

reloop

what we waste

Tracking 20 years of growth in
international drinks container wastage,
and how refillables and deposit return
systems can reverse this trend





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Supported by

Changing Markets Foundation

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reloop

ReLoop is an international non-profit organisation that brings together industry, government and NGOs who share a vision of a thriving global circular economy - a system where resources are kept in continuous use and waste and pollution are eliminated. Our broad network seeks to bring about positive change at all levels of resource and waste policy.



The Changing Markets Foundation was formed to accelerate and scale up solutions to sustainability challenges by leveraging the power of markets. Working in partnership with NGOs, other foundations and research organisations we are keen to explore effective solutions to the plastic pollution crisis. This is why we also supported this independent report.

Foreword

Reloop believes in smart policy. We want our research and analysis to inspire policymakers to develop regional and national policies that create space for proven and innovative solutions.

Circular economy policies deliver critical benefits to society, such as an increase in jobs and a significant contribution to climate change strategies, alongside ensuring that resources remain resources.

As part of Reloop's core focus on packaging, we have now studied data on the sales and recycling rates of drinks containers from 93 countries over a 20 year period. We discovered that there is a stark difference between the outcomes for countries that do have smart policy and those that don't.

In this report you'll find the story of how single use plastic, metal and glass beverage packaging is being wasted at ever-increasing rates around the world – with wastage defined as landfilled, incinerated or lost to the environment as litter. It is a story which is particularly concerning in countries with inadequate waste management systems.

But there are countries who are leading the way, showing us that there are circular economy models for managing reusable and recyclable resources – models which collect the most material and ensure the best quality for refill or closed-loop recycling.

Ultimately, the report shows us that waste reduction and proper resource management strategies should be deployed immediately at a global level.

We're excited to share this compelling report with you. We believe it should spark conversations across the political, business and community spheres; conversations that ultimately should lead to positive policy change.

Finally, we are grateful to the Changing Markets Foundation for financially supporting this work and to Break Free From Plastic for working with us to reach countries and regions in which it operates.

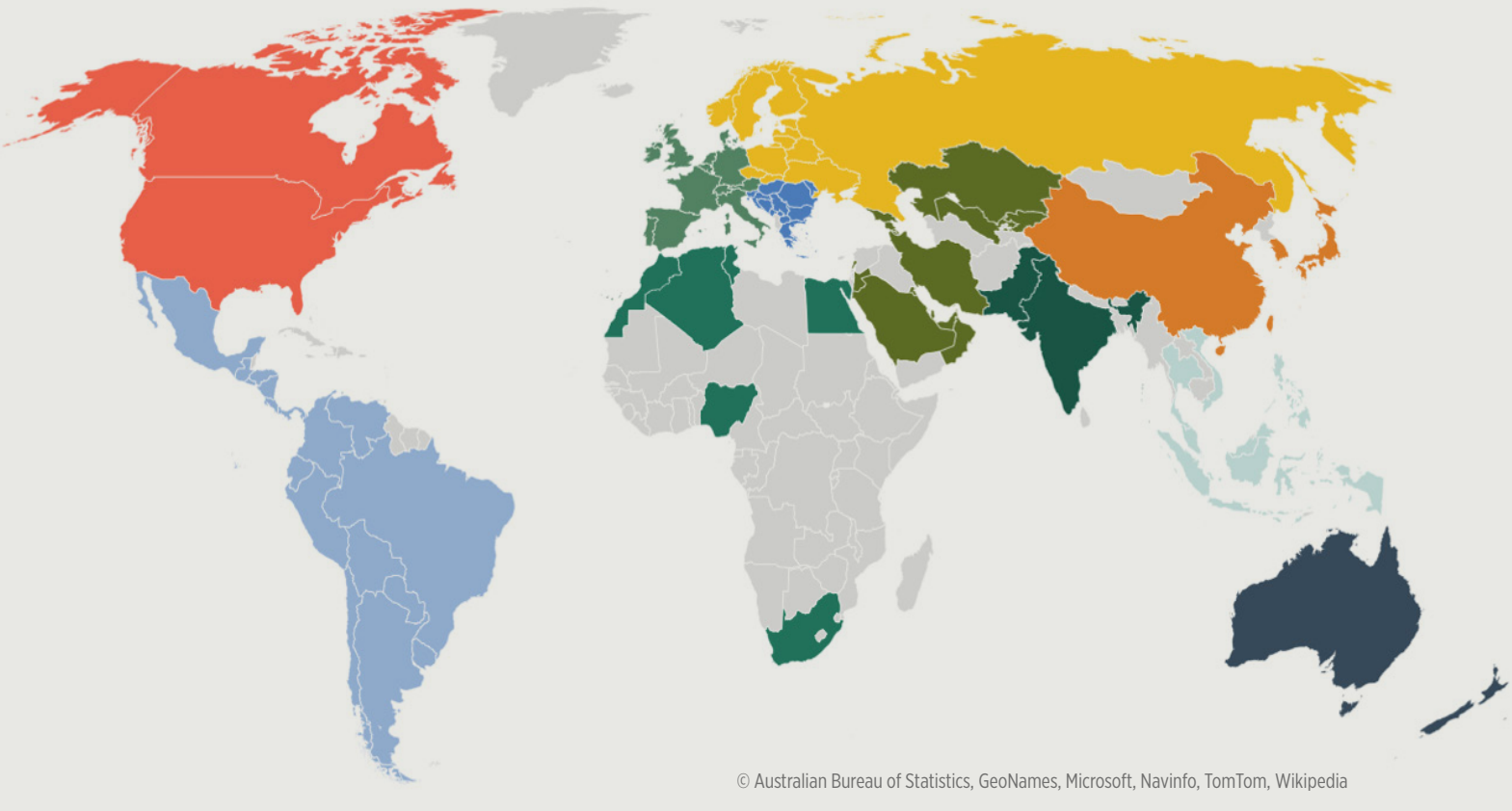
Clarissa Morawski
CEO & Co-Founder, Reloop



Circular economy
policies deliver
critical benefits
to society.



Technical overview



This report draws on data from 93 countries, some of it dating back to 1999, to examine trends in sales, collection and wastage of drinks containers, where wastage is defined as containers ending up in landfill, incineration, or in the environment. The countries included comprise 81% of the world's population as at 2019.

In particular, it considers the relationship between wastage rates and the beverage industry's shift from refillable bottles to single-use drinks packaging, alongside the impact the implementation of a deposit return system can have, both on wastage and on supporting the share of refillable bottles on the market.

The sales data for the 93 countries was purchased by Reloop under licence from GlobalData. Of those countries, complete datasets showing sales of all ready-to-drink beverages was available for 66 of them. For 27 countries (mostly in the Western Asia/Middle East region), data was available for all beverage categories except beer and cider. Under the terms of that licence we cannot republish raw sales data, but we can use it comparatively and in conjunction with other datasets. This includes some or all recycling rate data across a smaller subset of countries, including 24 EU member states, three other European countries, North America, Indonesia, Malaysia, Philippines, South Africa, Thailand and Vietnam.

These datasets allow us to explore market share by material and by drinks segment, to look at the history of changes to refillable market share and the uptake of deposit return, and to estimate the effects in particular countries if refillable market share could be increased or deposit return adopted.

Introduction

Over the period covered by this dataset for global beverage sales, from 1999 to 2019, the countries covered saw a substantial increase in the volumes of ready-to-consume beverages sold.

When the first data in this set appears, in 1999, it shows that 685 billion drinks were sold in metal cans, in plastic or glass bottles, or in board/cartons.

By 2019, this figure had almost doubled to 1.3 trillion. This dataset does not cover approximately 100 countries, and other methodologies estimate the full global figure to be [2 trillion in beverage sales](#) for that same year.

The primary packaging materials covered by our sales dataset are glass bottles, both single-use and refillable, PET bottles (polyethylene terephthalate, the plastic typically used for water and carbonated beverages, which are largely but not always sold on a single-use basis), and steel or aluminium cans, which can of course be recycled but not refilled. Our sales data also covers HDPE bottles (high-density polyethylene) and board (including cartons, such as Tetra Pak), but these two materials are not included in our recycling datasets.

There are two primary datasets used here: beverage sales rates from 1999 to 2019, from GlobalData, and national datasets covering the recycling rates of the materials listed above. Other data sources include Reloop's [Global Deposit Book](#), World Bank, and others as identified.

It should be noted that with recycling rates there is often a lack of clarity between “materials collected” and “materials recycled”. The common approach, particularly in systems that recover dry mixed packaging for recycling from the kerbside, is for the weight of the packaging collected, including contaminants, to be reported as the recycling rate, which is inaccurate. So, in general, these datasets are likely to overestimate the proportions of material actually recycled, especially in non-deposit territories.

This report looks at units sold, recycled and wasted, not tonnage, but we can approximate this overestimate by looking at a [recently published Ball Packaging report](#) on imminent changes to European reporting of tonnage recycled. This will see the point of measurement moved from the point of collection to the point materials leave a materials recovery facility.

A collection rate of PET at 58% is expected to equal a recycling rate of 42%, while glass is expected to fall from 76% to 66%, This would mean more than a quarter of the weight of PET bales collected for recycling is actually contamination, as is more than an eighth of the glass. Aluminium will be least changed, falling from 74.5% to 69% (unsurprisingly given it is the easiest to reclaim from mixed recycling and the most valuable material by tonne).



Making cans from recycled aluminium uses just 5% as much energy as using virgin materials.

Furthermore, because deposit return systems require producers and importers to account for every container put onto the market, countries with such systems will tend to show higher and more accurate sales figures. Overall, because recycling figures tend to be overestimated and sales figures underestimated, real wastage figures will tend to be higher than the calculations we can make from the available datasets.

In 2019 the overall beverage market in our dataset broke down by container material into 42% PET (41.5% single-use, 0.6% refillable), 25.5% metal, 25.5% glass (17.2% refillable, 7.3% single-use), 6.4% board or carton, and 1.3% HDPE.

In territories where the refillable market had been dismantled prior to 1999, refillable bottles for non-alcoholic carbonated drinks have mainly been replaced by single-use PET bottles, while single-use aluminium cans have largely taken over from refillable beer bottles.

Between 1999 and 2019, the overall market share of single-use PET has increased from 17% to 41%. In some territories this change was even sharper: in the same period in Thailand the market share of this material grew from 7% to 45%, while in India the market share grew from 8% to 48%.

With this increase in beverage production and consumption came a substantial increase in wasted packaging: materials used to make drinks containers that then ended up in landfill, in an incinerator, littered in our urban and rural areas, or breaking down in and polluting our marine environments.

This report looks at that wastage, at the extent to which it has grown, and at the effectiveness of existing systems designed to minimise it, before considering how it can be most effectively tackled.

In addition to the visual impact, and the other obvious problems associated with litter, this wastage also indicates the use of far more carbon-intensive processes and virgin materials than the alternatives, where containers are collected separately after use. Making cans from recycled aluminium uses just [5% as much energy](#) as using virgin materials, for example, while using refillable bottles can [reduce emissions by at least 50%](#).

Littered beverage containers also lead to significant clean-up costs for local government. A [recent report from Changing Markets](#) and Eunomia indicates, for example, that the cost to Spanish local government associated with cleaning up this specific waste segment amounts to up to €529m a year.

All of these are costs essentially externalised onto wider society by the beverage industry. It is cheaper for manufacturers to operate high-wastage models with single-use containers, where permitted by regulation, than it is for them to take full responsibility for their packaging. It is not free to set up systems which collect and separate empty containers by material, whether for refill or for high-quality recycling. The pressures to continue with a high proportion of single-use packaging are compounded by the low price of oil, and by the global shortage of good quality recycle, given the relatively low number of territories with deposit return, and the low grade materials collected without such systems.

Public awareness of some of these issues has also grown markedly over the last decade, alongside campaign activities by NGOs and other actors. Plastic as a material category has attracted the most interest, with a particular focus on plastics littered in marine environments. This has led to increasing discussion at national and regional levels on what policies should be adopted to reduce litter, improve recycling, and build more circular economies for our resources.

In some packaging or product sectors, solutions to wastage are complex and hard to establish. For drinks containers the answer is more obvious and already proven. In this report, we will consider how a small financial incentive can underpin sophisticated deposit return systems which capture high volumes of single-use containers for recycling, in turn driving a greater use of refillable systems.



Deposit return should be understood in the context of this report to mean the use of small refundable deposits, paid by and repaid to consumers, to drive the collection of single-use drinks containers for recycling.

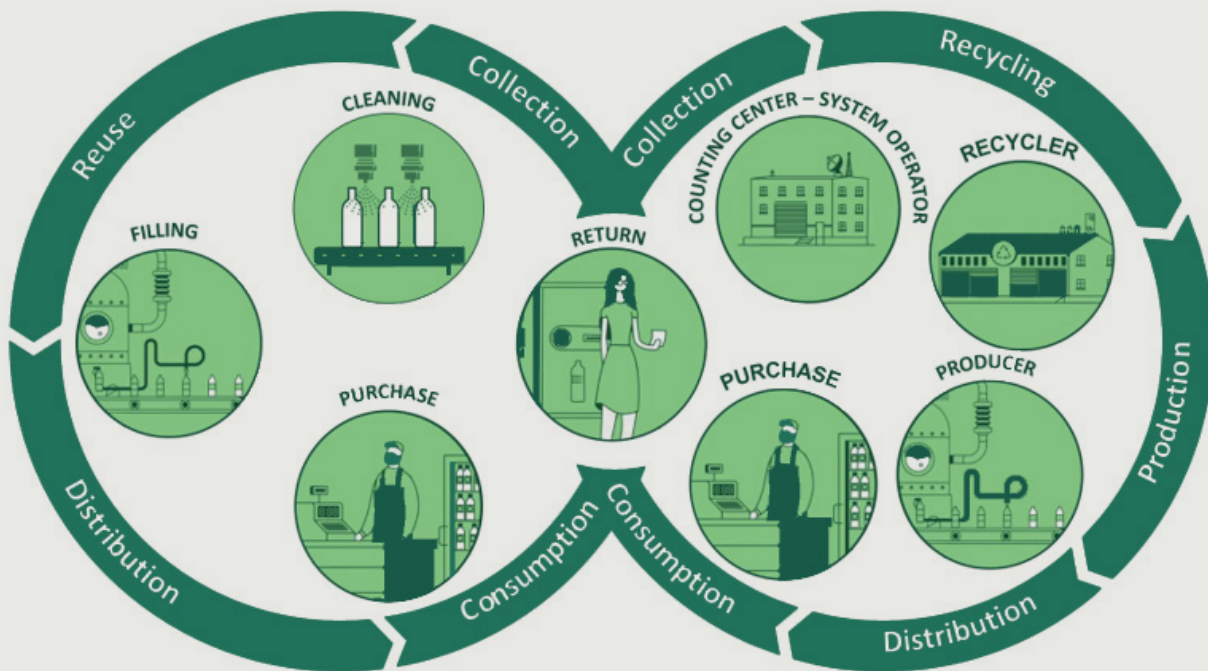
All significant refillable systems also use small refundable deposits, again to drive high return rates. In terms of the containers, the distinction here is what happens after they are returned: is it reuse or is it recycling?

Containers intended to be refilled by the producer are a very familiar system in many territories, and refillable bottles for beer, milk or carbonated beverages are often remembered fondly. Historically refillables were all glass, but PET plastic bottles now make up 3.3% of the global refillable market - they are made to be more robust and thicker than single-use PET bottles, and typically can be reused up to 25 times. Glass refillable bottles are also typically thicker and more durable than their single-use counterparts, enabling the bottles to be re-used, in some cases up to 50 times.

As the dataset shows, the market share for refillables has declined in almost all territories (even if absolute volumes are up in some territories), and ended completely in others.

Modern deposit return systems, however, are on the rise. While deposits have been used to encourage the consumer to return empties for refill for more than 200 years, in the early 1970s deposits began to be charged on single-use drinks containers to encourage their return for recycling and to reduce litter. Many of these systems came about via so-called “bottle bills” in North America, part of the first wave of environmentalism symbolised by the first Earth Day in 1970, the same year British Columbia became the first territory to adopt a deposit system to encourage recycling.

The earliest of this new wave of deposit systems tended to apply small deposits, take limited materials, and rely on a “return to depot” model, where specific return points were built away from the retail locations where the beverage containers were bought. As the concept spread to Europe, especially Scandinavia, systems evolved from the 1980s towards a more inclusive list of beverage packaging materials being accepted, higher deposit levels, and a return to retail model - in other words, you could return your drinks containers within the same environment where you bought them.



These systems typically secure a [return rate of over 85%](#), with Germany showing the best results at 98% returned. And they are spreading rapidly: by the end of 2018, [291 million people](#) lived in countries or territories with deposit return systems, and by the end of 2025 this figure is likely to reach almost half a billion, based on systems committed to but not yet operational.

There are some places where both single-use and refillable containers are used. However, from a consumer perspective in those territories, it does not matter whether the item they return for their deposit is recycled or refilled; that distinction is typically made behind the scenes, very literally, by the handling systems associated with deposit return.

These measures also do not conflict - in fact, the features they share, both behind the scenes and from that consumer perspective, make a strong refillable market a sound basis for introducing deposit return, and vice versa.

This report will therefore look at what the data tells us about how effective these two approaches are, separately and together, primarily through the lens of wastage reduction.

The central finding is that, on average, the countries with the least wastage per person collect their beverage containers via a deposit return system, both for single-use and refillable containers. Encouragingly, even when adopted alone, both refillable systems and deposit return still show marked impacts on wastage.

Wider policy recommendations based on the data and on Reloop's related research over the last six years will follow more detailed analysis of the key findings overleaf.

Key findings

Refillable bottles

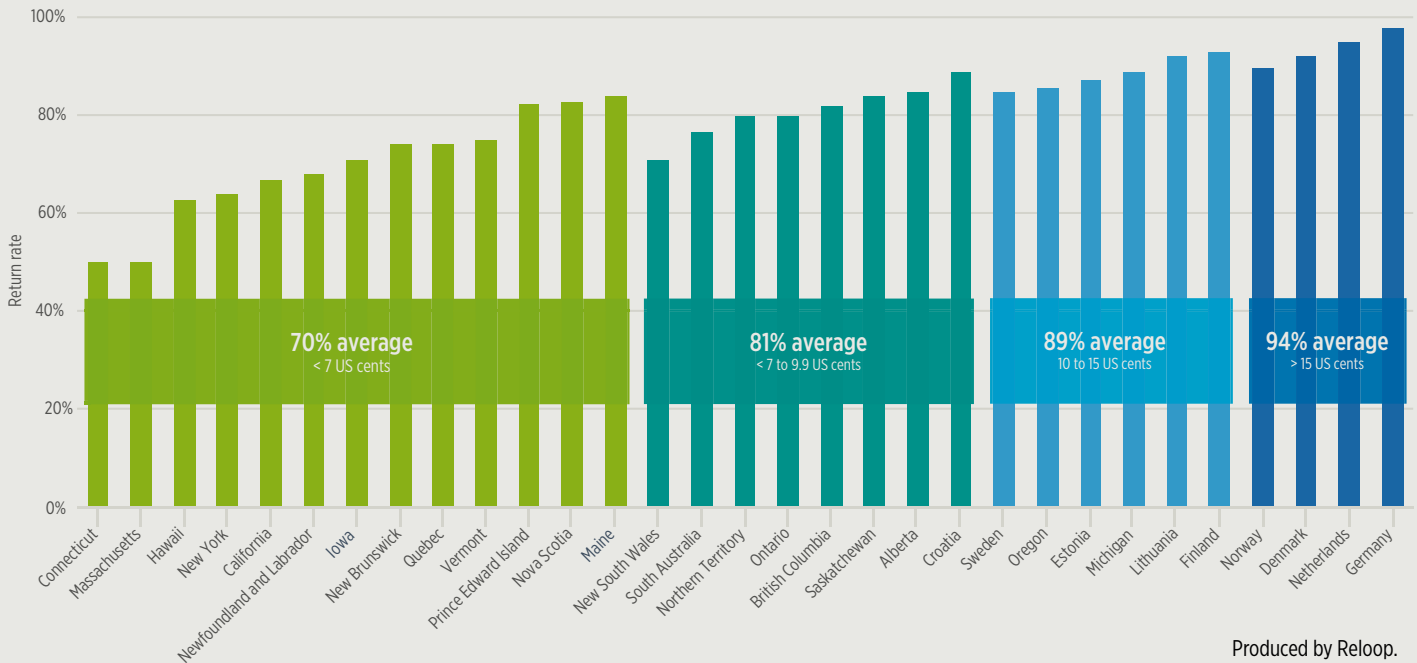
- In 2019, the 10 countries in our dataset with the greatest proportion of refillable sales averaged a 29% market share. In 1999, though, those same countries had on average a refillable market share of double that, at 60%. [\(see figure 2 below\)](#)
- In countries with a refillable market share of 25%+, that share of refillable bottles has fallen from an average of 59% in 1999 to 25% in 2019, with refillable packaging for carbonated drinks most commonly being replaced by single-use PET bottles and refillable beer bottles typically being replaced by metal cans.
- In countries with a refillable market share of 25%+ in 2017, wastage levels were on average 46 per capita, less than half the 95 average across comparable territories with a smaller or absent refillable sector.
- Our dataset shows that if Brazil, with a refillable rate of 24% in 2019, shifted to the refillable rate of neighbouring Colombia, at 54%, Brazil would have seen sales of single-use drinks containers fall from 33.3 billion to 23.2 billion.

Deposit return systems

- At the start of this dataset, in 1999, four European countries, nine US states, eight Canadian provinces/territories, and one Australian state used a deposit return system. By 2020, six more European countries had deposits in operation, five more states in Australia and three additional Canadian provinces/territories had adopted deposits. In the USA, one more state adopted it, while one repealed.
- Those deposit territories achieved an average return rate of containers covered by their systems of 79% in 2018-19, albeit with variation between more modern systems and those established in the 1970s; the latter using deposit levels which are now markedly lower, often because of the effects of four or five decades worth of inflation. To give the example of the US state of Maine, the \$0.05 deposit on beer and soft drinks set in 1978 remains unchanged - if it had kept pace with inflation it would now be just over \$0.20.
- In territories with a deposit return system, wastage levels were on average 78.6% lower in 2017 than comparable territories without deposits.
- In 2015, in Lithuania, prior to the introduction of deposit return, 113 drinks containers were wasted per capita, more than one every three days per person. By 2017, the first full year of the system being in operation, this had fallen sharply to just 14, barely one a month.

Figure 1

Latest return rates in deposit jurisdictions, by minimum deposit level



Overall

- ➔ Global sales of single-use drinks containers across the countries in our dataset have increased by 135% over this period, from 456 billion in 1999, up to 1,075 billion (or 170 per capita) by 2019.
- ➔ Within that, some drinks categories have seen sharper increases: sales of bottled water have increased globally from 72 billion in 1999 to 309 billion in 2019, going up from 11% to 24% of all beverage sales.
- ➔ At the start of the time period being considered, refillables held an average of 33.6% market share across the 82 countries in the 1999 dataset. Eleven of these countries already had a refillable market share below 10% at that point.
- ➔ The best-performing countries use both measures, with a 25%+ share of refillables alongside a deposit return system. Looking at Europe, where we have the most comprehensive dataset, the unmoderated markets - i.e. markets without a deposit return system and where refillables have a <25% market share - generate on average almost seven times the wastage level seen in the best-performing group. [\(see figure 7 below\)](#)
- ➔ The data also shows that a very high-performing deposit system can deliver very low wastage rates even without a robust refillable market. The second and third best-performing countries after Germany in the European data are Lithuania and Finland, both of which had a refillable market share below 25% for that reference year (Finland at 5% and Lithuania at 14.6%).

Recommendations

The following recommendations are consistent with the data and with Reloop's knowledge of the principles which need to be followed for deposit and refillable systems to be considered best-in-class. Design and implementation of these systems will always need to be guided by the nature of each market and other policy measures already in place.

Given the period over which waste materials persist in our environment and the longer term consequences of continued high levels of demand for virgin materials, adopting either or both of these measures sooner will have marked benefits.

- 1 Reduce wastage by introducing deposit return systems on all single-use beverage containers.
- 2 Require those deposit systems to be inclusive by material and size, centred on return to retail, and as accessible as possible to the public, including people with disabilities, those on low incomes, and customers of delivery services.
- 3 Incentivise beverage producers to switch to refillable beverage bottles where appropriate, by ensuring they can access their containers once collected through wider deposit return systems.
- 4 Consider enacting refill targets or quotas for appropriate types of packaging to incentivise the beverage industry to shift towards better collection models, to allow legislators to assess progress and establish - if the targets have not been achieved - whether additional policy interventions may be required.
- 5 Support beverage container collection systems that allow producers to rent a standard refillable bottle from a third party.
- 6 Set key performance indicators for the refillable sector to maximise environmental benefits, especially minimum number of rotations and minimum collection rates.
- 7 Require all refillable containers to be readily recyclable so that the system follows the waste hierarchy.
- 8 Support the transition away from high-wastage models, including by introducing tax incentives and funding pilots of innovative reusable packaging or recovery methods, in order to shift behaviour within the beverage supply chain.
- 9 Where both measures are in operation (or planned), ensure their clear interoperability from the consumer perspective so that the highest rate of return is achieved.

Refillables

As discussed above, refillables have a centuries-long history, but in the second half of the 20th century the environmental strengths of this approach were less widely recognised. In many markets they were superseded by what was widely perceived at the time as more efficient systems, despite the clear reduction in virgin material demand associated with refillable containers, and, relatedly, the lower carbon impacts. These issues are considered in more detail in a co-authored report by [Reloop here](#).

Given that a shift to single-use cans and bottles allows manufacturers to externalise their waste costs, and in the context of a lack of regulation to protect refillable markets in almost all territories, the market share held by refillables has been under considerable pressure over our time period, and indeed before. In many G12 countries, including the USA, France, Japan and the UK, refillables represented less than 10% of units sold by 1999, the point at which our first datasets begin. Some smaller producers of milk, beer or soft drinks still ran their own refillable systems in these countries, but for a negligible aggregate market share.

Elements of our dataset go back to 1999, and in 40 of the 82 countries represented in the data, including mainland China, Nigeria, Thailand and Vietnam, refillable bottles were still used for the majority of drinks. By 2019, in a slightly larger dataset of 93 countries, just four of them saw a majority of drinks sold in refillable bottles - Columbia, the Philippines, Venezuela, and Germany.

Across those 82 countries with a complete dataset from 1999 to 2019, only four showed an increase in market share held by refillables. In each case it is clearly associated with a change in one or other specific beverage sector.



Unlike deposit return, the use of refillable systems is now most widespread outside Europe.

Morocco saw just 2% of carbonates (fizzy soft drinks) sold in refillable glass in 2009, but by the very next year this was up to 22%, and by 2019 29% of carbonates were sold in refillable glass after a 2016 peak. The carbonates market in Bosnia & Herzegovina also led a small overall increase over this period, with that segment going from a 20% refillable share in 1999 to 33% in 2019. Costa Rica similarly saw a 45% increase in refillable market share for beer over this period, which contributed to a small overall increase. Saudi Arabia saw a tiny overall increase, driven again by carbonates: the market there remains overwhelmingly supplied via single-use containers. The explanations for these instances of increased national refillable market share are not immediately obvious, and further investigation could prove fruitful.

Unlike deposit return, the use of refillable systems is now most widespread outside Europe. Germany is the only European country amongst the top 10 countries for refillable use, by absolute unit volume, with mainland China, Mexico, India and the Philippines making up the rest of the top five.

In most of that top 10, absolute volumes of refillable units sold have risen over that 20 year period, and, looking across the whole of this dataset, we see a marginal aggregate increase in refillable units sold, from 230m in 1999 to 233m in 2019. However, in all these countries, in the context of substantially increased sales of drinks in single-use containers, refillables now claim a smaller market share, down by between 16% and 52%.

Brazil illustrates this trend neatly, as the table below shows. While the overall volume of refillables increased marginally between 1999 and 2011, as a share of a growing market refillables fell from 40% to 24%.

Across those same 10 countries, the table shows that single-use PET containers outsold refillables for the first time, on average, almost 10 years ago. The increase in sales of other single-use packaging, especially cans, further eroded the refillable market share. Overall, looking at the most recent four years of data, the market share for refillables across the whole dataset is falling at just over 0.5% per year.

Figure 2

Top 10 countries by sales, with market shares for 1999 and 2019, and change in market share over that period

Country	Market share refillable 1999	Market share refillable 2019	Change 1999-2019
Mainland China	52%	22%	-30%
Germany	73%	54%	-19%
Mexico	53%	27%	-26%
India	87%	34%	-52%
Philippines	86%	59%	-27%
Brazil	40%	24%	-16%
Colombia	91%	54%	-37%
Nigeria	87%	43%	-44%
Vietnam	52%	31%	-21%
Thailand	51%	20%	-31%
Total Top 10	60%	29%	-31%

By comparison, the global data, dominated by markets like the US where refillables held negligible market share throughout this time period, shows metal cans increasing less steeply from a higher base, but second only to single-use PET bottles by the end of the time period considered.

In many of those markets the transition of beer in particular from refillable glass to single-use aluminium cans had taken place prior to 1999. The charts below, again, show the rapid shift to single-use PET dominance taking place over this period.

Figure 3

All beverage sales, 1999 – 2019, by material: top 10 countries, total refillable sales 2019

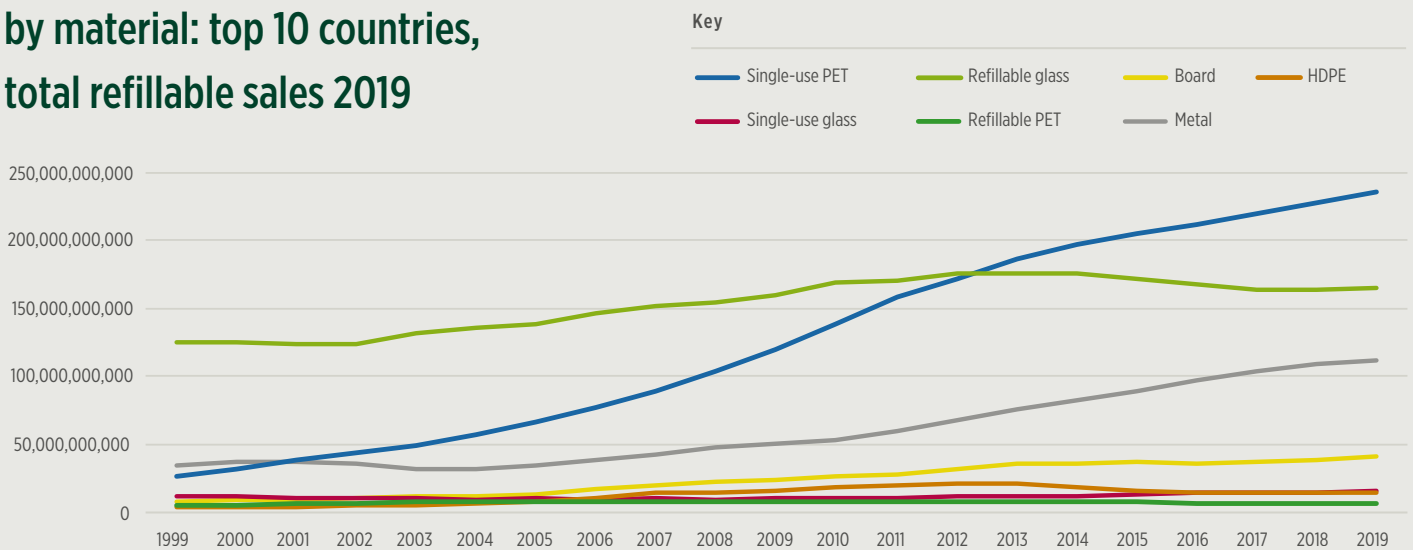
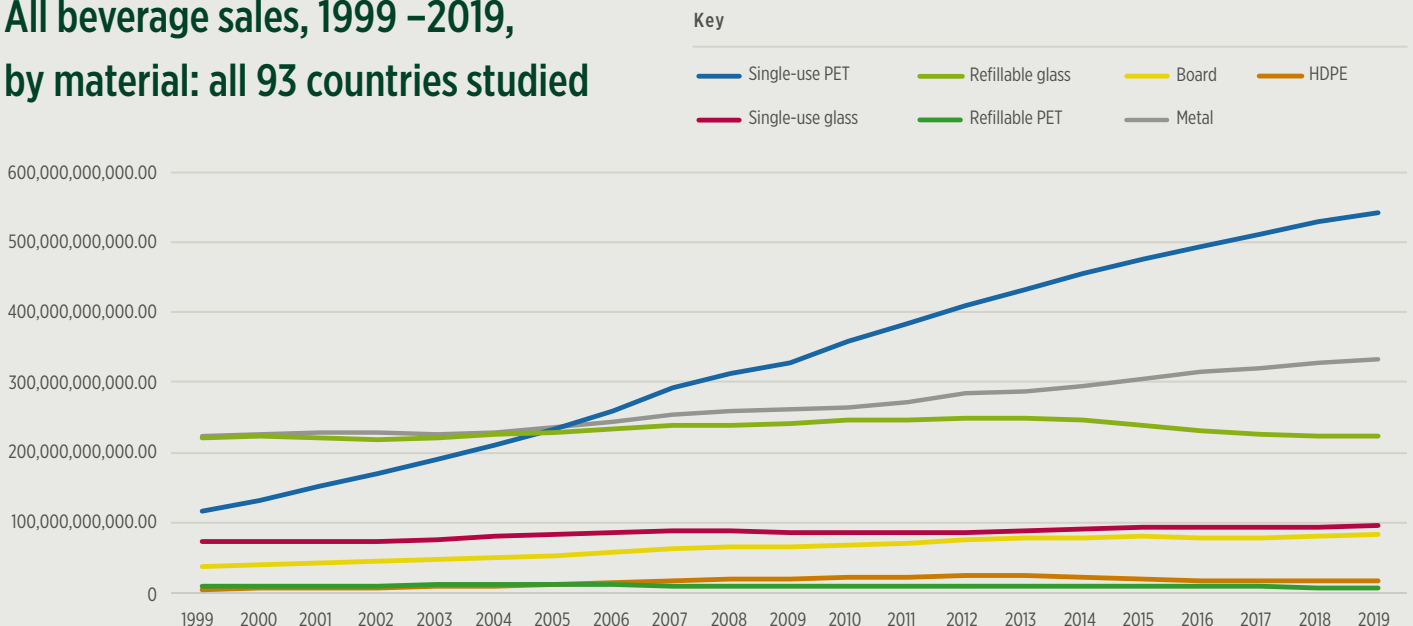


Figure 4

All beverage sales, 1999 –2019, by material: all 93 countries studied



The example of Mexico is also very telling. In 1999, 55% of carbonates were sold in refillables. In 2000 Vincente Fox, the former Chief Executive of Coca-Cola Mexico, was elected President, and served until 2006. By 2009, the refillable share of that beverage segment was down sharply to 31%, although it stabilised over the next decade to 2019, only falling another 3% points to 28%.

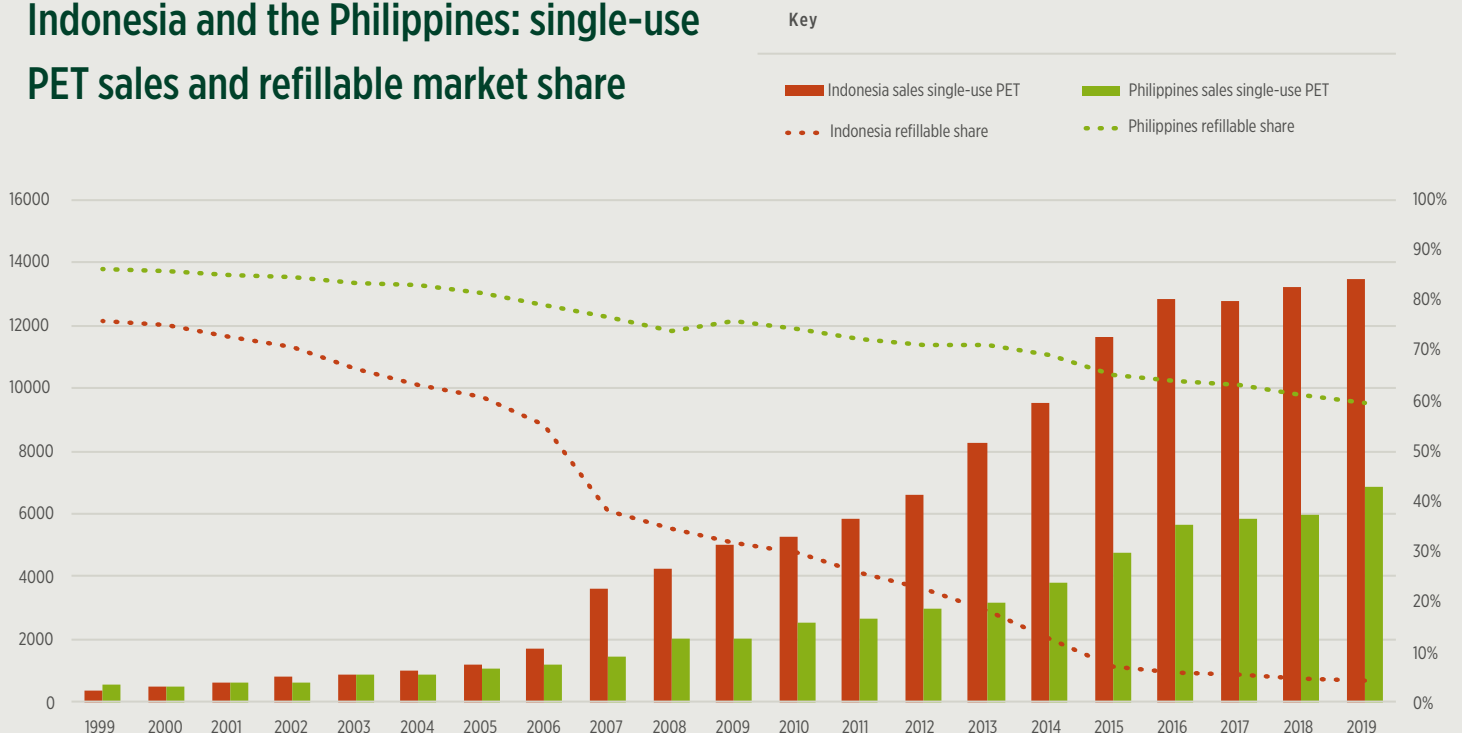
Comparing the Philippines to Indonesia illustrates how a relatively resilient refillable market share can affect the change in the volume of single-use PET bottles sold (and hence wastage) - especially when compared to Indonesia, where the refillable sector has almost disappeared.

In 2019 refillables retained 59% of the overall market in the Philippines, the highest level seen in Asia, albeit down from 86% in 1999. Over that period, the sale of single-use PET bottles did increase substantially - from over 500m in 1999 to nearly 7,000m in 2019: i.e. more than 13 times as many were sold during the last year for which we have data.

However, in Indonesia, where the refillable market share has fallen from 76% in 1999 to just over 4% in 2019, we see sales of single-use PET bottles increase from 374m in 1999 to 13,481m by 2019. This is an almost 36-fold increase, much sharper even than that seen in the Philippines.

Figure 5

Indonesia and the Philippines: single-use PET sales and refillable market share



However, this absolute disparity is not seen in wastage per capita figures, given that Indonesia has a much higher population than the Philippines (267m vs 106m). GA Circular, commissioned by Coca-Cola, published [data in 2019](#) which showed the recycling rates for PET only in six Asian countries: Indonesia, the Philippines, Vietnam, Thailand, Myanmar, and Malaysia. Using those numbers, while noting the producer interest in that research, we can estimate per capita wastage figures for PET only in five of those six countries (the GlobalData dataset does not cover Myanmar).

The data shows Indonesia is actually the lowest, given markedly lower overall levels of consumption, with 38 PET bottles wasted per person per year, while Malaysia and Vietnam are both at 43, and Philippines just above that at 44. The outlier from this group is Thailand, at 117. This is a result of markedly higher sales of drinks in PET containers in Thailand - more than three and half times as many are sold per capita as Indonesia, which has the lowest sales in this group.

Despite the widespread decline in refillable market share, there are areas where this may change, typically led by industry rather than by the kind of governmental measures discussed in the recommendations. For example, [Coca-Cola in Brazil](#) has been moving to reintroduce refillable PET bottles for carbonated beverages, and the company is aiming for 40% of their drinks in that category to be sold in this format in future. If the whole carbonates sector in Brazil had achieved that refillable market share in 2019 the number of single-use containers sold in the country would be reduced by more than 2 billion. We note here that, in the absence of good data for the current recycling rates, the current wastage level for Brazil cannot be estimated.

In order to maximise the ecological and economic benefits associated with refillables, there are a range of modest policy requirements which have proved effective when seeking to reduce wastage.

First, the benefits of refillables are correlated with the high collection rates associated with the refundable deposit, and with high rotations (ideally, as close as possible to their maximum lifespan, of course). These are sensible performance indicators for policy-makers to prioritise where the sector is subject to regulation.

Similarly, no refillable containers can be reused forever, so it is important also to require all refillable containers to be made from readily recyclable materials. This reduces the risk of wastage at their end of life.

Relatedly, appropriate market segments could be subject to refill targets or quotas. The aim here is to establish whether other regulations and support are providing a sufficient steer to the market, and to help close off opportunities for some producers to continue to externalise a higher proportion of their costs back onto the public sector.

Per-manufacturer refillable containers (typically used for brand recognition purposes, mainly through the use of particular shapes) also increase aggregate market costs. Policy-makers should consider supporting systems where producers can rent a standard refillable bottle (or one from a range of standard bottles). The providers of such bottles may also be the best bodies to wash and sterilise bottles for reuse.

While measures of this sort can help protect or build a refillable sector in partnership with producers, those territories which have retained relatively stronger refillable sectors have largely done so as a result of cultural factors, including strong traditions of refillable use in particular segments (like beer, in some countries) and also wider attitudes to waste and circularity.

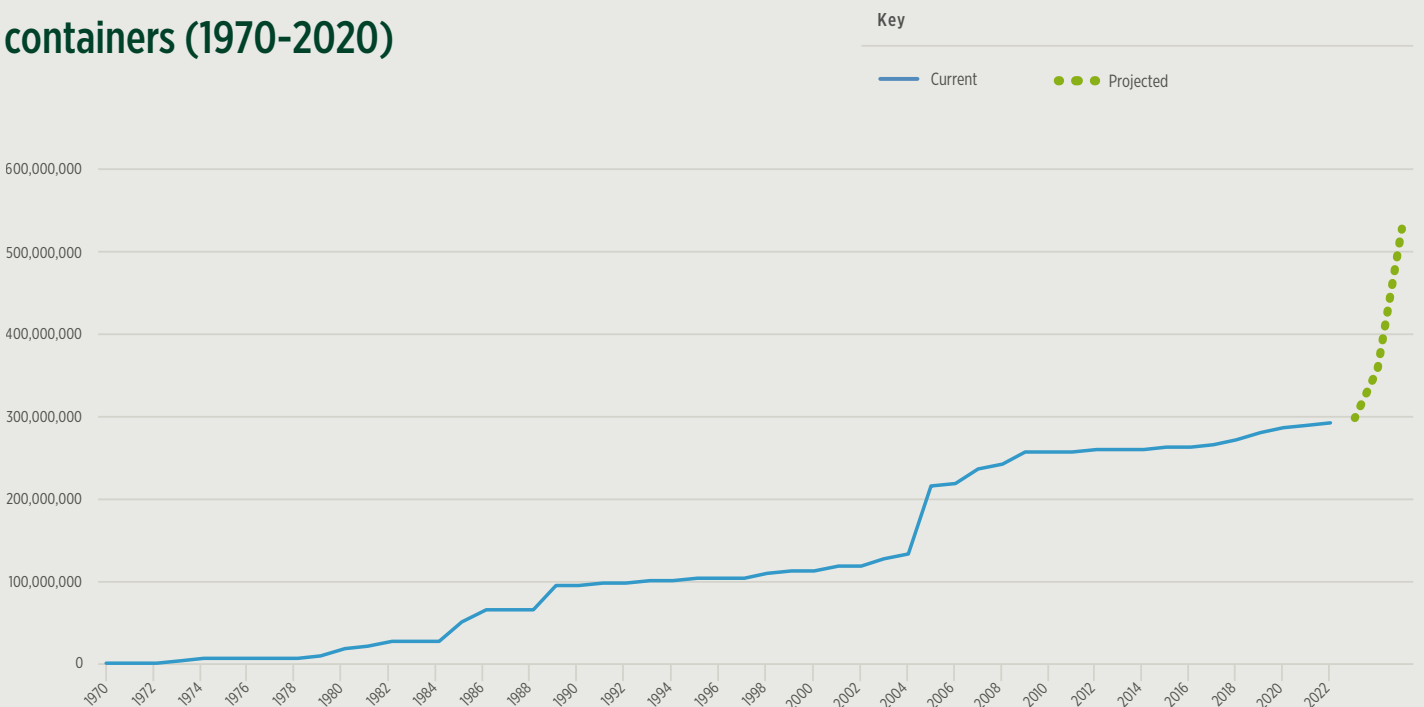
Deposit return

Deposit return systems charge the consumer a small deposit on drinks containers, a sum which is refunded in full when they return the empty container, either over the counter or through a reverse vending machine. These systems began to spread in the early 1970s, and can now be roughly divided into those early return-to-depot systems, which encompass most of the US states with deposits, and modern return-to-retail systems, predominant (although diverse in detailed implementation) in Europe, especially Scandinavia and the Baltic countries.

Deposit return is spreading rapidly as an effective model for states and territories to use to reduce wastage costs. By the end of 2020, 291 million people lived in countries or territories which used deposits, a figure expected to reach almost 500 million by the end of 2023. The overwhelming bulk of those systems are of the modern type, with all capturing PET bottles and metal cans, many also covering single-use glass, and some even including board and other materials.

Figure 6

Global population with access to deposit return systems for single-use beverage containers (1970-2020)



Within Europe, this trend is likely to accelerate soon: Romania and Turkey have start dates set in law, as does Scotland. EU member states without a deposit system are likely to adopt one to meet the terms of the [Single Use Plastics Directive](#), which sets a 77% separate collection target for plastic bottles by 2025, going up to 90% by 2029, a target which is not met anywhere without the use of deposit return.

Policy-makers are increasingly looking to embed circular resource management practices to achieve a range of objectives, both economic - as the process of implementing and running a national deposit system is shown to create a significant net gain in new jobs - and environmental, including improving communities by reducing litter. To give one example of the potential for litter reduction, Eunomia conducted research on the effect a deposit return system will have in Scotland on littering rates. Despite a population of just 5.5m, they estimate that each day [140,000 bottles and cans](#) are littered in Scotland that would have been collected via deposit return. The Scottish Government similarly estimate the daily carbon savings associated with deposit return at [131 tonnes](#), and the daily savings for local government if deposit return were introduced at just over £0.5m across Scotland ([see par 65 here](#)).

Comparing all deposit territories to all non-deposit territories (irrespective of refillable share), we see a marked difference in wastage per capita. In deposit territories this rate averages to 24 containers wasted per year, but is more than four and half times higher in non-deposit territories at 112 containers per year.



The typical country-wide deposit return system sees median return rates of 91% for PET, 89% for cans, and 87% for glass. This allows us to see what the impact would be of adopting a system of that sort. For example, if Greece introduces a deposit system that achieves those return rates, it would reduce its annual wastage of PET bottles from 1.5 billion to just 207 million, reduce can wastage by 233 million, and glass wastage by 122 million.

Recycling rates for countries in the global south are much harder to obtain. In 2014 mainland China's overall plastics recycling rate was reported at [22.8%](#): it is of course much more speculative, but we can calculate wastage as if that rate was accurate for PET drinks containers. If that were the rate, more than 90bn PET bottles would have been wasted. Adopting a typical deposit return system would have seen wastage fall that year to just over 10bn.

The example of the United States is particularly stark. Their overall drinks container sales per capita is the highest in this dataset, almost 15% higher per capita than Belgium in second place. Of the 50 states, 10 have deposit return systems of one sort or another, with Oregon's and Michigan's systems being the best performing, delivering return rates comparable to the modern European systems. Oregon was the first state to pass a "bottle bill" in 1972, and modernised its system at the start of 2018. It now operates in a similar way to those European deposit systems, although does not pay the retailer handling fee typical across Europe (with handling fees being one of the principles Reloop believes to be a key factor of a best-in-class system). Michigan achieves a 90% return rate, while the Oregon Beverage Recycling Cooperative, which handles the bulk of containers in Oregon, saw a rate of [90.8% in 2019](#), similar to the median national deposit system discussed above.

Using recycling data from US sources per material ([NAPCOR for PET](#), the [Aluminum Association](#), and the [Environmental Protection Agency](#) (EPA) for glass), we can estimate the overall reduction in wastage if the whole of the United States adopted a system with a 90% return rate, i.e. as efficient as those two state systems. In 2017, 137 billion drinks containers were wasted nationally: this would fall to just over 20 billion with deposit return.

As discussed above, the effectiveness of refillable systems at reducing overall wastage is primarily a function of three variables: deposit level, market share, and return rates (i.e. how often a container is collected and refilled).

The equivalent to market share for a deposit return system, though, is scope: what materials and/or drinks are mandated to be sold with a refundable deposit? Those systems which are limited to metal cans and PET bottles will inevitably do nothing to reduce wastage of glass bottles, cartons, or other materials.

Furthermore, a broad scope is important to reduce the risk that manufacturers switch materials to avoid deposits, although there are technological or market restrictions on this - for example, carbonated materials cannot be sold in cartons, and there may be consumer resistance to packaging change for particular drinks or segments.

Return rates, of course, matter exactly as much for deposit systems for single-use containers as it does for refillables. The most obvious variable here, as with refillables, is the use of an appropriate deposit level - high enough to motivate consumers to return containers but not so high that they distort the market.

However, ease of container return is just as important, which points toward a return-to-retail model rather than return-to-depot. This would typically require limited exemptions for small retailers and options for voluntary return points, as well as systems for return via delivery systems, which are showing a steady increase in popularity with consumers.

Other elements of best practice for deposit return - such as how a system should be run, what handling fees should be paid to retailers, etc - are covered in [analysis for ReLoop here](#).

Conclusion

How these measures work together to reduce wastage

Europe, especially northern and western Europe, give us a unique opportunity to consider how this pair of measures affect wastage levels in comparable territories, separately and together.

Modern deposit return systems are concentrated in these markets, and there are a moderate number of countries with a relatively strong refillable market share here too. We also have better data for this region, with sales and recycling numbers available, both broken down by material, for 27 countries, albeit only for 2017.

This richest part of the dataset allows us to make clear comparisons between four approaches, where “uses refillables” is defined as having a refillable market share of 25% or more across drinks categories:

“unmoderated markets”

Territories without deposit return and with a refillable market share below 25%, instead relying on kerbside or other communal recycling facilities, shown in ■ purple below.

“refill and deposits”

Territories with a refillable market share at 25% or above and a deposit return system, shown in ■ green below.

“refillable only”

Those territories with a refillable market share at 25% or above but without deposits for single-use containers, shown in ■ orange below.

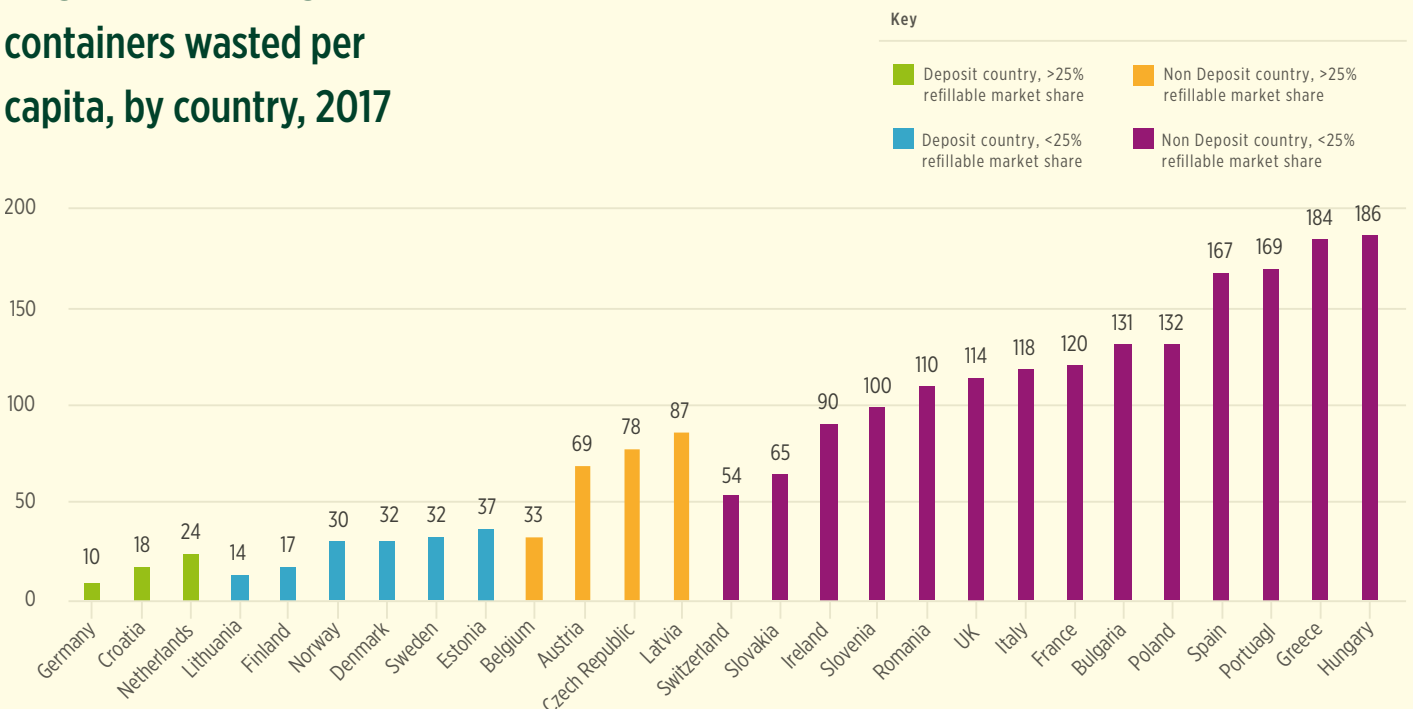
“deposits only”

Those that use deposits for single-use containers but have a refillable market share below 25%, shown in ■ blue below.

The chart below shows how those 27 European countries, once divided into those four categories, score in terms of wastage of containers.

Figure 7

Single-use beverage containers wasted per capita, by country, 2017



It should be noted that the deposit return system operational in the Netherlands does not yet include cans or PET bottles below 1l in size, although that will change in July 2021 as smaller PET bottles for water and carbonates are brought into scope (cans for water, carbonates and beer will also be included from the end of December 2022). We have used the PET return rate for those larger bottles already in scope to generate this wastage figure, so the actual wastage figures for the Netherlands will be substantially higher than shown here (although it is likely to be a close approximation to their figures once the inclusion of smaller PET bottles has bedded in).

Even 24 per capita per year, though, already makes the Netherlands the worst-performing country in that top category, i.e. countries with a 25% refillable share and a deposit return system. This factor also means the Netherlands data cannot accurately be shown in the PET-specific chart below.

The dataset we are using here does not always align with in-country data: for example, in Norway their deposit system operator records a markedly higher volume of beverage sales overall. The only place this makes a marked difference to the chart above is with Austria, where the data shows a refillable share of 29%, but Austrian government data shows it at just 21%. This would move them into the “unmoderated markets” section, where they would be the third best-performing country. This chart uses the GlobalData dataset throughout for methodological consistency.

The per capita American wastage figure is more than twice that of any other national number calculated by Reloop.

With that caveat in mind, the gap between the best- and worst-performing systems in this dataset is not small - Hungary and Greece both see more than 18 times more drinks containers wasted per capita per year than best-placed Germany. Looked at another way, Germany is the only country where the average monthly drinks container wastage per person is below one, whereas in Hungary one container is wasted per person every 48 hours.

The only two other countries we have data for here are the USA and Canada. Canada would appear above Poland and below Spain, with 139 containers wasted per capita per year. The American figures are, as far as this dataset goes, in a class of their own, with 422 wasted containers per capita per year, slightly over half of which are PET bottles.

This per capita American wastage figure is more than twice that of any other national number calculated by Reloop. As discussed earlier, all such wastage figures can be assumed to be an underestimate due to certain known limitations in the data. This general disparity can be illustrated using the US data in two ways.

First, we have used the EPA’s 2017 glass recycling rate of 38.9%, but information from the Container Recycling Institute (CRI) indicates that the EPA substantially underestimates glass containers put onto the US market, and that a rate of 27% is more likely to be accurate. If we applied a 27% glass recycling rate it would increase the 2017 wastage number from 422 to 435 per capita.

Second, and more significant, the GlobalData sales figures do not cover wines and spirits, overwhelmingly sold in glass in the US, nor milk, nor do they cover pouches and board, predominantly used for non-alcoholic drinks. Again using estimates from CRI, the overall wastage figure with those beverage and packaging types added in is expected to be closer to 600 than to 500, per capita, markedly above the figures produced by our model. This illustrates how important it is for policy-makers to have access to accurate, comprehensive and transparent in-country data on both sales and recycling rates.

As the chart clearly shows, the combination of both measures is, on average, the best way to reduce wastage, although the best-performing deposit-only systems, typically inclusive in terms of materials scope, are competitive here. Although “refillable only” countries score less highly than “deposit only” ones, they still show a reduction in wastage, on average, of almost 46% compared to the unmoderated markets which include some of the continent’s most populous countries.

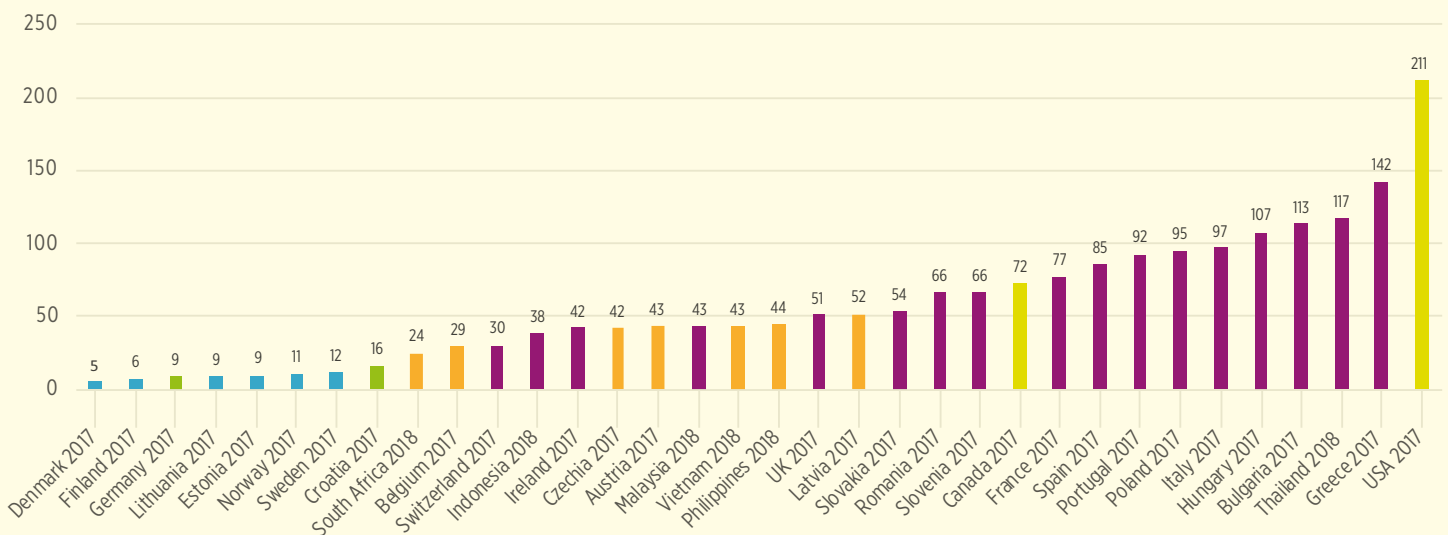
Finally, the GA Circular dataset discussed above allows us to show levels of PET-only wastage across a range of countries where we cannot always generate wastage of other materials, and again the correlation between deposit return and lower wastage levels is clear.

Figure 8

Single-use PET beverage containers wasted per capita, by country, 2017/18

Key

- Deposit country, >25% refillable market share
- Non deposit country, >25% refillable market share
- Partial deposit country, <25% refillable market share
- Deposit country, <25% refillable market share
- Non deposit country, <25% refillable market share



Whether any individual unmoderated market should adopt a refillable or deposit return system as a next step to reduce their own wastage levels will depend on their economic and political context, and perhaps also historical experience. However, the litter reduction and improved resource management effects they share, and their common financial incentive for the consumer, plus their requirement for packaging waste collection infrastructure, means that either or both would be a positive step.

In reality, a deposit system for single-use containers creates supporting system conditions for a refillable system, and vice versa, both in terms of the collection infrastructure and consumer engagement.

In a European context, the most effective way to minimise wastage remains both measures and, in Reloop's view, that approach is the ideal more widely, subject to local conditions.

The relationship between refillable market share and the presence of a deposit return system is complex and varies widely according to the specifics of regulation, business decisions and consumer culture.

Finland, for example, had a refillable market share of 80% in 1999, three years after their deposit return system launched. This share had dropped to 4.3% by 2019, with the change predominantly driven by a cut in taxes on single-use containers introduced in 2004.

In Lithuania, however, refillable market share has actually grown slightly since their deposit system launched in 2016, from 16.3% in 2015 to 17.2% by 2019, mostly in the beer category. The chair of USAD, the deposit return system administrator, has [set out in detail](#) how the interoperable design of these two systems has worked both for consumers and to protect refillable glass market share.

In Germany, the refillable market share has fallen since the 2003 introduction of deposit return, but the story is not as it is sometimes represented. Refillable market share was falling continent-wide as producers took the opportunity to reduce the costs to them, but as [has been noted](#): *“the decline in the use of refillables was less pronounced in Germany, from a market share of 71.1% in 2000 to 54.9% in 2017, and the introduction of the one-way DRS [deposit return system] can be considered a significant causative factor”*.

To put this discussion into a broader context, mechanisms which allow producers to recover their containers, either for refill or recycling, should be understood as part of the broader extended producer responsibility agenda. The costs of running these systems fall on producers, and typically they are also in a position to ensure they run as efficiently as possible, i.e. they are not permitted to externalise their costs associated with packaging, but they are permitted to minimise those costs where not at the expense of the societies they operate in.

In Lithuania refillable market share has grown slightly since their deposit system launched in 2016.

The consumer may not have considered whether a particular bottle they return through a reverse vending machine is destined for refill or recycling - that sorting takes place behind the scenes. They merely know it is not being wasted.

At first glance, approaches which both charge the consumer a deposit might look like “consumer responsibility” schemes. However, with both refillables and deposit return, the net costs of running the system are borne by industry - excluding the unredeemed deposits, which reduce those costs - and the consumer gets their money back in full when they return their empties.

This model may also be applicable to other markets, beyond the scope of this report, most obviously starting with the adjacent market for single-use cups for hot drinks, where again deposits and uniform returnable cups are starting to be implemented in some local areas.

In general, the experience of the post-war expansion in single-use products and packaging shows that the principle of extended producer responsibility, with 100% net cost recovery, is the most significant policy lever in terms of reducing waste, unlike consumer education or other non-regulatory measures.

The economic incentive of small refundable deposits, either to recover refillable bottles or a broader spectrum of single-use materials for recycling, simply works. But, even better, in those territories where both are in operation and working well, such as Germany, the experience for the consumer is typically seamless, with the ultimate outcome being a return rate of all containers of up to 98%. In some cases they will be returning refillable bottles to retail outlets which specialise in those markets, or it will be obvious that a metal can will be recycled once returned. In other cases, though, as the Lithuanian example above shows, they may not even have considered whether a particular bottle they return through a reverse vending machine is destined for refill or recycling - that sorting takes place behind the scenes. They merely know it is not being wasted.





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