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Assessing Climate Impact: Reusable Systems vs. Single-use Takeaway Packaging

Executive Summary

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Report for

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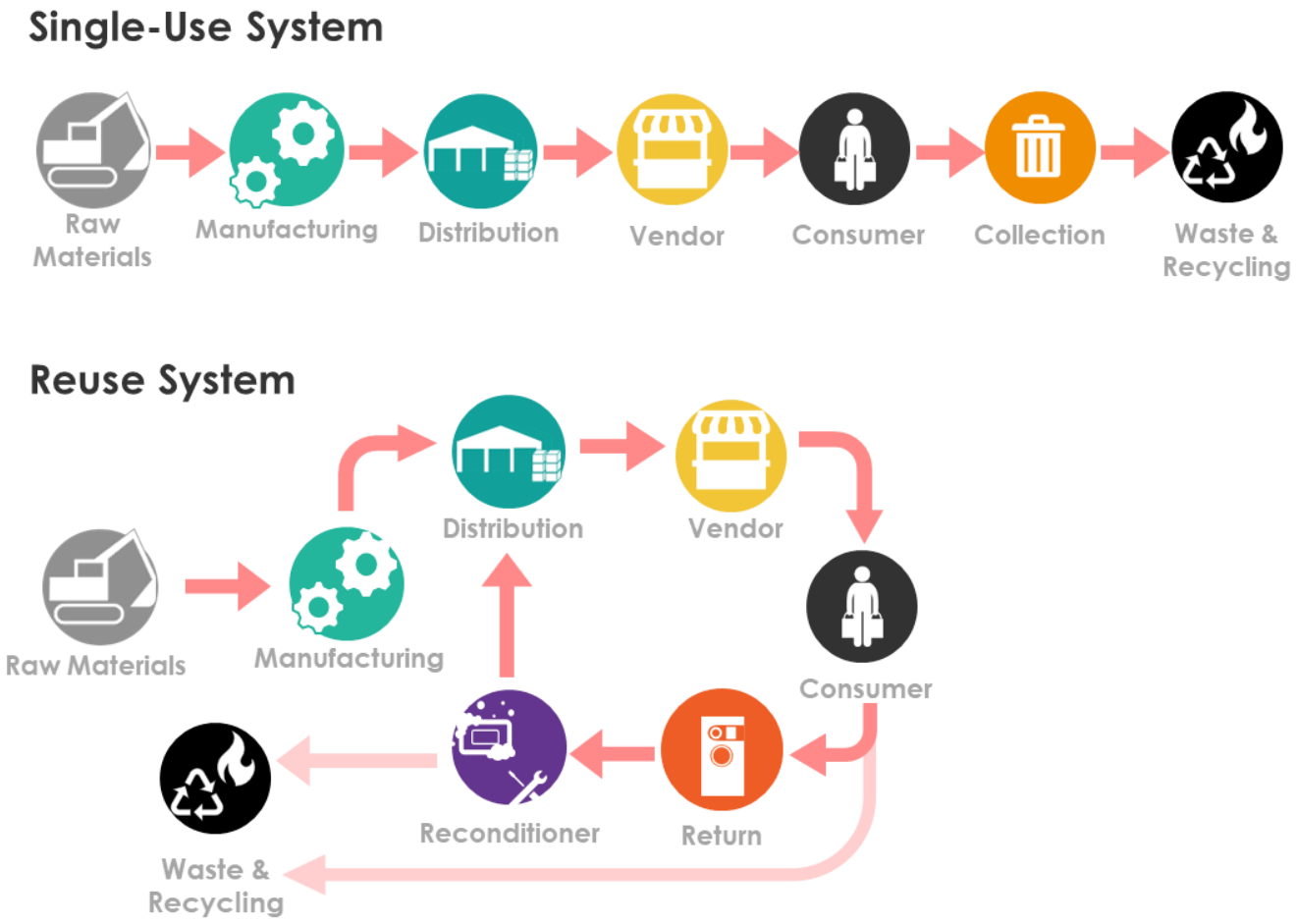
Executive Summary

This study involved modelling to measure the greenhouse gas (GHG) emissions from reusable takeaway packaging compared to single-use equivalents. The results indicate that, for most types of takeaway packaging used in Europe, reuse through a safe, efficient system for collection, washing, inspection, and redistribution has potential to yield greater environmental benefits than recycling or discarding single-use containers. The study also highlights key aspects to optimise in designing and operating reuse systems.

The research simulated a reuse system that employs logistical networks to manage the efficient reuse of takeaway containers. The figure below depicts the lifecycle stages of containers in both a single-use and a reusable system.



When a consumer buys a takeaway coffee (for example), some GHGs have already been emitted to extract raw materials, transform them into the cup via manufacturing, and distribute it. More GHG will be emitted as the cup is managed as waste at the end of life. A cup that is used only once embodies all the emissions from its manufacture, distribution, and end-of-life management. It may be recycled, although single-use takeaway containers are often thrown away, with some ending up as litter due to inadequate waste management.

In a reusable system, each container is used for multiple servings of food or drink (multiple consumption events). Fewer raw materials are used to enable each consumption event, and fewer containers need

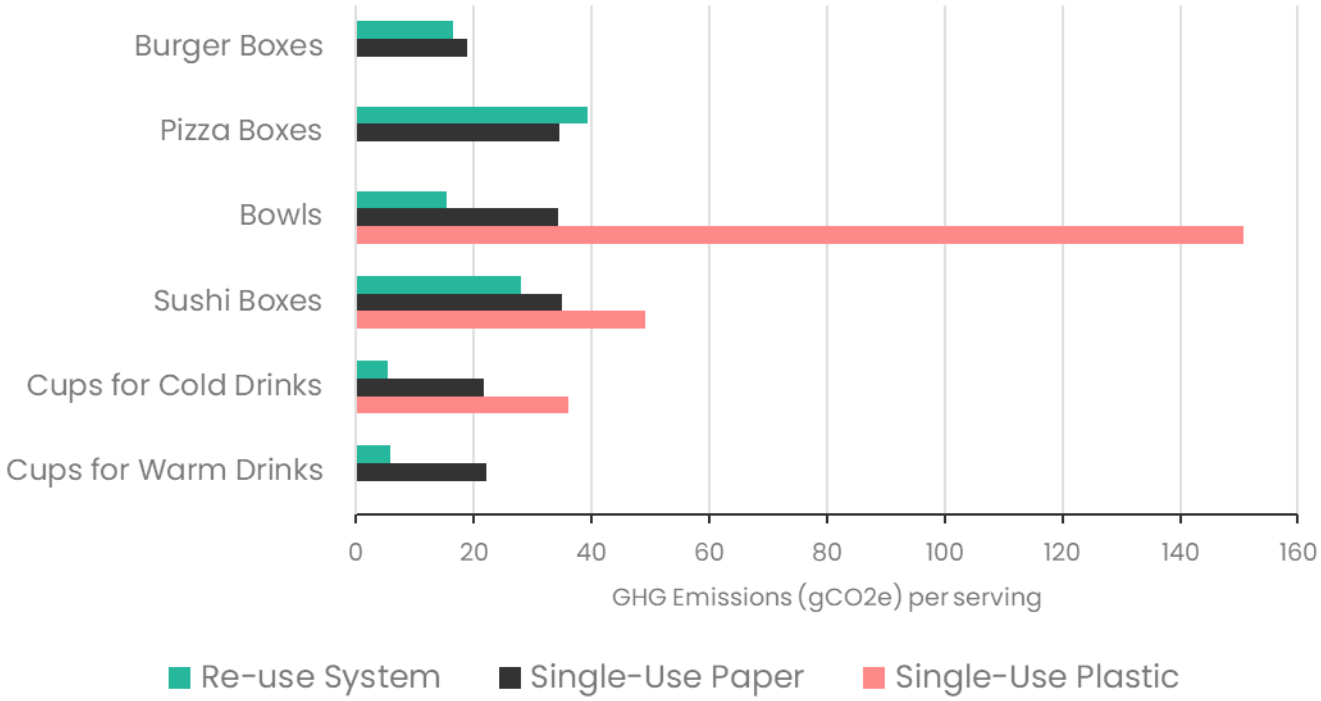
to be manufactured and then eventually managed as waste. This means that each container's embodied emissions are spread over numerous consumption events rather than just one.

Results

The study modelled the climate change impacts associated with providing a single serving of takeaway food or drink across all six packaging formats used in Europe: bowls; boxes for pizza, burgers, and sushi; and cups for warm and cold drinks. All results were normalised to individual servings of takeaway items; For instance, reusable packaging impacts are allocated per serving based on the packaging's total lifetime servings.

The scope of the study envisions a scenario in 2030, reflecting a near-future setting. By then, it is possible that reusable packaging systems will have reached steady-state and electrified transport and decarbonised electricity grids will be more prevalent, aligning with international targets. This time frame was chosen to emphasise the relevance of understanding future impacts rather than current ones.

The study found that, for all formats except pizza boxes, switching from single-use (both plastic and paper) containers to reusable ones in an efficient system has good potential to reduce GHG emissions – see the figure below. The extent of possible reduction varies between container types, with cups showing the largest reductions. Some types, such as pizza boxes, are likely to need further design improvements to fully realise the benefits of reuse.



Assumptions and Sensitivities

Climate impact assessments of reusable vs single-use packaging often rely heavily on assumptions that significantly affect results. Certain assumptions help model aspects of consumer behaviour for which data is sparse, such as return rates, home washing, and dedicated return journeys. The lack of good data in these areas does create some uncertainty. To address this, the study tested the sensitivity of some key assumptions used in the modelling to identify break-even points – the point at which the assumption changes the outcome.

The key sensitivities explored were changes to the energy grid, the proportion of dedicated car journeys, the throughput of the professional washing process, and reuse return rates/rotations. These sensitivities give system designers a good benchmark to aim for to ensure that reuse is the optimum solution. Table E-1 shows how many rotations are necessary for each reusable item to outperform single use; this should be the *minimum* design-life specified.

To demonstrate how design can influence the outcome, the weight of a reusable pizza box was also varied – its large and bulky mass makes it the most challenging item to reuse. The results show that decreasing the weight of the reusable pizza box by 20% (85g) could reduce the GHG impacts from a reusable system below those from a single-use system.

Table E- 1: Breakeven analysis on the reuse return rates for different reusable packaging formats

Product	Breakeven # Rotations	Breakeven Return Rate
Burger Boxes	30	97%
Pizza	63	98%
Bowls	13	92%
Sushi Boxes	35	97%
Cups for Cold Drinks	6	83%
Cups for Warm Drinks	6	83%

Conclusions

The results of this study show there is definite potential for a reusable system to outperform a single-use system in the takeaway sector. However, such a system must be designed and implemented well. Some of the key assumptions are driven by aspects of behaviour that require a mindset change, one that must be ingrained into societal norms. While the study demonstrates the art of the possible, this cannot happen without thinking beyond simply swapping one packaging type for another.

The results can be used to help guide those implementing reusable systems by indicating the potential for reducing GHG emissions and highlighting the important system design considerations that are required to facilitate success. There now appears to be enough evidence to move the conversation move from a discussion of reuse vs single-use towards: *How can we implement re-use in the most effective way?*

Real-world trials, such as the Aarhus project in Denmark, are needed to further evaluate the findings, refine the system, and measure the benefits, although small trials and pockets of activity are unlikely to show the long-term benefits this study demonstrates are possible. The evidence presented here and gathered through trials should be used to inform the development of standards for effective reusable systems. This will be where the true gains are likely to be realised.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