure 3-7 of one wash line operating for 24 hours and one wash line operating for eight hours are equivalent to reuse packaging systems in towns with populations of ~60,000 and ~20,000, respectively (equivalent to a reuse packaging system offering roughly 10,000 or 3,700 servings per day, respectively). Note that this may be an underestimate of the population size required to fulfil each scenario if takeaway consumption rates per capita are lower in smaller cities.

Finally, it is worth highlighting that when designing a reuse packaging system for smaller-sized cities in practice, there are many elements of the system that could be modified (such as the truck size, washing machinery size and utilisation of part-time and multi-functional staff), which have not been explored in this study.

Key finding: While economies of scale do exist for reuse packaging systems, there was no significant difference between Aarhus and Berlin in the model created for this study. Extending this logic to the *minimum* size city/town that such a system can work for, it appears that there is also not a significant increase for much smaller towns than Aarhus. The net costs would not increase significantly, even for cities/towns as small as 20,000 population size.

3.1.1.5 Other Sensitivities

In addition to the three key sensitivities of single-use packaging costs, return rates and economies of scale for reuse packaging systems discussed above, there are many other sensitivities that also significantly impact the results. A selection of these are listed below, along with a description of how they impact the net cost (this is not intended to be a comprehensive list and only serves to illustrate the sensitivity of the cost model):

- **Deposit costs/penalties:** Similar to the impact of lowering the return rate, increasing the deposit/penalty means that the net cost of a reuse packaging system is lowered.
- **Scrappage rate** (i.e., the rate at which reusable packaging is disposed of after it has been returned due to some form of product failure, such as scratches, foul odours, discoloration, etc.): Unlike the return rate, increasing the scrappage rate will increase the net cost of a reuse packaging system, as the system operator will need to replace the reusable packaging.

- **Credit card charges:** If credit providers implement higher charges and/or consumers frequently only return one item per transaction, then the net cost of a reuse packaging system will increase. However, this would only be relevant for smaller packaging formats such as cups. Even very high credit card charges would not significantly impact the results for packaging formats such as pizza and burger boxes.

3.1.2 Extended Producer Responsibility (EPR) Fees in Berlin

The study so far has excluded any fiscal policy measures, such as EPR fees, that would affect the price of single-use takeaway packaging and therefore the net cost/saving to the vendor of moving to reuse. While it is useful to understand the results in the absence of any interventions, it is also useful to understand how real-world fiscal policy measures might affect the conclusions of the study. In this section, the results for Berlin have been amended to consider the EPR scheme currently in place.

EPR fees are currently being applied to single-use takeaway packaging in Germany, and a similar EPR scheme will enter into force in Denmark in 2025. Reusable packaging is exempt from EPR fees in Germany.²² The current fees that would apply in Germany will vary between the different producer responsibility organisations (PROs), but we believe the following paper-based single-use takeaway packaging fees to be reasonable middle range values:

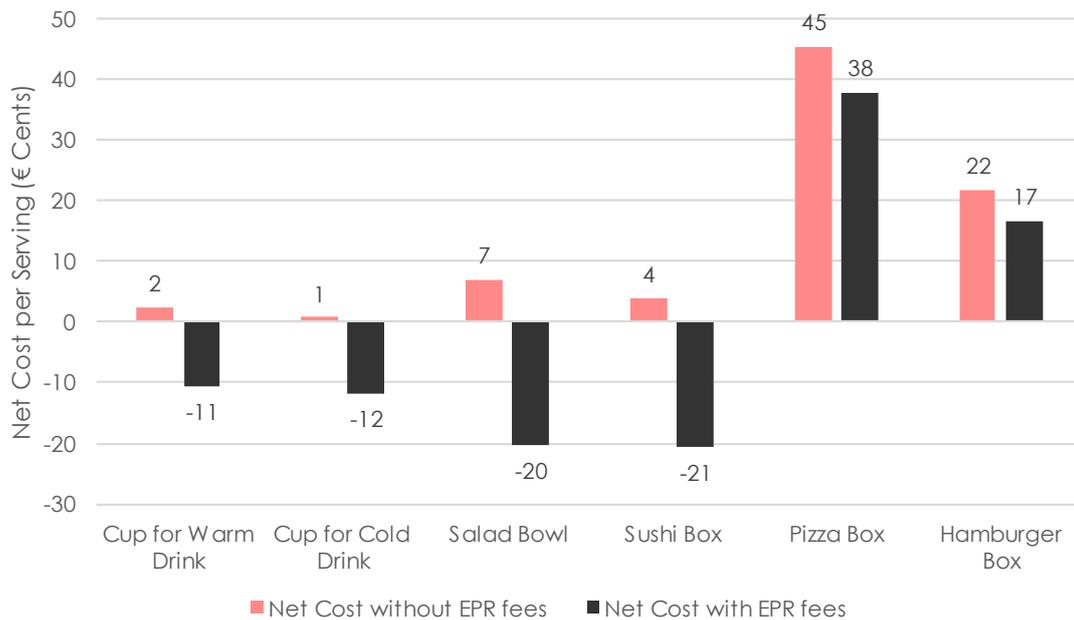
- Paper and Cardboard: €1,750 per tonne POM
- Other Composite Packaging: €8,740 per tonne POM

In the results presented in Figure 3-8, paper-based packaging formats that are typically lined with a plastic coating (cups, sushi boxes and bowls) have been classified as composite packaging, while formats that are not typically lined (burger and pizza boxes) are classified as paper and cardboard.

The results show that, for the single use formats classified as 'composite packaging', the application of EPR fees would likely result in a vendor cost savings of between 10 and 20 euro cents per serving (depending on the format). For pizza and burger boxes, the application of the 'paper and cardboard' EPR fees would likely slightly reduce the net costs of switching to a reuse packaging system.

²² German Packaging (VerpackG), July 2021, <https://www.bmu.de/gesetz/gesetz-ueber-das-inverkehrbringen-die-ruecknahme-und-die-hochwertige-verwertung-von-verpackungen>

Figure 3-8: Net Costs of Reusable Packaging by Format in Aarhus, with and without EPR Fees



3.2 Monetary Impact External to Vendor Costs

Single-use is only relatively low cost because the environmental externalities associated with it are not currently priced in – these being the costs of litter clean-up, waste disposal, litter disamenity and carbon impacts. These externality costs are borne by society as a whole, and so are paid by a wider group of citizens than takeaway consumers. This section of the report firstly explores the societal cost of litter collection, waste disposal and carbon emissions (section 3.2.1), and then considers the impact of litter disamenity (section 3.2.2).

3.2.1 Cost Externalities / Costs to Society

Although this study has found that, without supporting fiscal policy measures in place, there is likely to be a net cost for vendors associated with a reuse packaging system, there are a number of costs external to vendors that need to be considered when comparing reuse packaging systems against single-use packaging.

Litter collection: Given the on-the-go nature of its consumption, single-use takeaway packaging contributes to a large proportion of waste generated in public spaces and therefore requires the arrangement of appropriate collection. Compositional studies conducted in the municipality of Aarhus suggest that 27% (by mass) of inner-city waste (from public bins and mechanical sweeping) is of takeaway packaging, raising to 46% when wider food and beverage packaging is considered.²³

The costs incurred by the municipality include not only waste disposed of correctly (in litter bins) but also waste disposed of incorrectly (littered to the environment and picked up via manual or automated

²³ These results are unpublished but were communicated directly from the municipality during the research phase of this study.

sweeping). A reduction in single-use takeaway packing may therefore correlate to a reduction in the overall waste management costs borne by the municipality (and indirectly by taxpayers). There is supporting evidence for this from the reusable packaging trial taking place in Aarhus, in which the municipality completed a compositional analysis on two tonnes of waste collected from litter bins in the city centre over one weekend. In the sample taken, only seven reusable cups were found, while almost 1,300 reusable hot cups were returned to the RVMs.

The exact value of the litter collection cost is less well established and is difficult to estimate. The value chosen in this study equates to €0.06/item for cups, and €0.11/item for food containers disposed of, which have both been taken from a recent Danish Environmental Protection Agency report assessing the cost of litter clean-up and public bin emptying.²⁴ This figure is at the lower end of several values found during the research period, but still holds a high degree of uncertainty. It has then been multiplied by the fraction of takeaway packaging assumed to be disposed of 'on-the-go'.²⁵ Finally, given there is a high variance in the volume for food containers, this value is weighted according to the volume of each format (for example, pizza boxes are bulkier than sushi boxes), assuming that salad bowls represent an 'average' food container.²⁶ The same value has been used for both Aarhus and Berlin due to a lack of geographically specific data for the latter.

Although it is possible to estimate the costs of litter resulting from single-use takeaway, we would caution against the assumption that removal of the single-use packaging would result in cost savings equivalent to the estimated current costs. Litter cleansing costs are shared between single-use takeaway packaging and many other littered items. By removing single-use takeaway items less work is required, but that might not result in a direct proportion reduction in costs.

Waste disposal: The disposal of waste has been accounted for separately and does not appear to be significant. The avoided cost of disposing of waste is based solely on the gate fee for incineration, as that will be the treatment route for the vast majority of residual waste collected from public areas in Aarhus and Berlin. The gate fee for Aarhus has been assumed to be €70/tonne (confirmed by the municipality of Aarhus), which is magnitudes lower than the cost of collection (over 50 times lower based on the figure chosen in this report). While a gate fee could not be established with certainty for Berlin, a figure of €200/tonne was assumed, which also does not significantly impact results.

Social cost of carbon: Additionally, if a reuse packaging system can be delivered in a way that results in greenhouse gas (GHG) savings, this would translate into savings related the social cost of carbon that could be monetised. The social cost of carbon is the estimated cost associated with the negative impacts of climate change, allocated to a single tonne of CO₂. The values in Figure 3-9 have been derived assuming a social cost of carbon of €300/tonne²⁷, and assuming that switching to a reuse packaging system results in reductions/increases in GHG emissions per serving in line with those presented in the Environmental Addendum of this report (see the Environmental Addendum for more information on specific values).

Combined: The combined results of these external costs are summarised in Figure 3-9. As with the cost-to-vendor results (presented in Figure 3-2), the impacts of costs external to the vendor vary significantly by packaging format. Variance by format can be explained by the relative volume of each format and the assumptions made regarding the proportion consumed on-the-go. Variance by city can be explained by the gate fees in each city and the carbon benefit of switching to reuse (which tends to be higher in

²⁴ Miljøstyrelsen (2024), *Renholds- og omkostningsanalyse jf. Engangsplastdirektivets oprydningsansvar*. Available at: [978-87-7038-575-6.pdf \(mst.dk\)](https://mst.dk/575-6.pdf)

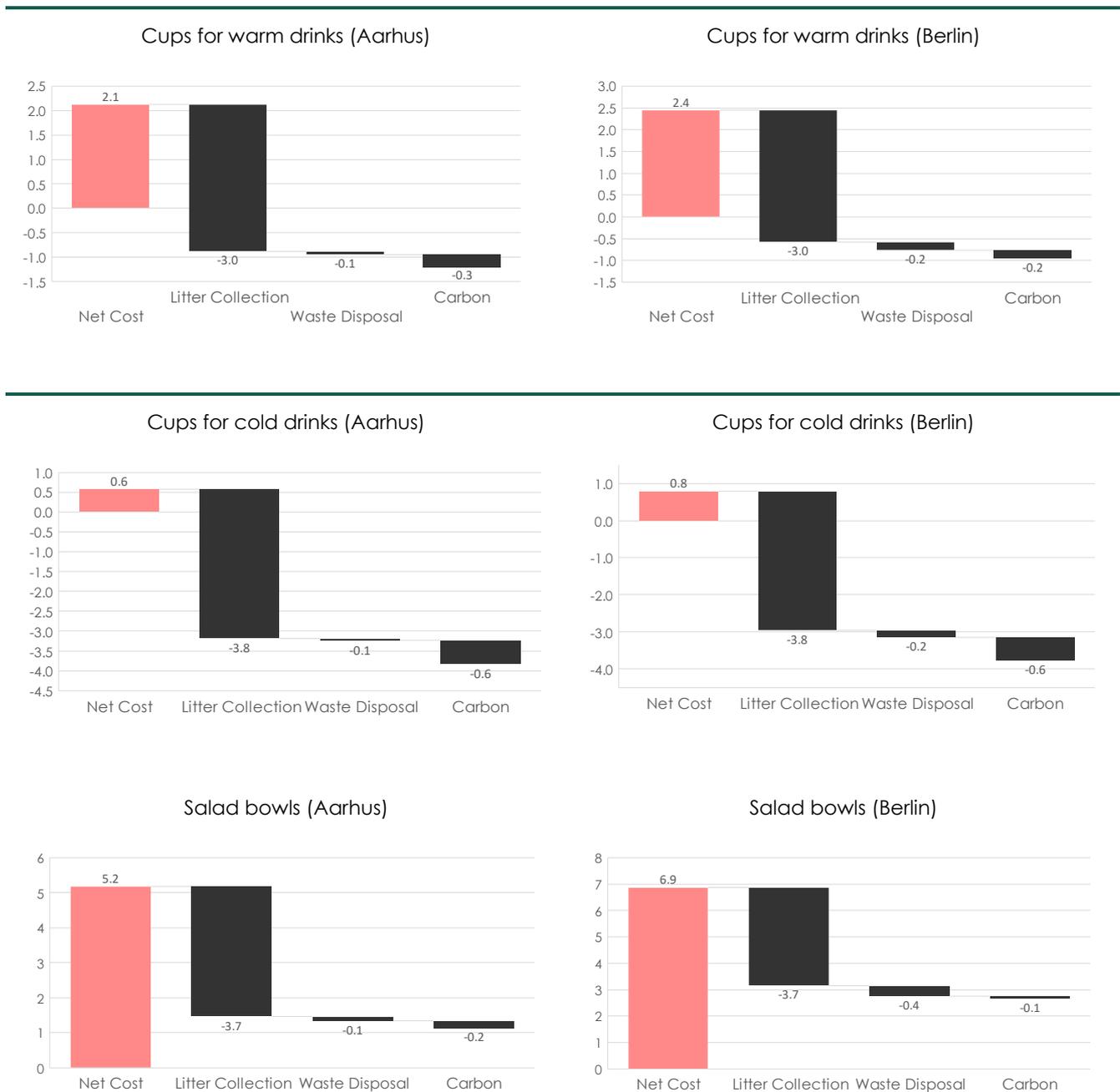
²⁵ An estimation that 35% of food items and 55% of drink items are consumed 'on-the-go' (as opposed to 'at-home/office' or 'dine-in') has been used.

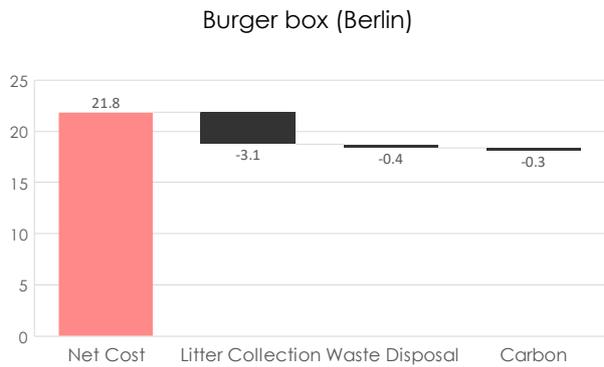
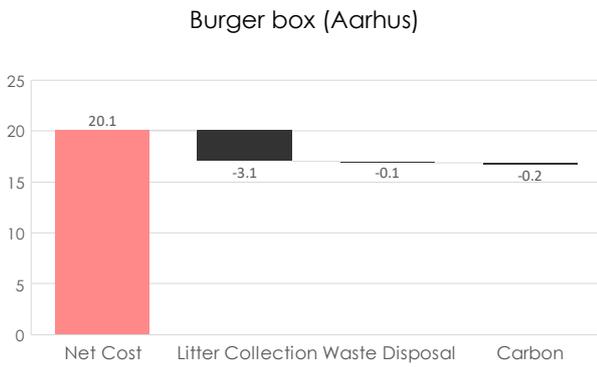
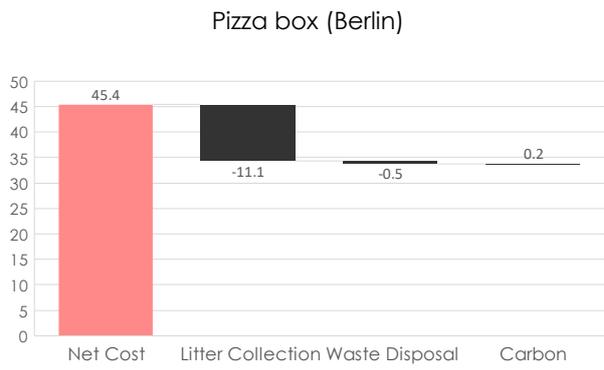
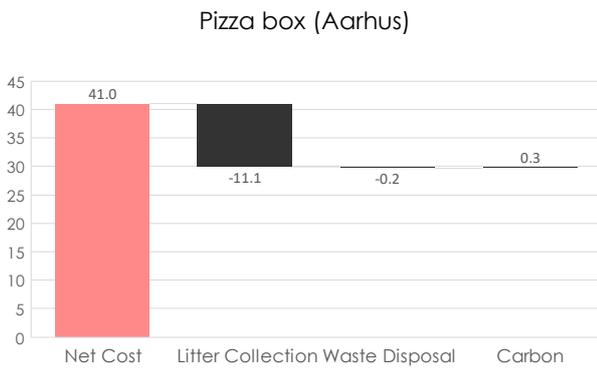
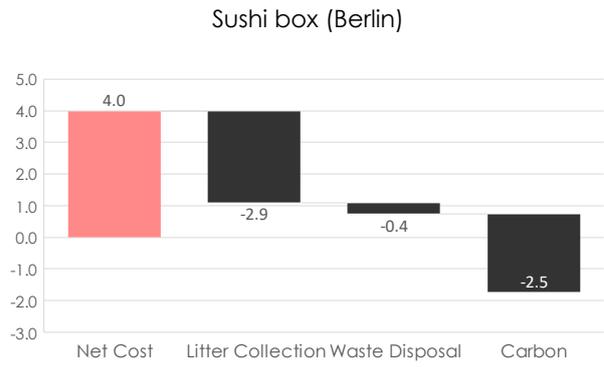
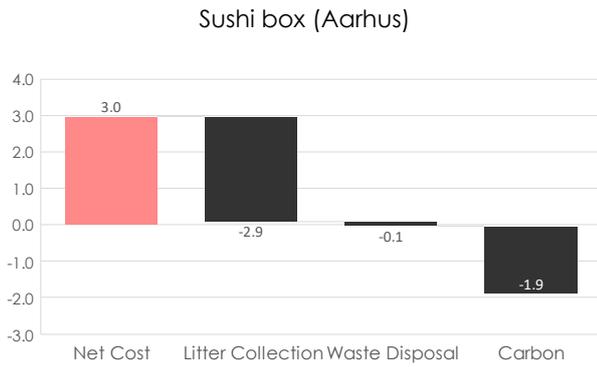
²⁶ The effectively uplifts the value

²⁷ UK Government (2020) *Valuation of greenhouse gas emissions: for policy appraisal and evaluation* Available at: <https://www.gov.uk/government/publications/valuing-greenhouse-gas-emissions-in-policy-appraisal/valuation-of-greenhouse-gas-emissions-for-policy-appraisal-and-evaluation#annex-1-carbon-values-in-2020-prices-per-tonne-of-co2>

Aarhus due to the electricity grid). For three of the formats (cups, bowls and sushi boxes), when the selected external costs are considered, there is effectively a net saving of switching to reuse. For one format (bowls), when the external costs are considered, reuse is still a net cost but it is now relatively small and could be a net saving if, for example, the higher limit of the single-use costs presented in Table 3-1 were chosen instead of the central case of assumptions. For the final two formats (pizza boxes and burger boxes), even when these external costs are considered, there is still a relatively large net cost associated with switching to reuse, which is unlikely to be reversed in any of the sensitivities discussed so far in the report.

Figure 3-9: Net Costs of Reuse, Considering Costs External to the Vendor – unit is cost per serving in euro cents (¢) for all charts





3.2.2 Litter Disamenity

Finally, there are also less obvious indirect costs associated with the visual impacts of litter, known as litter disamenity. This refers to the theoretical value that people would be willing to pay to reduce the level of litter by a specified amount, and can also refer to the social welfare cost associated with the presence of high quantities of litter.²⁸ For example, high levels of litter can contribute towards poor mental health, and have negative economic impacts in terms of lowering property values and discouraging tourism.^{29, 30} Litter has one of the highest effects on the quality of the local environment and has one of the highest

²⁸ Circular Online (2019) *DRS: theoretical v direct benefits*. Available at: [DRS: theoretical v direct benefits \(circularonline.co.uk\)](https://circularonline.co.uk)

²⁹ Isonomia (2014) *Picking up the evidence: what's the cost of litter?* Available at: [Picking up the evidence: what's the cost of litter? - Isonomia](https://www.isonomia.com)

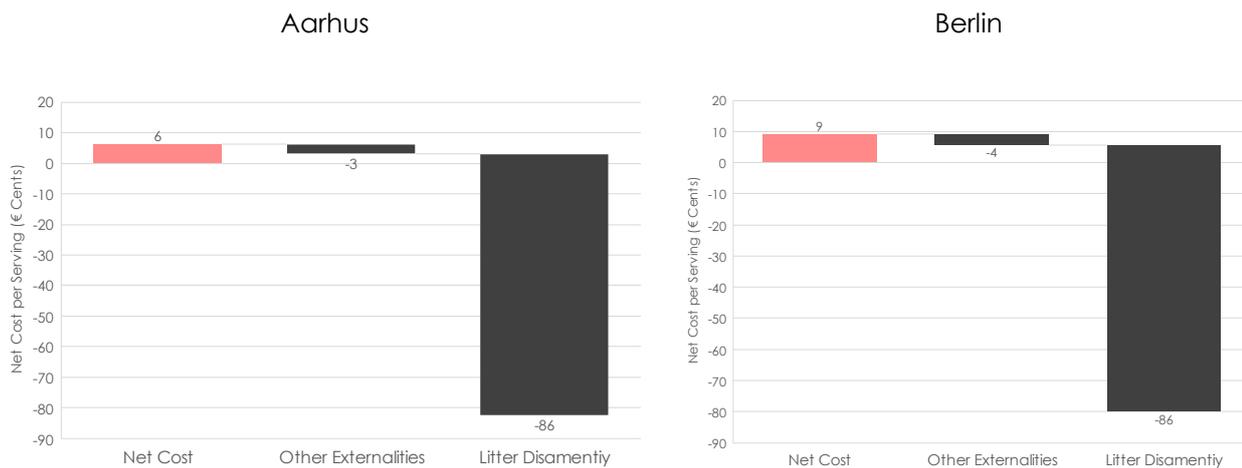
³⁰ Marine Debris Program (2024) *The Economic Impacts of Marine Debris on Tourism-Dependent Communities*, available at: <https://marinedebris.noaa.gov/research/economic-impacts-marine-debris-tourism-dependent-communities>

values of willingness to pay, indicating the level of unpleasantness it causes society, and therefore the level of social welfare improvements that could result from improved litter management.³¹

Figure 3-10 shows that the value of reducing litter disamenity is potentially very significant in the context of the net costs of implementing reuse. Only the values for the mixed-format system are presented for brevity, as the key finding that litter disamenity is significantly higher than the net cost to vendor is true for all formats.

The values used in this study are based on a study by Wardman *et al.* (2011), which found that individuals living in the inner-city are willing to pay £15.81/month to move from the *worst* to the *best* level of litter³², which can be reasonably interpreted as meaning eliminating all litter in the context of the Wardman study.³³ This was then combined with two figures: firstly, the compositional information from Aarhus of 27% of public waste bins (by mass) being single-use takeaway packaging, and secondly, the 85% market penetration rate applied in this study. Combining these figures generates an average 'willingness to pay' of just over £3.50 per person per month, for the reduction in litter disamenity that would be brought about by the reuse system. When this figured is then adjusted for inflation, the currency is converted, and it is scaled based on the number of servings per person, the results are equivalent to roughly 85 euro cents per item POM, as shown in Figure 3-10.

Figure 3-10: Net Costs of Reuse, Considering Litter Disamenity, for a Mixed-format System



The litter disamenity value used in this study has been used by the UK Government when considering this topic where local bespoke evidence is not available.³⁴ However, there is a high degree of variability and uncertainty within the academic literature regarding the value of litter disamenity. Nevertheless, even if these values were replaced by much lower ones (for example, if the willingness to pay figure was only €1.50/month), litter disamenity could still provide a justification for modifying the costs of single-use and thereby levelling the costs between single-use packaging and reuse packaging systems. The purpose of

³¹ *ibid*

³² Mark Wardman, et al (2011) Estimating the Value of a Range of Local Environmental Impacts, Report for Dept. for Environment, Food and Rural Affairs, 1 April 2011

³³ The Wardman (2011) study uses photo elicitation techniques to establish a person's willingness to pay for litter reduction, with the photo depicting the 'best' improvement level showing a street with no litter.

³⁴ Defra (2013) *Local Environmental Quality: Valuing the Neighbourhood in which we live*. Department for Environment, Food & Rural Affairs, August 2013. Available at:

https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/226561/pb14015-valuing-localenvironment.pdf

this section is not to state with confidence the exact value of reducing litter disamenity, but to raise attention to it as a potential additional benefit of reuse packaging systems.

3.3 Conclusions on Net Costs

Overall, this study shows that introducing a reuse packaging system covering the six takeaway packaging formats of bowls, boxes for pizza, burgers, and sushi, and cups for warm and cold drinks, without any supporting fiscal policy measures, would very likely lead to a net cost to vendors when compared with the single-use packaging it would replace. However, the results vary significantly depending on the packaging format, and implementing a reuse packaging system for more efficient formats such as cups, sushi boxes and bowls could be close to cost neutral.

This difference in cost between formats shows that a reuse packaging system for takeaway packaging may be more effective for some formats than others. Those for which it may be less effective, such as pizza boxes, should still be included in the scope of any system in order to maintain a level playing field among formats. However, the cost disparity would be a challenge to address through further innovation in the takeaway sector, to ensure the reuse packaging system was cost effective while maximising the environmental benefits.

For some vendors that pay more for single-use packaging, a reuse packaging system may break even – meaning that the net cost of the system would be the same as those the vendor would pay for single-use packaging. However, for vendors that pay less for single-use packaging (typically large-scale vendors) a reuse packaging system may cost more than the single-use packaging they currently employ.

In the case of Berlin, where EPR fees currently apply to single-use packaging, the cost of some single-use takeaway packaging formats may already be higher than in a reuse packaging system. It is interesting to note though that although EPR fees in Germany have been shown to likely result in lower reuse packaging system costs than single-use, we are yet to see reuse systems in Germany achieving high levels of market penetration.

Finally, this study finds that the externality costs of single-use packaging are greater than the increased costs to vendors of switching to a reuse packaging system. Therefore, the cost benefits for society as a whole of making the switch outweigh the increase in cost for vendors. It is important to understand, however, that this finding is highly sensitive to assumptions about the costs of litter disamenity, which have been made using values drawn from the literature for citizens' 'willingness to pay' to reduce litter.

4.0 Policy Instruments to Incentivise Adoption of Reuse



4.1 The Challenge

Under the requirements of the adopted PPWR, final distributors selling food and beverages in takeaway beverage packaging will have to provide consumers with the option of packaging within 'a system for reuse'.³⁵ Consumers will therefore have a choice between reusable and single-use takeaway packaging. Given the likely timescales for the PPWR's implementation and the 36-month grace period on this policy contained in the legislation, this is likely to be required from approximately 2028. It is important to note that the PPWR refers to 'a system for reuse' in broad terms (in line with its Annex VI), under which the specific reuse packaging system described in this report is one possible example of a system for reuse for takeaway packaging.

Furthermore, final distributors are encouraged to endeavour to offer 10% of takeaway products in reusable packaging by 2030 (calculated as 10% of either the total number of units of products or the total volume). Final distributors are also required to sell food and drinks in reusable packaging at no higher cost and in no less favourable condition than those bought in single-use packaging. The PPWR also mentions that incentivising food and drink vendors to provide reusable packaging is a means of contributing towards the attainment of EU packaging reduction targets (the PPWR requires Member States to reduce the volume of packaging waste per capita by 5% by 2030, 10% by 2035, and 15% by 2040, based on 2018 levels).

As the target for 10% of takeaway products being sold solely in reusable packaging is not a mandatory one, Member States may be unlikely to pursue it in the absence of further legislative requirements. This target can be taken, however, as representing an ambitious scenario for what the EU is likely to achieve on a PPWR pathway alone. Figure Figure 4-1 summarises the earliest likely timeline for such a scenario.

Figure 4-1: Timeline for Earliest Likely PPWR Pathway Scenario



³⁵ European Parliament legislative resolution of 24 April 2024 on the proposal for a regulation of the European Parliament and of the Council on packaging and packaging waste, amending Regulation (EU) 2019/1020 and Directive (EU) 2019/904, and repealing Directive 94/62/EC (COM(2022)0677 – C9-0400/2022 – 2022/0396(COD)), European Parliament https://www.europarl.europa.eu/doceo/document/TA-9-2024-0318_EN.pdf

Individual cities, regions and Member States may, however, want to go further than the minimum requirements of the PPWR. They may, for example, want to set higher ambitions regarding transitioning to reuse-only systems for takeaway packaging items.

The PPWR does not set mandatory targets for the level of market penetration to be achieved. In this context, market penetration would be the proportion of sales of takeaway packing included within a reuse packaging system, as opposed to sales of single-use packaging. As the goal should be to achieve high levels of reuse to maximise the environmental benefits of reuse, market penetration (along with return and rotation rates) will be an important factor in a reuse packaging system's success. Market penetration is also important in driving behaviour change, as consumers are more likely to engage with a reuse packaging system the more that they encounter reusable packaging as the predominant packaging type. Policy should therefore be aiming to move from the current situation of reuse not yet being a mainstream option to one in which reuse is the expectation.

To better understand the policy challenges of transitioning to a reuse packaging system for takeaway packaging, and the potential for different policies to achieve different levels of market penetration, here we consider two market penetration scenarios, as shown in Table 4-1Table .

Table 4-1: Reuse Packaging System Market Penetration Scenarios

Scenario	Description
Evolving	<ul style="list-style-type: none"> • The early phases of trialling, establishing and improving reuse packaging systems • Market penetration rates are likely to be quite low (e.g., <20%)
Evolved	<ul style="list-style-type: none"> • Reuse represents the predominant mode of takeaway packaging provision • Market penetration rates are high, at ~85%

Experience with deposit refund systems (DRS) for beverage packaging (in which consumers pay an additional charge that is refunded when they return containers at collection points) has shown that >95% market penetration is necessary to achieve high return rates. For a DRS, market penetration would be a measure of the proportion of beverage containers included in the system, and 100% penetration would mean that all beverage containers of a given material type (e.g., plastic bottles, aluminium cans, glass bottles) were included in the DRS. As consumer satisfaction levels also appear to be higher with higher market penetration, it is likely that the link with high return rates is due to systems being easier to engage with for consumers – i.e., they do not have to think about whether or not a container can be returned. It is also likely that high penetration normalises the system in consumers' perceptions, encouraging behaviour change. If the same dynamics apply to reuse packaging systems, high market penetration may also be an important factor in achieving high return rates (along with factors related to system design, e.g., the level of the deposit/penalty).

A key challenge associated with adopting reuse is that, even on an evolved scenario at a steady state of operation, and without policy interventions, **a reuse packaging system is likely to, on balance, and without policy interventions, cost more than single-use packaging** with this cost difference constituting a disincentive for reuse. As discussed in section 3.0, for high-volume large businesses, reusable packaging is likely to be more expensive than single-use packaging across all formats, while for small business vendors, which have relatively higher single-use costs, reusable packaging could be cheaper for cups, bowls and

sushi boxes. This means that, for large businesses, there would likely be no financial incentive to adopt reusable packaging, and no financial incentive for small businesses to do so for burger and pizza boxes.

However, it is important to note that **the cost of single-use packaging is only lower than a reuse system option because the associated externalities are not priced in**, these being the costs of litter clean-up, litter disamenity and carbon impacts (see section 3.1.2). Therefore, **single-use packaging costs need to be modified to internalise the current externalities**, thereby creating a more level playing field for reusable packaging to compete with single-use packaging.

Another key challenge for reuse adoption is that, in addition to being lower cost than reusable alternatives, **single-use packaging is perceived as being more convenient than reusable packaging**. It is likely that, in terms of the amount of effort required of both vendors and consumers, single-use packaging will be perceived as the more convenient option in the evolving scenario. Therefore, in the absence of policies to further incentivise reuse, if given a choice between reusable and single-use packaging, the majority of vendors and consumers would likely continue to choose single-use as their preferred option. It should also be noted that even if the challenge around cost can be met, this challenge around convenience would likely remain.

While single-use packaging may be more convenient for vendors and consumers at the consumption stage, the associated end-of-life impacts mean that it results in greater inconvenience for society at large than reusable packaging would. For example, litter represents an inconvenience for the municipalities tasked with cleaning it up, and the taxpayers who ultimately fund the clean-up. Therefore, while single-use is perceived as being convenient, it is important to ask whom it is convenient for.

In addition, single-use packaging is only currently so disproportionately convenient for vendors and consumers because it is sold within a linear economic system, with an attendant waste management system. While there would likely still be a difference in convenience between single-use and reusable packaging on the evolving reuse packaging system scenario, the difference would not be so large on the evolved scenario, as the supporting infrastructure would have developed to a point that enabled easy engagement with the system. Furthermore, it is worth noting that adoption of wider reuse packaging systems (e.g., for household plastic packaging) in the future would serve to make reuse a more convenient option overall.

However, convenience of vendor and consumer engagement will be an important success factor through the evolving scenario stage of a reuse packaging system's development, and therefore **convenient reuse should be incentivised as a policy priority. While the transition from single-use to reuse will likely involve an increase in inconvenience for vendors and consumers, this inconvenience would be reduced by implementing efficient reuse packaging systems that achieved high levels of market penetration and interoperability, in evolved scenario.**

The final key challenge for reuse adoption is achieving the high return and rotation rates required to realise the highest possible environmental benefits. There is a risk that, if not properly incentivised, reuse packaging systems may optimise on costs by targeting incomes from the penalties and unredeemed deposits associated with lower return rates. Therefore, **efficient and effective reuse should be incentivised to maximise the environmental benefits.**

Key message: While the adopted PPWR will require Member States to provide takeaway reuse system options alongside single-use options in the near future and to endeavour to achieve 10% of sales via reusable packaging, it does not set mandatory targets on the rates of reuse to be achieved. Therefore, individual cities, regions and Member States may want to pursue a more ambitious course than following the PPWR pathway alone.

To do so, it will be necessary to meet some key challenges for reuse adoption. As single-use takeaway packaging – without policy interventions – is both lower cost to the vendor and more convenient than reusable takeaway packaging, it will be important to modify the price of single-use packaging to internalise current externalities, thus reflecting the costs to society, and to incentivise convenient reuse. It will also be important to incentivise an efficient and effective reuse packaging system capable of achieving the high return and rotation rates needed to achieve high levels of environmental benefit while being as convenient as possible to use for vendors and consumers.

4.2 Overview of the Policy Tools

Given the challenges discussed above, it is likely that a range of different policy tools will be needed to facilitate the adoption of reuse packaging systems for takeaway packaging. The following sections explore the policy tools available.

4.2.1 Fiscal Measures

As noted above, one key adoption challenge is around cost. In the absence of supporting fiscal measures for reuse, single-use packaging is generally cheaper than reusable packaging. Fiscal measures can be used to address this cost imbalance and create a more level playing field on which prices more accurately reflect the impacts of single-use and reusable packaging, thus potentially providing an economic incentive for reuse.

Fiscal measures can be used to achieve two policy goals:

1. **To create a financial disincentive on the consumption of single-use packaging.**
2. **To generate funds to finance the development of reuse packaging systems.**

Fiscal policy measures can internalise the costs associated with litter clean-up, litter disamenity and carbon impacts into the price of single-use packaging, thereby increasing its cost relative to that of reusable packaging. This creates a financial disincentive for economic operators and consumers to use single-use options, and an incentive to use reusable ones.

There are three types of fiscal measures available: **taxes, levies and modulation of Extended Producer Responsibility (EPR) fees**. The difference between a tax and levy is that, while funds raised through a tax must go into a central government spending reserve, funds raised through a levy can be ring-fenced for spending on specific concerns – as can funds raised through EPR fee payments. It seems appropriate that funds raised through fiscal measures should be ring-fenced to support the evolution of reuse systems, and to achieve this the fiscal measure employed would therefore have to be either a levy or modulation of EPR fees.

The two policy goals may be complementary during the evolving scenario, as while there is a relatively low level of reuse market penetration, sales of single-use packaging subject to fiscal measures will be high enough to generate high levels of funds to finance reuse. However, as the evolved scenario is reached, rising reuse market penetration and a corresponding reduction in single-use packaging sales will mean that the funds raised through fiscal measures will diminish. This is not likely to be a policy issue,

as by the time the evolved scenario is reached, reuse packaging systems will have developed to a scale and level of optimisation at which they will be funded by producer fees.

Different jurisdictions, such as cities and regional governments, have different powers regarding their ability to charge taxes and levies. For example, some city level governments may not be legally empowered to set taxes – as this power may only be available at the state or national level – but may be able to implement levies. Therefore, the range of fiscal measures available will vary by geographic region and, in some cases, amendments of national regulations may be required to facilitate the setting of taxes or levies.

Taxes and levies

There are some variations on how a levy or tax could be applied:

- **Implementing an environmental tax or levy on single-use packaging placed on the market by packaging manufactures/importers.** The benefit of charging manufacturers/importers is that the levy/tax can be applied to a small number of economic operators while also capturing all the in-scope packaging placed on the market. However, this is only likely to be practical at a national level. EPR frameworks are already directed at manufacturers/importers, so further amending EPR may be an appropriate method of focusing on this part of the supply chain. It is also likely to be the case that when charging manufacturers/importers, the level of financial disincentive will be less visible to vendors and consumers than with other fiscal options.
- **Implementing an environmental tax or levy on single-use packaging placed on the market by takeaway food and drink vendors.** Cities or municipalities could achieve this at their regional level, providing they have the power to implement such measures. However, as it is likely to involve taxing/levying a relatively high number of economic operators (i.e., vendors), it could therefore be complex to administer and regulate.
- **Implementing a consumer facing levy on single-use packaging.** This measure would directly and explicitly charge consumers an additional fee when purchasing food and drinks in single-use packaging. Therefore, it would create a cost incentive to adopt reuse while sending a clear signal to consumers that single-use was not the preferred option, which could help to promote behaviour change and reuse adoption. However, there could be a challenge in enforcing the measure at the large number of vendors providing single-use takeaway packaging, many of which are micro-businesses, making the measure potentially difficult to regulate. This measure could be implemented at city, municipal or national level.

Modifying the use of fee structures within packaging EPR systems

EU Member States are essentially required by European law to transfer the “necessary costs” of meeting packaging recycling targets, and the costs of packaging waste litter cleansing, back to obligated packaging producers. Producer Responsibility Organisations (PROs) deliver these obligations on behalf of producers by charging fees to producers and distributing those fees to economic entities in the waste management and recycling supply chain.

The PPWR text establishes that Member States must ensure that EPR schemes and deposit systems dedicate a minimum share of their budget to financing waste reduction and prevention actions. The percentage of the minimum share will have to be set by Member State. Therefore, national EPR laws and regulations could be adapted to facilitate the uptake of reuse along similar principles to those stated for taxes and levies, by:

- Modifying EPR fees to increase the costs of single-use; or
- Using raised EPR fees to support the development of reuse packaging systems.

There are few existing examples of substantive changes to national EPR laws to facilitate reuse. The most notable recent example comes from France, where all active PROs were instructed by law to use a proportion (5%) of overall packaging fees to facilitate reuse and refill activities.

Modifying producer EPR base fee calculations for takeaway packaging

EPR base fees could be recalculated, or potentially eco-modulated, to increase the costs of single-use packaging. The fees could also be used to support the evolution of reuse. The key considerations potentially relevant to this type of approach are:

- Existing fee structures are unlikely to be granular enough to capture whether packaging is single-use or reusable.
- The level of increase in EPR fee required would likely be very significant relative to current fee levels.

A challenge is that EPR fees are commonly set for packaging material types rather than for packaging product types (e.g., for plastic packaging rather than for plastic cups, trays, etc.), so specifically targeting takeaway packaging would require additional granularity in fee setting. This would in turn require additional data to determine the full net necessary costs of collecting, managing, recycling and disposing of takeaway packaging (including clean-up costs), as this is what packaging EPR fees are intended to cover.

As explored in section 3.1.2, Germany has in place fiscal policy measures in the form of EPR fees on single-use packaging. The results of this study show that such fees are likely to increase the cost of single-use takeaway packaging for some formats (such as cups and bowls) to the extent that a reuse packaging system is expected to have a lower cost to the vendor and consumer. Furthermore, the German EPR scheme supports reuse in that reusable packaging placed on the market is not subject to EPR fees. It is interesting to note that although EPR fees in Germany have been shown to likely result in lower reuse packaging system costs than single-use packaging, we are yet to see reuse systems in Germany achieving high levels of market penetration. This perhaps indicates that the scale of these types of fiscal interventions on vendor costs are on their own insufficient to facilitate high levels of market penetration of reuse takeaway packaging systems.

Another challenge is that, in terms of euro cents charged per item, EPR fees are typically set at a much lower level than, for instance, consumer facing levies, and would have to be scaled up far beyond current levels to match levy rates. For example, while a €0.50 consumer facing charge on a 15g cup is feasible under a levy, an EPR malus of €0.50 per cup would equal over €30,000 per tonne. Lastly, while it is possible and helpful to ring-fence a percentage of funds from EPR fees on single-use packaging for the development of reuse packaging systems (e.g., as mentioned above, in France, the PROs CITEO and Léko are required to dedicate 5% of single-use fees for this purpose), this measure alone does not sufficiently disincentivise single-use.

4.2.1.1 Setting Fiscal Instrument Levels

Three key factors should be considered in determining the appropriate monetary levels for fiscal instruments designed to move from single-use packaging to a reuse packaging system. It seems reasonable that the cost of single-use packaging should be modified by the amount that is necessary to:

1. Internalise any costs that are currently external to the vendor;
2. Provide a sufficient incentive to change consumption behaviours; and
3. Be sufficiently below any levels of deposits or penalties applied in the reuse system.

Table 4-2 summarises the cost differentials identified in section 3.0 of this report for Aarhus and suggests scales of single-use levy/tax measures needed to address the three factors identified. Levy/tax values have been simplified to whole round 25 cent increments for simplicity. The suggested levels of levy, tax or EPR equivalent more than address the reuse to single-use cost differential (the final column of the table) and in general would appear to be lower than total externalities.

Table 4-2: Comparative Costs of Additional Vendor Costs for Reuse, Externalities of Single-use Packaging, and Single-use Taxes/Levies, for Aarhus (euro cents)

	Additional vendor cost of reusable packaging	Single-use packaging externalities (litter collection, social cost of carbon and waste treatment)	Total externalities (including litter disamenity)	Example of possible single-use levy/tax or equivalent EPR fee increase	Levy/tax minus additional reuse cost
Cups (warm)	2	3	55	50	48
Cups (cold)	1	5	55	50	49
Bowls	6	4	105	50	44
Sushi	3	6	95	50	47
Pizza	42	11	150	100	58
Burger box	20	4	95	75	55

In setting the level of a levy/tax on single-use packaging, it is important to remember that consumers would be responding to the effects on single-use packaging prices while also responding to the deposit/penalty placed on reusable packaging. Should the financial disincentive on single-use packaging consumption approach a similarly high level to the incentive to return reusable packaging, there would be a risk of this affecting how consumers engaged with the reusable packaging system. This is because, for example, if a single-use cup carried a €0.50 levy/tax and a reusable cup carried a €0.50 deposit/penalty, then although consumers might still choose the reusable cup – viewing this as the environmentally preferred option – they may do so without a clear intention to return the reusable cup, as not doing so would only financially penalise them as much as would choosing the single-use option. This dynamic could therefore negatively impact return and rotation rates.

However, it should be noted that there is uncertainty around what consumer behaviour would look like in a given reuse packaging system. In general, the important point is that governments would need to be mindful of price dynamics and the interactions between taxes/levies on the one hand and deposits/penalties on the other when setting the levels of each.

While the values presented in Table 4-2 are subject to uncertainty and so should be treated with caution, regardless of the exact numbers involved a general policy principle holds true that, for the majority of the

takeaway packaging types, a levy/tax would help to better reflect the true costs of single-use packaging and could increase the cost of single-use packaging to a level above the additional cost of reusable packaging to vendors.

4.2.2 Objectives for a Packaging Reuse System

The rationale for promoting reuse comes from the environmental improvements that can be achieved if it is implemented effectively. Therefore, it is important that reuse systems are developed in a mannered way that realises the potential environmental benefits. This should be driven by the introduction of **objectives for packaging reuse systems to ensure that they operate efficiently and achieve high levels of reuse.**

In an evolving scenario, such objectives would need to be set as voluntary targets, with both those actors providing the reuse packaging system (i.e., reuse system operators) and those actors engaging with the system on the procurement side (i.e., vendors and governments or their agents) signing agreements to work towards them on a voluntary basis. This is because the initial development of reuse packaging systems up to market penetration levels of <20% would involve joint working from all stakeholders on the trialling, roll-out and subsequent improvement of the systems and associated policies.

However, as the reuse packaging system develops and achieves higher levels of market penetration, it would become appropriate to set objectives as mandatory targets. This is because more evolved systems would be well functioning and robust enough to be expected to meet regulated minimum requirements. Furthermore, at this point, it is likely that mandatory targets would be needed to achieve the level of system optimisation needed to achieve the evolved scenario and the highest levels of reuse.

Objectives for a packaging reuse system could include:

- **Minimum return rates**, to ensure that system operators achieved high levels of reuse activity.
- **Minimum rotation rates**, to ensure that high return rates translated into high levels of reuse by ensuring that reusable packaging is designed for longevity.
- **Minimum requirements on collection point coverage**, whether this is per geographical area or per proportion of the population, to ensure that reuse is a convenient option for consumers and that deposits could in fact be redeemed/penalties avoided.
- **Maximum and minimum reusable packaging deposit/penalty levels**, to be set by individual cities, regions and Member States, to ensure consistency between service operators and that deposits/penalties provided a sufficient financial incentive to return takeaway packaging for reuse while also being at an acceptable level to consumers.
- **A requirement that funds from unredeemed penalties/deposits stay within the reuse packaging system**, to contribute towards the development of the system.

Zero Waste Europe, as part of its Reuse Vanguard Project, has published its *Blueprint for harmonising the implementation of takeaway food and drinks packaging in Europe*, which contains a set of five essential criteria for reuse systems.³⁶ These criteria provide the following additional objectives for reuse packaging systems:

³⁶ Zero Waste Europe (2023), *Blueprint for harmonising the implementation of takeaway food and drinks packaging in Europe*, available at: <https://zerowasteurope.eu/wp-content/uploads/2023/10/RSVP-Reuse-Blueprint-October-2023.pdf>

- **Reuse packaging system infrastructure and reusable packaging should be designed to be recognisable as such, and distinguishable from the single-use alternatives.** For example, collection points should be clearly distinguishable from waste bins, and reusable packaging should be made of robust material that makes it look obviously reusable.
- **A basic level of interoperability between systems in different cities,** extending to packaging design, collection points, data points, traceability and storing and use of data.
- **Inclusivity, in terms of both ease of use and accessibility by consumers, and participation by economic operators.** For example, digital literacy should not be a barrier to participation for consumers and systems should be designed to incorporate different packaging types.
- **Effectiveness, in terms of ensuring optimisation over time.** In addition to the kinds of minimum performance indicators discussed above (i.e., return rates and rotations), this would include incentives to drive buy-in from system users and consumers.
- **Guaranteed safety of the reuse system.** To ensure hygiene standards are met, the system should meet legal requirements for food contact material and rules around proper sanitation should be put in place.

Objectives could also be implemented in various ways. Given the current evolving situation for reuse, they might best be implemented as licensing requirements for the system operator, serving as conditions for the continued operation of the system by the licensed entity. Progress towards targets and compliance with standards and requirements could be monitored through yearly government auditing/system operator reporting.

As a general principle, the higher the level of government at which objectives could be set, the better, as this would create greater harmonisation and interoperability across different reuse packaging systems and regions. This would make it simpler, easier and more convenient for both consumers and vendors to adopt reuse. Thus, for example, national standards would be preferable to regional standards, while EU-wide standards would ultimately be even more preferable. However, as it is likely that the first reuse packaging systems will be implemented by cities and municipalities trialling and developing their own systems, it is important to note that the presence of such objectives is not a prerequisite for cities or municipalities taking individual actions. In addition, cities and municipalities can pursue harmonisation by following best practice guidelines, such as those provided in Zero Waste Europe's *Blueprint for harmonising the implementation of takeaway food and drinks packaging in Europe*.³⁷

To ensure that funds raised through the application of fiscal measures to single-use packaging are spent in an effective manner to support the development of a reuse packaging system across the whole city, region or country in which it is implemented, it is important that **funds generated through fiscal measures should be managed by a not-for-profit entity established for the purpose of promoting reuse**. It should not be left up to individual vendors to determine how funds raised from the single-use takeaway packaging they sell are spent, as this would lead to a myriad of competing systems with limited potential to deploy funds strategically as part of coherent policy.

The operating conditions placed on the entity managing the funds should include requirements to:

- Ring-fence the funds they receive for the management of the reuse packaging system;
- Use the funds to support the evolution of the reuse packaging system; and

³⁷ Ibid.

- Develop a strategy for and work towards interoperability of different reuse packaging systems.

It should be noted that some design aspects may be more appropriate to address through guidance rather than objectives – at least in an evolving scenario. For example, while interoperability between different reuse packaging systems and across geographical areas should be an end goal in order to make reuse more convenient, drive economies of scale and ultimately increase market penetration, legislating for this initially would be challenging. Therefore, governments could instead produce guidance for system operators aimed at planning in as much interoperability as possible in the early stages of system development.

4.2.3 Other Supporting Measures

In addition to fiscal measures, there are a number of other measures that can further support reuse adoption. While these measures alone are unlikely to have a significant effect on market penetration, they are all examples of good practice and should be included in all policy scenarios. They are:

- **A ban on single-use takeaway packaging of all materials for 'dine in' consumption.** Some vendors serving takeaway food and beverages give consumers the option of eating/drinking in-store and still provide single-use packaging for this purpose. As single-use packaging consumed in-store does not serve the function of single-use takeaway packaging (i.e., to be disposed of after being taken away), it is functionally redundant. Banning it would force a shift to reusable alternatives, helping to normalise reuse and increase market penetration with the attendant environment benefits, making the rationale for doing so clear. Furthermore, it is easier in practice for takeaway vendors to convert to providing reusable packaging for both takeaway and 'dine in' consumption at the same time. It should be noted that the adopted PPWR already includes a ban on the provision of single-use plastic packaging for 'dine in' consumption. But a full ban covering all materials, including paper-based packaging, is strongly encouraged to not only support the uptake of reusables but also to avoid a material shift and its consequent impacts on the environment and society.
- **A mandate that the default packaging option for serving takeaway food and beverages should be reusable packaging within a reuse system, and that where single-use packaging is an option, consumers should have to actively opt in to receive it.** As the adopted PPWR would already require vendors to provide reusable takeaway packaging, this supporting measure would work in an effective synergy with that requirement, helping to shift consumption to reusable options, normalising reuse and encouraging consumer behaviour change. While it would support an increase in market penetration, it should be noted that it may be challenging to implement while at low levels of market penetration. This is because of the extra inconvenience it would entail while single-use remains the predominant option. It could also be less easy for vendors or consumers to engage with a relatively unfamiliar reuse packaging system. However, the degree of difficulty of engagement would also depend upon the specific system design – for example, if consumers were required to pay and redeem deposits via an app, possible inconvenience would likely fall on the consumer side. As reuse packaging systems are new to takeaway consumers (compared with single-use), it is essential that such systems are introduced alongside educational campaigns.
- **Requirements for minimum levels of staff vendor training on the packaging reuse system.** This measure would help to ensure that the reuse packaging system was implemented correctly by vendors. Although difficult to enforce, given the challenge of monitoring a large number of vendors, this supporting measure would be a clear example of good practice.

4.2.4 Exemptions to Measures

It may be the case that it is appropriate to exempt certain types of vendors from the policy measures set out in this report. For example, the adopted PPWR exempts micro businesses from its requirements around

reuse for the takeaway sector. Clearly, these exemption decisions should be made on a case-by-case basis by policymakers in each jurisdiction. However, perhaps it is reasonable to sound a cautionary note on what exemptions might mean for evolved reuse systems. Section 3.1.1.1 of this report indicates that micro businesses are more likely to be closer to a cost benefit from moving to a reuse packaging system and therefore could potentially avoid cost increases from reuse system adoption. Perhaps the most significant reason to caution against exempting certain vendors is that reuse needs to be normalised as the standard method for purchasing takeaway food and drinks. The higher the number of exempted sales of takeaway food and drink, the less likely it is that reuse will be seen as the norm.

4.2.5 Examples of Policy Tools in Action

While there are examples of reuse packaging systems for takeaway packaging developing in several European cities, they can all be considered to be evolving at this point of time. As there are no concrete examples of evolved reuse packaging systems, there are no examples to show exactly what policy tools and measures would be needed to achieve an evolved scenario.

However, there are examples of taxes, levies and other similar policy tools that have aimed to increase recycling rates, improve waste prevention and, in some cases, encourage reuse, although it is important to acknowledge that they are examples from other sectors than the takeaway sector. While potentially useful as indicative examples, caution should therefore be taken in assuming that they provide evidence of how policy measures would work in driving adoption of reuse packaging systems for takeaway packaging to an evolved scenario.

Table 4-3 provides summaries of relevant case study examples of waste prevention and reuse policy tools in action.

Table 4-3: Illustrative Policy Case Studies

Case study	Type of policy	Description	Impact
Germany, Tübingen – city- wide	Single-use Tax/Levy	A levy is made on vendors using single-use packaging for food and beverages; single-use cutlery, all materials, not just plastic. €0.5 for each packaging item, €0.2 for single-use cutlery, to a maximum of €1.50 per meal. Reusable packaging is subsidised by the city.	There has been a reduction in single-use consumption and an increase in the use of reusable packaging, but the market penetration levels of reuse are not clarified.
Netherlands – Radboud University, Campus Cup Return System	Deposit Return System (DRS)	To reduce waste, Radboud University partnered with Billie Cup in May 2022 to implement a DRS for beverage purchases on campus. Customers paid a €1 deposit for a reusable Billie Cup, which they could exchange for a Billie Coin to get a new cup or a €1 discount. By December 2022, disposable cup usage dropped by 180,000 compared to the previous year, achieving a 58% reuse rate. ³⁸	36% reduction in disposable cup usage

³⁸ Radboud University, 'Billie Cup'.

Case study	Type of policy	Description	Impact
Norway – Nation-wide DRS	DRS Variable environmental taxation that is reduced as return rates increase	Norway's DRS is the world's most successful, achieving a 92.3% return rate for beverage bottles and cans in 2021. Key factors include widespread reverse vending machines, a competitive deposit value (€0.20 per container), and a unique variable environmental tax that decreases as return rates increase, incentivising retailers and producers to maximise returns. ³⁹	Nation-wide adoption of returning beverage containers High return rates, thereby facilitating higher recycling rates and a reduction in litter
EU – Carrier Bag Directive	EU Directive	In order to reduce littering of plastic carrier bags and promote more efficient use of resources, the EU Carrier Bag Directive requires that Member States either: a) ensure that national consumption of lightweight plastic carrier bags (LPCBs – defined as bags with a wall thickness below 50 microns) does not exceed a specified limit, while leaving it up to individual Member States to determine how they achieve this, or b) ensure that LPCBs are not provided free at the point of sale. ⁴⁰ Member States choosing option a) typically implement environmental taxes aimed at producers / importers or bans on certain types of bags. For option b), the measure is determined as a consumer facing levy. Some Member States	Between 2018 and 2021, there was a 31% reduction in the total number of LPCBs consumed among the EU Member States for which data is

³⁹ 'Norway's Deposit Return Scheme Is World's Recycling Role Model'.

⁴⁰ DIRECTIVE (EU) 2015/720 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 29 April 2015 amending Directive 94/62/EC as regards reducing the consumption of lightweight plastic carrier bags, <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32015L0720>

Case study	Type of policy	Description	Impact
		have taken a combination of both options by implementing the targets of option a) while choosing to achieve this via a consumer facing charge.	available for all four years of that period. ⁴¹
France – Funding reuse through EPR	EPR	France's 2020 AGEC Law requires that minimum percentages of income from EPR schemes are spent on funding waste prevention and reuse. For the household packaging EPR scheme, 5% of fee income must be ring-fenced for reuse. For capital goods EPR schemes, the law creates dedicated funds for reuse and repairs, with 5% of fees going to reuse under each scheme and the amount going to repairs varying from scheme to scheme.	Obligated PROs to contribute towards a national target of 5% of packaging POM being reusable by 2023

⁴¹ Consumption of plastic carrier bags – estimates, Eurostat Statistics Explained, October 2023, https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Consumption_of_plastic_carrier_bags_-_estimates

Key messages: Fiscal measures can be used to address the reuse adoption challenge of single-use packaging currently being lower cost to a vendor than a reuse packaging system in the absence of any supporting fiscal policy measures. Targeting single-use packaging through fiscal interventions to internalise the current externalities of litter and carbon impacts through levies/taxes, or using EPR fees to achieve specific waste management goals, would create a more level playing field that more accurately reflects the true costs of single-use packaging and potentially provides an economic incentive for reuse. The funds raised through such measures could also be ring-fenced for spending on establishing and supporting the development and evolution of reuse packaging systems.

To ensure that reuse packaging systems operate efficiently and achieve high levels of reuse, it would be necessary to introduce mandatory minimum standards and requirements, ideally at the highest level of government possible. This would achieve the greatest possible interoperability between different systems/regions and make engagement simpler and more convenient for both vendors and consumers across markets.

In addition, there are a range of other supporting measures which, while unlikely to have a significant effect on market penetration alone, are examples of good practice and should be included in all policy scenarios. These include bans on single-use takeaway packaging for 'dine in' consumption, a mandate that the default packaging option for serving takeaway food and beverages should be reusable packaging and requirements for minimum levels of staff vendor training on reuse.

It is important to note that, during the current evolving period of reuse packaging systems, there are as yet no clearly evidenced examples of how effective specific measures or combination of measures will be in reaching evolved reuse packaging systems for takeaway packaging.

4.3 How are the Policy Tools Likely to Work?

The following sections consider which policy tools are likely to be most appropriate under the evolving and evolved reuse packaging system scenarios.

4.3.1 Evolving Scenario

Reuse packaging systems will initially need to be established in an evolving scenario (probably with relatively low market penetration, e.g., <20%), through trialling, roll-out and subsequent improvement. Policy tools should therefore be geared towards supporting these initial processes. The key policy tools for an evolving scenario are likely to be:

- **Fiscal measures designed to disincentivise the consumption of single-use takeaway packaging**, whether environmental taxes/levies on economic operators, consumer facing levies or negative modulation of EPR fees. Such measures would be necessary to address the challenge of single-use packaging being cheaper than reusable packaging.
- **Ring-fencing of funds generated through fiscal measures to support reuse adoption**, providing funding for research and development, system trials, the development of standards, minimum requirement and guidance for system operators, and for joint working between different system operators / geographic regions to achieve some level of interoperability between different reuse packaging systems.

4.3.2 Evolved Scenario

Although fiscal measures will be necessary to achieve the evolving scenario, the scale of market penetration that they can achieve is uncertain. This is because, although attempts at establishing reuse packaging systems have been made so far, none have displayed all the fiscal policy features recommended in this report, and therefore it is not possible to ascertain what impact the recommended policies would have.

Therefore, **it may be necessary for policymakers to design policies with safeguards for the potential failure of specific fiscal and other measures. One such appropriate safeguard could be to set a timeframe for achieving an evolved scenario, with specified targets for achieving certain market penetration levels by certain dates.** Additionally, governments could also mandate timebound targets for other performance metrics such as return and rotation rates. This overall approach would provide the takeaway industry with the opportunity to achieve an evolved scenario within an overarching policy framework and timeframe. In order to adequately incentivise all actors in the system to work towards achieving ~85% market penetration, it would be necessary that meaningful sanctions be imposed if the targets were missed.

Subsequently, if and only if the targets are not met, it may be necessary to introduce measures prohibiting placing single-use takeaway packaging on the market. Single-use bans may ultimately be necessary because, while fiscal measures can address the cost-related challenges of adopting reuse, they cannot address the challenge of single-use packaging being more convenient than a reuse packaging system, which is another significant barrier to achieving high market penetration. It may not be possible to achieve the evolved scenario while also continuing to provide vendors and consumers with the same level of choice which they have historically enjoyed. A potential additional policy aspect under such an approach would be for the level of fiscal interventions to scale up annually for each year that targets are not met, up to point at which a ban would ultimately be implemented if the targets were still not met.

It should also be noted that, as mentioned in section 4.2.1, once a 'steady state' has been achieved in an evolved scenario, the use of funds generated through fiscal measures targeting single-use packaging to support the reuse packaging system may no longer be appropriate, as at that point the system should be capable of funding itself. Furthermore, since the key purpose of targeting single-use packaging with fiscal measures is to address the cost difference between single-use and reusable packaging to support reuse adoption, such measures would have served their purpose in an evolved scenario and could potentially be de-implemented.

Key message: Fiscal measures targeting single-use takeaway packaging are necessary to achieve an evolving scenario, both by disincentivising single-use and creating a source of funding to support the development of the reuse packaging system. However, there is uncertainty regarding whether fiscal measures alone are enough to achieve an evolved scenario with high levels of market penetration of ~85%, and therefore it may be necessary to set time-bound targets for the reuse packaging system, with meaningful sanctions if they are not met. If these targets are not met, then it may be appropriate to introduce bans on single-use takeaway packaging. This phased policy approach would incentivise all actors in the system to work towards high market penetration of reusable packaging and provide the takeaway industry with the opportunity to achieve an evolved scenario within an overarching policy framework and timeframe.

5.0 Conclusions & Key Recommendations



5.1 Conclusions and Recommendations

The key conclusions emerging from the cost comparison of reusable vs single-use packaging undertaken for this study are:

- In an evolved reuse packaging system scenario (i.e., a steady state of operation with market penetration of ~85%), where no supporting fiscal measures have been adopted, reusable packaging is likely to cost takeaway vendors, and therefore takeaway consumers, more than the single-use option for all packaging formats considered. The difference in net cost varies between formats, with some that are easier to wash and transport (such as cups) being close to cost-neutral on the reuse option, and others (such as pizza boxes) costing significantly more.
- Single-use is only relatively low cost because the associated environmental externalities of litter clean-up, litter disamenity and carbon impacts are not priced in. These externality costs, which are borne by society as a whole, are greater than the increased costs to vendors of switching to a reuse packaging system. Therefore, the cost benefits for society of switching to reuse outweigh the increase in cost for vendors. However, this is highly sensitive to assumptions about the costs of litter disamenity.
- In the case of Berlin, where EPR fees apply to single-use packaging, this study shows that the cost of single-use takeaway packaging is likely to be higher than for a reuse takeaway packaging system for some formats. It should, however, be recognised that although EPR fees in Germany have been shown to likely result in lower reuse packaging system costs than single-use, we are yet to see reuse systems in Germany achieving high levels of market penetration.
- There is considerable uncertainty regarding vendor single-use packaging costs, with virtually no market transparency on this matter. However, it seems reasonable to conclude that, for all formats, high-volume large businesses are likely to have lower single-use packaging costs and that therefore the net cost of a reuse packaging system is likely to be greater for these entities. At the opposite end of the scale, small business vendors might experience some net cost savings from a reuse packaging system for cups, bowls and sushi boxes.
- While economies of scale do exist for reusable packaging systems, there was no significant difference between Aarhus (which has a population of 368,131) and Berlin (which has a population of 3.87 million) in the model created for this study.^{42 43} Extrapolating this conclusion to the smallest towns and cities, it seems that although costs would rise the smaller the town/city, the costs would not become prohibitively high, even for towns significantly smaller than Aarhus.

Policy interventions are needed to incentivise and facilitate the adoption of effective reuse packaging systems that can deliver both environmental and economic benefits to society. The key policy recommendations of this report are:

- In the first instance, policy will need to be directed at moving from the current situation in which takeaway packaging reuse is not yet mainstream to an evolving scenario with greater, albeit still low, reusable packaging market penetration of ~20%. Initially, this may be more likely to occur at a city/municipality level, rather than at a national level, as individual cities implement trials of reuse packaging systems.

⁴² Statistics Denmark (2024) Population Figures. Available at: <https://www.dst.dk/en/Statistik/emner/borgere/befolkning/befolkningstal>

⁴³ Berlin.de The Official Website of Berlin (2023) Statistics: Berlin's population continues to grow. Available at: <https://www.berlin.de/en/news/8425887-5559700-statistics-berlins-population-continues-.en.html>

- Considering that a key limitation to achieving an evolving scenario is a lack of funding for the development of reuse packaging systems, cities /municipalities will need to implement fiscal interventions that disincentivise single-use while raising funds to support reuse.
- Fiscal measures can be used to address the reuse adoption challenge of single-use packaging being cheaper than reusable packaging. Targeting single-use packaging through fiscal interventions would create a more level playing field more accurately reflecting the true costs of single-use packaging and potentially provide an economic incentive for reuse. These interventions could include measures that internalise the current externalities of litter and carbon impacts through levies or taxes, or negatively modulating EPR fees to achieve specific waste management goals.
- To ensure that reuse packaging systems were operated efficiently and achieved high levels of reuse, it would be necessary to introduce system objectives. These should include minimum return and rotation rates, minimum requirements on collection point coverage, minimum and maximum deposit/penalty levels, a requirement that funds from unredeemed penalties/deposits stay within the reuse packaging system and guarantees around the hygiene safety of the system. While such objectives would initially, in an evolving scenario, need to be agreed between governments and industry on a voluntary basis, in an evolved scenario it would be appropriate to legislate for them as mandatory minimum standards and requirements.
- Objectives should ideally be agreed/set at the highest level of government possible to achieve the greatest possible interoperability between different systems/regions and to make engagement simpler and more convenient for both vendors and consumers across markets.
- Furthermore, it is important to start developing performance objectives around minimum return and rotation rates at an early stage, to ensure that the reuse packaging system isn't funding itself/profitting from low returns rates resulting in high numbers of unredeemed deposits/penalties, as such low-cost but low-performing systems will not be the most environmentally beneficial.
- As there is uncertainty regarding whether fiscal measures alone are enough to achieve an evolved scenario with high levels of market penetration ~85%, it may be necessary to set mandatory, time bound performance targets, with meaning sanctions to be imposed if these targets are not missed. Subsequently, if and only if the targets are not met, then it may be necessary to introduce measures prohibiting placing single-use takeaway packaging on the market. It would be important to communicate clearly to industry that, in the first instance, mandatory targets would be introduced if desired levels of performance were not achieved and then, in the second instance, that single-use bans would be introduced if the targets were not met. This would incentivise all actors in the system to work towards achieving high market penetration of reusable packaging.
- There are a range of other supporting measures which, while unlikely to have a significant impact on market penetration alone, are examples of good practice and should be included in all policy scenarios. These include bans on single-use takeaway packaging for 'dine in' consumption, a mandate that the default packaging option for serving takeaway food and beverages should be reusable packaging, and requirements for minimum levels of staff vendor training on reuse.

