

The background of the entire page is a close-up, artistic photograph of several glass bottles. The bottles are out of focus, with a shallow depth of field that highlights the necks and shoulders of the glass. The lighting is warm and golden, creating a soft glow on the glass surfaces. The bottles appear to be empty and are arranged in a way that suggests a collection or a display.

OAKDENE HOLLINS  
RESEARCH & CONSULTING

# Raise the Glass

*A report to provide the glass packaging industry with the scientific evidence  
to inform debate on any proposed introduction of mandatory policies on  
food and drink containers in the EU-28 Member States*

*October 2018*

# Raise the Glass

*Value-driven  
consulting*

*Science-led  
research*

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## Contents amendment record

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## *Glossary*

ARA	Altstoff Recycling Austria
CEP	Circular Economy Package
DPG	Deutsche Pfandsystem GmbH
DRS	deposit-return system
EFTA	European Free Trade Area
EPR	extended producer responsibility
EU-28MS	28 Member States of the EU
HORECA	hotels, restaurants and catering (sector)
MS	Member State (of the EU)
PET	polyethylene terephthalate
PPWD	Packaging and Packaging Waste Directive 94/62/EC
PWC	Price Waterhouse Cooper
RVM	reverse vending machine
SEK	Swedish Krone
SGÅ	Svensk Glasåtervinning
USAD	Užstato Sistemos Administratorius

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# 1 Executive summary

On 14 June 2018, the EU Waste Package was published in the Official Journal. This included legally binding EU targets for the recycling of glass packaging across all 28 EU Member States (EU-28MS) as detailed within the Circular Economy Package (CEP) of:

- A minimum recycling rate of 70% for glass by 2025.
- A minimum recycling rate of 75% for glass by 2030.

This supercedes the previous mandatory recycling targets that formed part of the EU-28MS obligations under the 1994 Packaging and Packaging Waste Directive (PPWD) – 94/62/EC.

This study investigates two key questions:

- Are mandatory deposit return schemes (DRS)<sup>1</sup> for one-way glass the best policy option for meeting the glass recycling targets? If not;
- What alternative approaches to increasing recycling rates for glass can be used?

## 1.1 Deposit return schemes for one-way glass

There are currently eight Member States of the EU-28MS operating national DRS policies for one-way beverage containers: Table 1 shows which materials have been included for each country. There is currently a strong political focus on DRS across Europe; countries such as England and Scotland have committed to implementing DRS and other countries are actively considering such policies.

Table 1: Deposit schemes for one-way beverage containers in use across the EU-28MS

Country	Mandate implemented	Materials included		
		Glass	PET	Cans
Croatia	2006	✓	✓	✓
Denmark	2002	✓	✓	✓
Estonia	2005	✓	✓	✓
Finland <sup>2</sup>	1996 cans, 2008 PET, 2012 glass	✓	✓	✓
Germany	2003	✓	✓	✓
Lithuania	2016	✓	✓	✓
Netherlands	2005		✓	
Sweden	1984 cans, 1994 PET		✓	✓

Source: The Reloop Platform, deposit systems for one-way beverage containers: global overview 2016 and 2018.

<sup>1</sup> The mandatory DRS for one-way packaging is much like the long-running voluntary DRS operating in the refillable beverage container market, where the consumer is incentivised to return empty containers to reclaim their deposit, paid at the point and time of purchase.

<sup>2</sup> [www.palpa.fi/beverage-container-recycling/deposit-refund-system/](http://www.palpa.fi/beverage-container-recycling/deposit-refund-system/)

This section of the study looks at three elements of the DRS:

- the impact the DRS policies in place across the EU-28MS have had on glass recycling rates
- the evolution of DRS policies for one-way beverage containers and
- the impact the introduction of a DRS can have on the market share of packaging.

### 1.1.1 Impact of the DRS on glass recycling rate

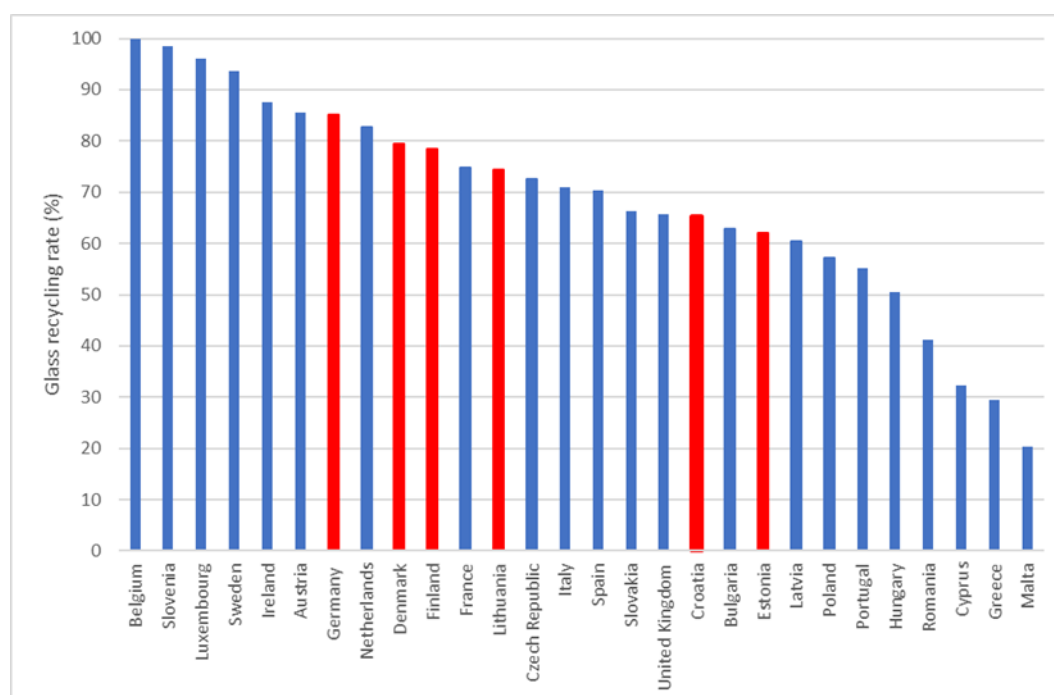
This section looks at:

- A review of the recycling rate for overall glass packaging.
- A review of the recycling rates in Member States operating a DRS for one-way glass packaging.

#### A review of the recycling rate for overall glass packaging

Figure 1 shows the recycling rates for overall glass packaging for the EU-28MS in 2015, with the Member States operating DRS for one-way glass beverage containers shown in red. This shows that the best performing MS operating a DRS is Germany. Although it has a recycling rate of 85.2%, which far exceeds the 2030 CEP target of 75%, it is only ranked 7<sup>th</sup> in the list. Estonia is the poorest performer operating a DRS, ranked 21<sup>st</sup> in the list with a recycling rate of 62.1%, just above their PPWD 2012 target of 60%.

Figure 1: Recycling rate for glass packaging in 2015 in the EU-28MS



Source: Eurostat. Cyprus and Malta = 2014 data.

Key: Red = MS operates a DRS for one-way glass; Blue = MS does not operate a DRS for one-way glass

Note: Lithuania is highlighted in red, but the DRS was not introduced until 2016, and hence the 74.3% recycling rate in 2015 pre-dates the introduction of the DRS.



### ***A review of the recycling rate in MSs operating a DRS for one-way glass packaging***

A review of the MSs operating DRS shows that the DRS is typically only applied to a select number of product categories, and hence alternative policies are used to increase recycling rates in the non-DRS mandated product categories. For example, Table 2 shows that the German DRS covers only beer, water and soft drinks and this accounts for just 4.6% of the total packaging glass collected for recycling in Germany. The majority of the glass (84.3%), which includes wine, spirits and food jars, is collected via the extended producer responsibility (EPR) schemes in operation.

*Table 2: Product categories included in deposit schemes for one-way beverage containers across the EU-28MS*

Country	Product categories included in the DRS
<b>Croatia</b>	Juices; mineral water; other waters; beer; wine; hard liquor and milk drinks in volume < 0.2l
<b>Denmark</b>	Beer (alcohol content > 0.5% by volume); carbonated soft drinks (alcohol content of 0–0.5%); energy drinks; mineral water; iced tea; ready-to-drink beverages (incl. lemonade, alcopops, energy drinks and cider products); mixer products where spirits, wine or other fermented products are mixed with other beverages such as soft drinks, cider, chocolate or juice (alcohol content 0.5% - 10%)
<b>Estonia</b>	Soft drinks; water; beer; cider; juice; juice concentrates; nectars; low-ethanol alcoholic beverages (up to 6% volume)
<b>Finland<sup>3</sup></b>	Almost all soft drinks; water; beer; cider; long drinks; sport drinks; juice; liquor/spirits/wine sold by Alko
<b>Germany</b>	Water (mineral water carbonated or non-carbonated, spring water, healing water, table water, water with additives, e.g. aroma, caffeine, oxygen, all other drinkable waters); beer & mixed drinks containing beer (incl. alcohol free beer); carbonated / noncarbonated soft drinks; mixed alcoholic drinks
<b>Lithuania</b>	Beer and beer cocktails; cider and other fermented beverages; mixed alcoholic and non-alcoholic beverages; all types of water; juice and nectars sold in glass, plastic, and metal (tin) packaging. Fruit wines and wine-product cocktailers are included when sold in plastic and metal packaging.

*Source: The Reloop Platform, deposit systems for one-way beverage containers: global overview 2016 and 2018*

Table 3 overleaf shows a comparison, where available, of the glass return rates of the respective DRS versus the overall glass recycling rates (as shown in Figure 1). This shows the high rates of return (above 80%) in all MS where data was available, and this is typically much higher than the respective overall glass recycling rates. For example, in Estonia in 2015 the return rate from the DRS is 87% and the overall glass packaging rate is 62.1%. It is reported that the exclusion of strong alcoholic beverages (vodka, wine, etc) and glass jars is a significant contributing factor and it would require a significant investment to include these product categories within the DRS.<sup>4</sup>

<sup>3</sup> <https://www.palpa.fi/beverage-container-recycling/deposit-refund-system/>

<sup>4</sup> Earth Care Ltd. Personal communication 14 August 2018.



Table 3: Glass return rates versus overall glass recycling rates across the EU-28MS and EFTA

Country	Glass return rate (%)			Overall glass recycling rate in 2015 (%)
	2015	2016	2017	
<b>Croatia</b>	Not available			65.2
<b>Denmark</b>	89	90		79.5
<b>Estonia</b>	87		88	62.1
<b>Finland<sup>5</sup></b>	88	88	87	78.4
<b>Germany</b>	Not available			85.2
<b>Lithuania</b>			83	74.3

Source: The Reloop Platform, deposit systems for one-way beverage containers: global overview 2016 and 2018

A review of the DRS and EPR schemes operating in Finland highlights the significant cost differences. RINKI reports that in Finland the EPR glass recycling fee currently (2018) stands at 112 euro per tonne, a reduction from the 135 euro per tonne figure for both 2016 and 2017.<sup>6</sup> The DRS recycles 130-140 million one-way glass units per year with recycling fees<sup>7</sup> in the range of 0.0792 to 0.2205 euro per container, depending on the type of container. Therefore, the glass recycling fees in the Finnish DRS are much higher, at between 205.92 and 617.4 euro per tonne. RINKI suggests<sup>8</sup> that this is due to the relatively high cost of DRS infrastructure - i.e. expensive reverse vending machines versus cheap 'bring banks' - and also the far greater number of collection points.

### 1.1.2 Evolution of DRS for one-way beverage containers

Table 1 shows that the date in which the DRS for one-way containers was implemented varies significantly - from the introduction of the scheme for cans, implemented in Sweden in 1984, to the implementation of the DRS scheme for one-way containers in Lithuania in 2016. The review of the schemes shows that there are three main drivers for implementation:

- To protect the market for refillables.
- To support the recycling of one-way beverage packaging during the transition from refillables to one-way packaging.
- Anti-littering and collection of single-use PET beverage containers.

#### Market protection of refillables

The product categories for which current DRSs have been implemented, (beer, water and soft drinks) were traditionally in refillable (predominantly glass) containers operated via industry-managed voluntary schemes. In countries such as Germany, the refill market for the beer sector is still buoyant and has strong industrial support from the brewers; the DRS on one-way containers was introduced in 2003 to assist in maintaining a high market share of beverages in refillable containers. The deposit fee on the one-way containers is higher

<sup>5</sup> [www.palpa.fi/beverage-container-recycling/deposit-refund-system/](http://www.palpa.fi/beverage-container-recycling/deposit-refund-system/)

<sup>6</sup> Finnish Packaging Recycling RINKI Ltd. EPR of non-deposit glass packaging in Finland. FERVER, General Assembly, 7th June 2018, Helsinki.

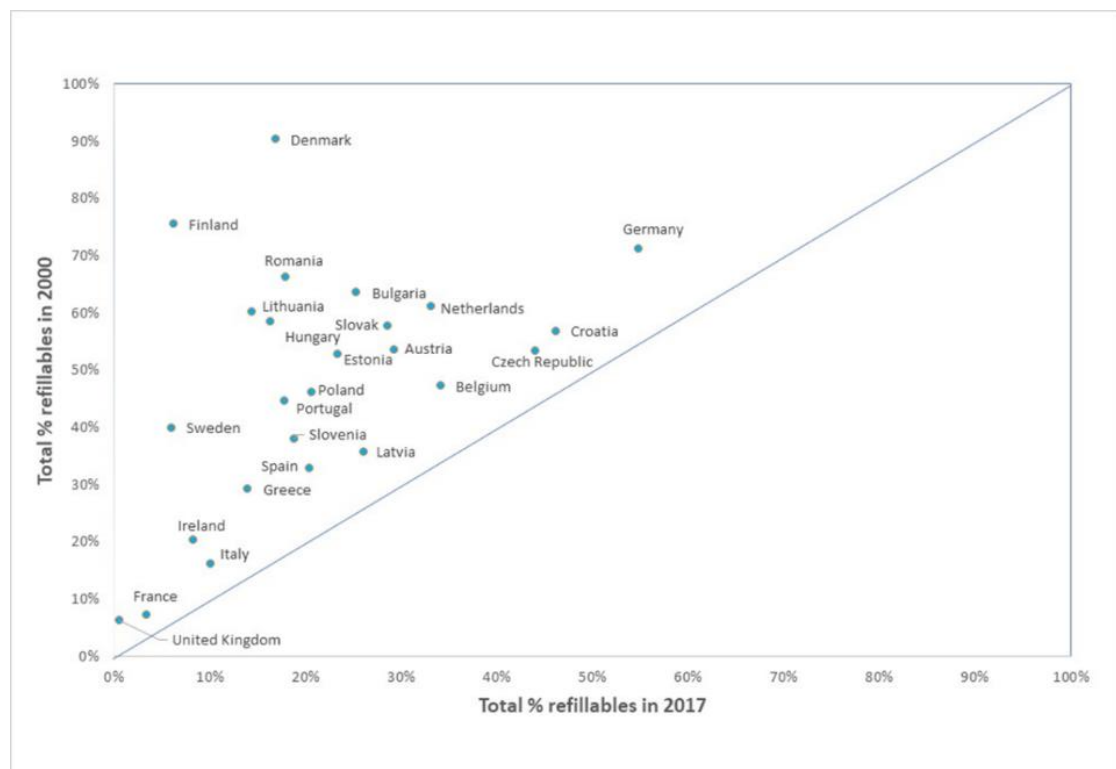
<sup>7</sup> [palpa.fi/static/studio/pub/Materiaalipankki/Hinnastot/Price+list\\_Glass+bottle\\_2018-01-01.pdf](http://palpa.fi/static/studio/pub/Materiaalipankki/Hinnastot/Price+list_Glass+bottle_2018-01-01.pdf)

<sup>8</sup> Finnish Packaging Recycling RINKI Ltd. Personal communication 21 August 2018.

than that of the voluntary DRS on refillables, which gives the consumers the financial incentive to buy the refillables. From the consumer perspective, return mechanisms for both refillable and one-way containers appear identical, i.e. packaging and crates are returned to retailers and hence, unlike in other countries, there is no additional 'convenience' to the disposing of a one-way container over the refillable container.

Figure 2 compares the market share of refillable containers in the beer, carbonates and bottled water categories in 2000 and 2017. It shows that 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 can be considered a significant causative factor.

*Figure 2: Scatterplot of the market share of refillables in beverage containers (beer, carbonates and bottled water) in the EU-28MS*



Source: Produced by Oakdene Hollins using data from Global Data

### ***Supporting the recycling of one-way beverage packaging during the transition from refillables to one-way packaging***

Conversely, in Denmark, Finland and Sweden, who also have a long history of using refillables via voluntary DRS, a mandatory DRS<sup>9</sup> for one-way containers has been introduced in each country to transition from refillables to one-way containers. These use the existing infrastructure and require little change in consumer behaviour, while transitioning from predominantly refillable glass bottles to one-way glass, PET and cans.

<sup>9</sup> The mandatory DRS for one-way containers in Sweden does not include glass, i.e. is only for cans and PET containers.

Other amendments to national mandatory policies, such as the abolition of the “can ban” in Denmark (2002) and the abolition of the eco-tax on one-way containers in Finland (2008), have also contributed significantly to the rapid decline in refillables in these countries. For example, Figure 2 shows that in Denmark, where the DRS on one-way containers was introduced in 2002, the market share of refills fell from 90.3% in 2000 to 16.9% in 2017 and in Finland, where the DRS on one-way glass was introduced in 2012, the market share in refillables fell from 75.5% to 6.2%.

### ***Increasing recycling of one-way containers / anti-littering***

Like Germany, Denmark, Finland and Sweden, Lithuania has a long history in the use of voluntary DRS for refillables and Figure 2 shows that in 2000 the market share in refillables stood at 60.2%. However, unlike in Finland and Sweden<sup>10</sup> where material-specific DRSs were introduced when the market shares in each material reached a certain level, the Lithuanian scheme was specifically set up to increase the recycling rate of PET beverage containers. It is reported that the material-specific recovery rates from the deposit scheme at the end of 2017 were 83% for glass, 92% for PET and 93% for cans. The PET recovery rate is considered a particular success since the recovery rate was only 34% before the scheme was implemented.<sup>11</sup> The increase in recycling rate for glass is less pronounced since the overall glass recycling rate in 2015 was 74.3% (Figure 1).

Consultations currently underway in Scotland and England are focused primarily on the introduction of mandatory DRS on one-way beverage containers as an anti-littering initiative with a particular emphasis on PET beverage containers. From a one-way glass perspective, a key challenge in the implementation of a DRS in these countries - as with Italy, France and Ireland - is that they are countries that have predominantly single-use beverage packaging (please see Figure 2), and will therefore need heavy investment in developing the DRS infrastructure, changing consumer behaviour and raising consumer awareness, unlike the countries discussed above.

#### ***1.1.3 Impact on the market share of packaging***

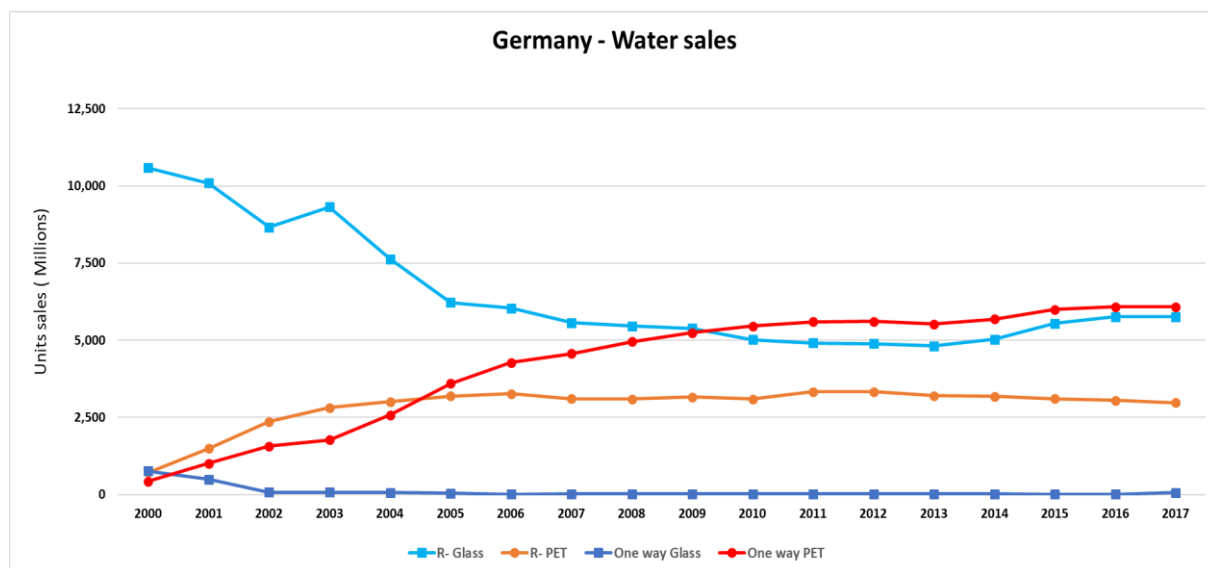
Figure 3 shows the market share of the water sales in Germany by packaging format. This shows that the market share of one-way glass dropped significantly pre-2003, before the one-way DRS was implemented. Originally retailers were only obliged to take back their own containers and this led to the so called ‘island solution’ in which retailers, especially the discounters, were heavily selective on the containers they would stock. This suggests that it is in the glass manufacturers’ interest to support the development of an effective glass collection scheme, since mandatory collection systems can affect market share.

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<sup>10</sup> For example, the can deposit system was introduced in law in Sweden after a multi-national producer started to manufacture cans in Sweden.

<sup>11</sup> [www.openaccessgovernment.org/recycling-lithuania-deposit-system-exceeds-all-expectations/45003/](http://www.openaccessgovernment.org/recycling-lithuania-deposit-system-exceeds-all-expectations/45003/) Accessed 17 July 2018

Figure 3: Germany – bottled water sales between 2000 and 2017



Source: Produced by Oakdene Hollins using data from Global Data

## 1.2 Alternative approaches to increasing recycling rates

This section of the study investigated the waste management structure and national policies in two countries with the highest glass recycling rates in Europe that do not operate DRS for one-way glass; namely, Sweden and Austria (ranked 4<sup>th</sup> and 6<sup>th</sup>, see *Figure 1*). Spain was also investigated, not because it is currently one of the very high performers, but because of the significant growth in glass recycling since 2002.

Further analysis was undertaken on the total and the per capita quantity of glass that is not recycled.

### 1.2.1 Sweden

Sweden adopted EPR legislation in 1994 as a means of transposing the PPWD. Household packaging is mainly collected through a national network of 5,800 'bring' sites, where clear and coloured glass are collected separately. Only one-third of households (mainly in apartment buildings) have access to 'close to home' collection but the plan is to increase this in line with higher recycling targets for 2020 set out by revised legislation in 2014.<sup>12</sup> The bring sites (recycling stations) are primarily financed by producer fees and supplemented with incomes from the sale of secondary raw materials.

Sveriges Bryggerier reports<sup>13</sup> that the quantity and quality of glass recovered is extremely high due to the long-established habit (since the 1950s) of bringing waste packaging to bring banks for recycling.

<sup>12</sup> PMCA Economic Consulting. *A deposit-refund system for Ireland? Experiences from other European countries.* December 2017.

<sup>13</sup> Sveriges Bryggerier. *Personal communication 29 August 2018.*

### 1.2.2 Austria

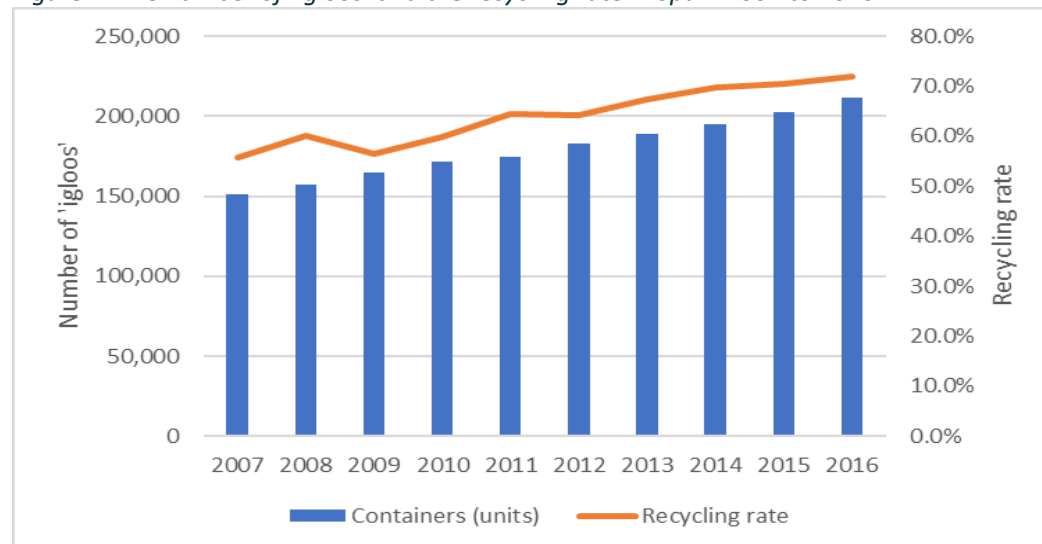
Currently 85% of glass (around 240,000 tonnes) is collected through the EPR scheme. Vetropack reports that there is no kerbside collection of glass from households, although a bring bank is, on average, located within 300-400 metres of every household. The glass is not typically colour-separated at bring banks, but Vetropack collects, colour sorts and reprocesses it at one of its two factories in Austria. Vetropack reports that the contamination rate is 5-6% in the glass collected from the bring banks.<sup>14</sup> According to Austria Glas Recycling<sup>15</sup> the high recycling rate and the low contamination rate in Austria is explained by very strong educational messages targeted at primary school level.

Additionally, in Austria, the Federal Ministry of Sustainability and Tourism has recently launched “*Reinwerfen statt Wegwerfen*” (English: “Toss it in the bin”), a voluntary initiative for businesses and social partners to improve the ecological performance of packaging (mainly beverage containers). This nationwide anti-littering campaign scheme receives between 700,000 and 1 million euro of annual funding from packers/fillers and retailers, and seeks to raise public awareness to prevent littering and promote the separate collection and recycling of packaging.

### 1.2.3 Spain

Unlike Sweden and Austria that have a long history of high glass recycling rates, Spain has seen a rapid growth in recycling from just 36.3% in 2002 to 70.4% in 2015. In 1997, the Packaging and Packaging Waste legislation (97/11) was introduced, which included the introduction of the EPR scheme. The EPR scheme operates like many of the Green Dot schemes operated across Europe, whereby packaging companies finance the scheme based on the weight of material they place on the market. The national EPR administrator for glass, Ecovidrio, has focussed on increasing the number of collection points (bottle banks called ‘igloos’). Figure 4 shows how the number of igloos have increased in Spain and the subsequent increase in glass recycling.

Figure 4: The number of ‘igloos’ and the recycling rate in Spain 2007 to 2016



Source: Produced by Oakdene Hollins using data from Ecovidrio

<sup>14</sup> Vetropack Austria GmbH. Personal communication 27 August 2018.

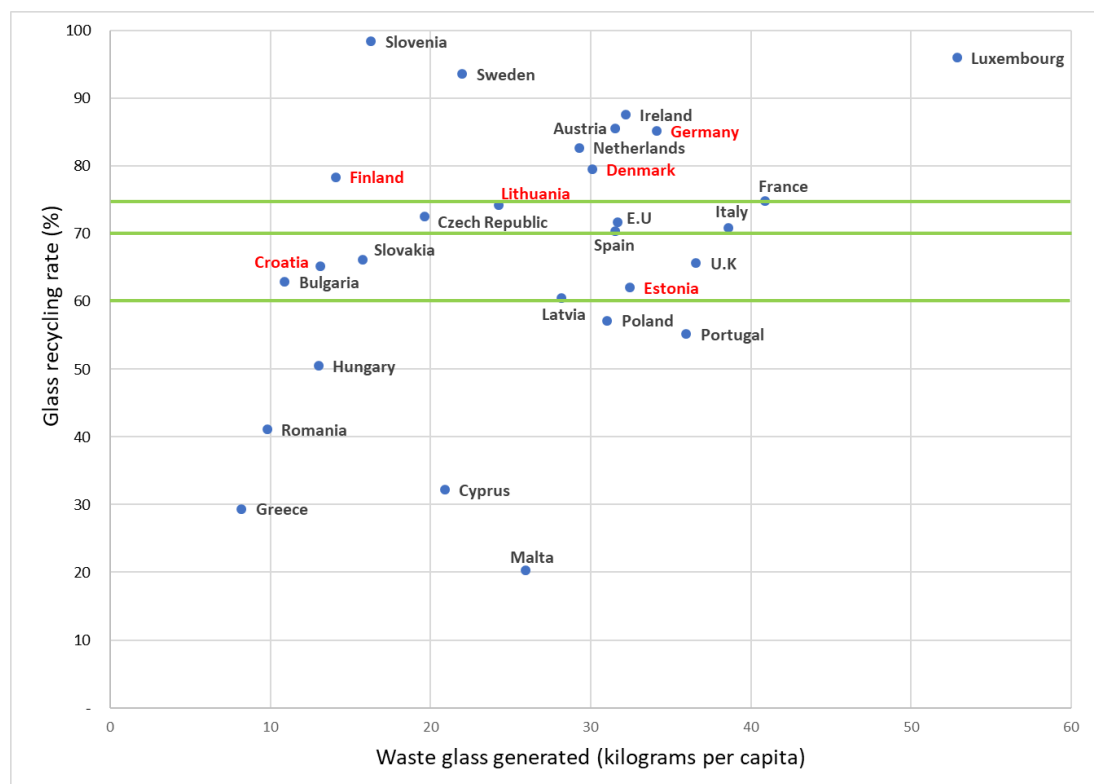
<sup>15</sup> Austria Glas Recycling GmbH. Personal communication 27 July 2017.

### 1.2.4 Review of relative quantities of glass waste arisings

Figure 5 shows the scatterplot of recycling rate versus the waste glass generated per capita within the EU-28MS. The three horizontal green lines show the three aforementioned recycling targets, and the six DRS schemes are shown in red. In Hungary, Romania and Greece, where the recycling rate is lower than the 60% PPWD target, less than 12kg per capita of glass waste is generated per annum. In these countries the economics of operating a glass collection scheme can be challenging. However, Portugal recycled less than 60% of its glass and generated 35.18 kg per capita in 2015, and therefore represents a more significant issue in terms of the quantity of glass that is not currently being recycled. This, again, suggests that glass manufacturers maybe best placed to support the development of an effective glass collection scheme to gain access to additional cullet.

The September 2018 report by the European Commission<sup>16</sup> “on the implementation of EU waste legislation, including the early warning report for Member States at risk of missing the 2020 preparation for re-use/recycling target on municipal waste” highlights the following common issues associated with the poor recycling performance: lack of recycling infrastructure and collection systems, ineffective EPR, lack of financial incentives to improve recycling and the lack of incentives for households to participate in separate collection.

Figure 5: A scatterplot of the waste glass generated per capita versus the glass recycling rate in 2015 by EU-28MS



Source: Adapted by Oakdene Hollins using Eurostat data

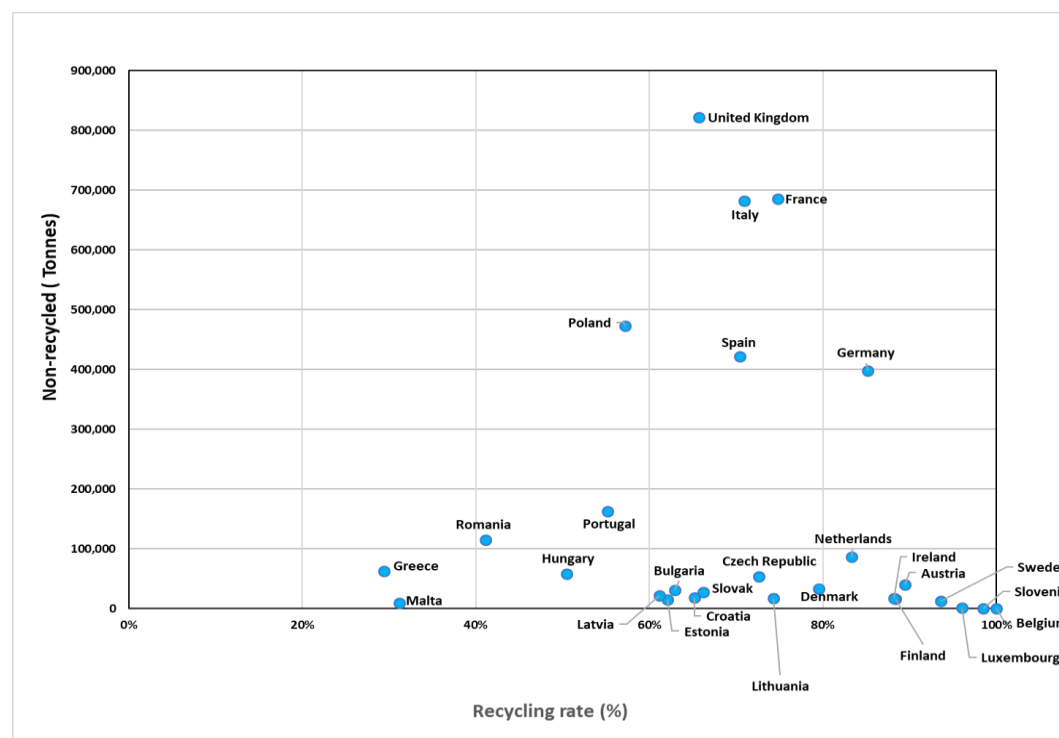
<sup>16</sup> [http://ec.europa.eu/environment/waste/pdf/waste\\_legislation\\_implementation\\_report.pdf](http://ec.europa.eu/environment/waste/pdf/waste_legislation_implementation_report.pdf)

### 1.2.5 Review of absolute quantities of glass waste arisings

Up to now, this study has focussed on the appraisal of the policy instruments with respect to the CEP and PPWD targets. However, this section takes a more circular economy approach by investigating the ‘leakage’ from the system, i.e. the quantities of glass that are not recycled within the EU-28MS.

According to Eurostat, 4.28 million tonnes of glass was not recycled in the EU-28MS in 2015 and Figure 6 shows that three countries with the highest tonnage (UK 822,000 tonnes, France 685,000 tonnes and Italy 682,000 tonnes) account for 51.1% (2.19mt) of the total non-recycled glass across the EU-28MS. France and Italy have already met the 70% 2025 CEP target and the UK is on track, recycling 65.7% of glass in 2015. However, from a circular economy perspective this is a significant quantity of glass to be lost from the economy each year and raises the question of whether more can and should be done at a national level to increase recovery rates. For example, the tradeable permits scheme in place in the UK was developed to be the ‘least cost option’ in terms of meeting the PPWD recycling targets. However, the mechanism does not motivate any additional recycling beyond the targets, since the value of the tradeable permits becomes worthless once the target is reached. Increasing the recycling target above that of the European legislative targets would drive up the recycling rates using this mechanism.

Figure 6: A scatterplot of the quantity of non-recycled glass versus recycling rate (%) by EU-28MS in 2015



Source: Adapted by Oakdene Hollins using Eurostat data



## 1.3 Conclusions

Traditionally, the mandatory DRS on single-use packaging has been introduced in countries that had a well established voluntary DRS for refillable beverage containers. The existing infrastructure and established consumer 'bring-back' culture enabled the switch from collection of refillables to collection of single-use beverage containers.

Currently, national debates on DRS are no longer focused on refillables, but on solving the relatively poor recovery rates for plastic, especially with the rise of the on-the-go market for beverages. Some DRS schemes include one-way glass, others do not. It shows that there is no single ideal DRS system, and the case for each needs to be analysed separately.

The study shows that where one-way glass has been included in a deposit return scheme, it has not been a decisive measure in increasing the recycling rates. The highest recycling rates for glass are achieved where there is source-separated collection of glass packaging, good governance of waste management systems, and effective public communication initiatives.

While the average EU glass recycling rate is high, at 74%, there is still a huge potential for improvement on the overall performance in glass recycling. From a circular economy perspective, whether it is in absolute terms (volume of waste not recycled per country) or in relative terms (glass waste generated per capita), there remains a noticeable leakage of glass from the economy.

This study emphasises the need for glass packaging manufacturers to actively support source-separated collection systems in Member States.

## 2 Background

This study investigates the impact of mandatory legislation with regard collection of packaging (typically, extended producer responsibility schemes) and beverage packaging (typically, deposit-return systems) on the market share for one-way glass containers.

### 2.1 Mandatory policies on one-way beverage containers

There are three types of policies in place across Europe: deposit return systems, eco-taxes and tradable permits.

#### 2.1.1 Deposit-return systems

A deposit-return system (DRS) is a system in which consumers pay a deposit for a container when purchasing a beverage and receive a refund of the deposit when they return the container. The main purpose of the deposit is to provide an economic incentive to consumers to return their empty containers. Traditionally, DRSs in Europe were paid on refillable containers with the primary objective of maximising trippage<sup>17</sup> rates; in Europe such systems tended to be voluntarily established and managed by the producers who had an financial interest in recovering packaging for reuse. In more recent times, DRSs with mandatory deposits have been introduced by governments, aimed at recovering one-way containers, in order to reduce litter or increase recycling rates.

#### 2.1.2 Eco-taxes

Eco-taxes or tariffs are used as an extended producer responsibility (EPR) policy to ensure that the end-of-life management costs associated with the recovery and reprocessing of the used containers are covered. The eco-tax is used to address the issue that producers of beverages in one-way packaging generally only pay for a share of the end-of-life management costs.

#### 2.1.3 Tradable permits

The UK operates the Packaging Recovery Note scheme as part of its strategy to meet its recycling obligations. Lithuania had a similar scheme, but this was abolished in 2012.

### 2.2 Project goals and objectives

#### 2.2.1 Goal

To shape the understanding of the glass packaging industry on the potential impact on one-way glass from the introduction of deposit schemes for one-way beverage containers. The study will also compare the relative performance of deposit schemes against alternative interventions in terms of:

- Impact on the recycling rates (including material quality).
- Cost of setting up and running the schemes.

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<sup>17</sup> 'Trippage' is the number of trips a bottle makes, including the first filling, until it is taken out of circulation.

### 2.2.2 Objectives

The objective of this study is to undertake a comprehensive 'objective' market study of existing voluntary and mandatory beverage container schemes currently in place in Europe, and to appraise each scheme in terms of the impacts the scheme has had / is having on the container glass industry.

The objective is to evaluate the performance of the alternative policy interventions in terms of:

- Meeting the policy objectives.
- Impact on the market share in glass.

## 2.3 Study methodology

The study methodology is split into three sections:

- Policy review. Review of the mandatory policies in place within the EU-28MS on beverage containers and one-way glass packaging;
- Impact of mandatory policies on recycling rates; and;
- A detailed review of the national policies in 6 Member States; 3 operating DRS for one-way glass and 3 operating EPR with no DRS for one-way glass.

### 3 Policy review

After the enactment of the 94/62/EC - Packaging and Packaging Waste Directive (PPWD) in 1994, EU Member States (MS) were required to implement waste management systems to fulfil their recycling and recovery targets. Box 1 provides a summary of the relevant details on recycling contained in the Directive.<sup>18</sup>

#### Box 1: Key points of Directive 94/62/EC from a recycling perspective

**Article 1** (Objectives): This Directive lays down measures aimed, as a priority, at preventing the production of packaging waste and, as additional fundamental principles, at reusing packaging, at recycling and at other methods of recovering packaging waste and hence at reducing the final disposal of such waste.

**Article 1** (Scope): This Directive covers all packaging placed on the market in the community and all packaging waste, whether it is used or released at industrial, commercial, office, shop, service, household or any other level, regardless of the material used.

**Amendment 2 of the Directive** (Directive 2004/12/EC adopted 18-2-04): No later than 31 December 2008 the following minimum recycling targets for materials contained in packaging waste will be attained: (i) 60 % by weight for glass.

Greece, Ireland and Portugal may, because of their specific situations - namely (respectively): the large number of small islands, the presence of rural and mountain areas and the current low level of packaging consumption - decide to postpone the attainment of the targets until a date of their own choice which shall not be later than 31 December 2011.

**Amendment 3 of the Directive:** (Directive 2005/20/EC adopted 16-3-05). Member States having acceded to the European Union by virtue of the Accession Treaty of 16 April 2003 may postpone the attainment of the targets referred to in paragraph 1(b), (d) and (e) until a date of their own choosing which shall not be later than 31 December 2012 for the Czech Republic, Estonia, Cyprus, Lithuania, Hungary, Slovenia and Slovakia; 31 December 2013 for Malta; 31 December 2014 for Poland; and 31 December 2015 for Latvia.

<sup>18</sup> [eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:01994L0062-20150526&from=EN](http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:01994L0062-20150526&from=EN) Accessed 13 August 2018.

On 14 June 2018, the EU Waste Package was published in the Official Journal. This included legally binding EU targets for the recycling of glass packaging across all 28 EU Member States (EU-28MS) as detailed within the Circular Economy Package (CEP) of:

- A minimum recycling rate of 70% for glass by 2025.
- A minimum recycling rate of 75% for glass by 2030.

The European Commission (2006)<sup>19</sup> reported that, although the overall objective is similar for all MS, the operational strategies for achieving the targets vary considerably from country to country.

### 3.1 Deposit schemes for one-way beverage containers

Deposit schemes for one-way beverage containers is currently a subject of much political debate, driven by the attention on plastics packaging. The EC proposal on single-use plastics (aimed at tackling marine litter) includes a collection target for plastic drinks bottles<sup>20</sup>:

*“Member States will be obliged to collect 90% of single-use plastic drinks bottles by 2025, for example through deposit refund schemes.”*

However, opinion is divided on the relative merits of implementing such schemes. In general, deposit schemes are perceived as a measure that can support waste prevention by reducing littering and incentivizing consumers to bring back their empty packaging. Although it is often associated with reuse, the current debate on deposit schemes applies to one-way packaging, and beverage containers in particular. However, traditionally for glass, a deposit-return system was the system to operate refillable glass packaging, and this ‘dual-nature’ of deposits needs to be carefully considered when assessing the impact of deposits on one-way beverage containers.

For the European glass packaging industry, it is important to better understand the impact on the relative market share of glass packaging of a deposit scheme for one-way containers. Although glass is not usually the material most concerned with the introduction of a deposit, such a measure will have an impact as it is close-to-market and either discriminatory (applying to some materials only) or inclusive (applying to all materials) and is usually associated to the retail sector in one way or another.

Adding to the complexity is that no two deposit schemes operating in Europe are the same: schemes need to be integrated with existing national policies on packaging and must account for differences in consumer behaviour in terms of recycling culture, demographic trends, etc. Thus, deposit schemes are tailored to the individual countries / regions and the impact of replicating such schemes elsewhere is difficult to predict.

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<sup>19</sup> European Commission (2006). *Implementation of Directive 94/62/EC on Packaging and Packaging Waste and its Impact on the Environment, as well as on the Functioning of the Internal Market. Report from the Commission to the Council and the European Parliament*, European Commission, Brussels.

<sup>20</sup> [ec.europa.eu/commission/news/single-use-plastics-2018-may-28\\_en](https://ec.europa.eu/commission/news/single-use-plastics-2018-may-28_en)

## 4 Impact of mandatory policies on recycling rates

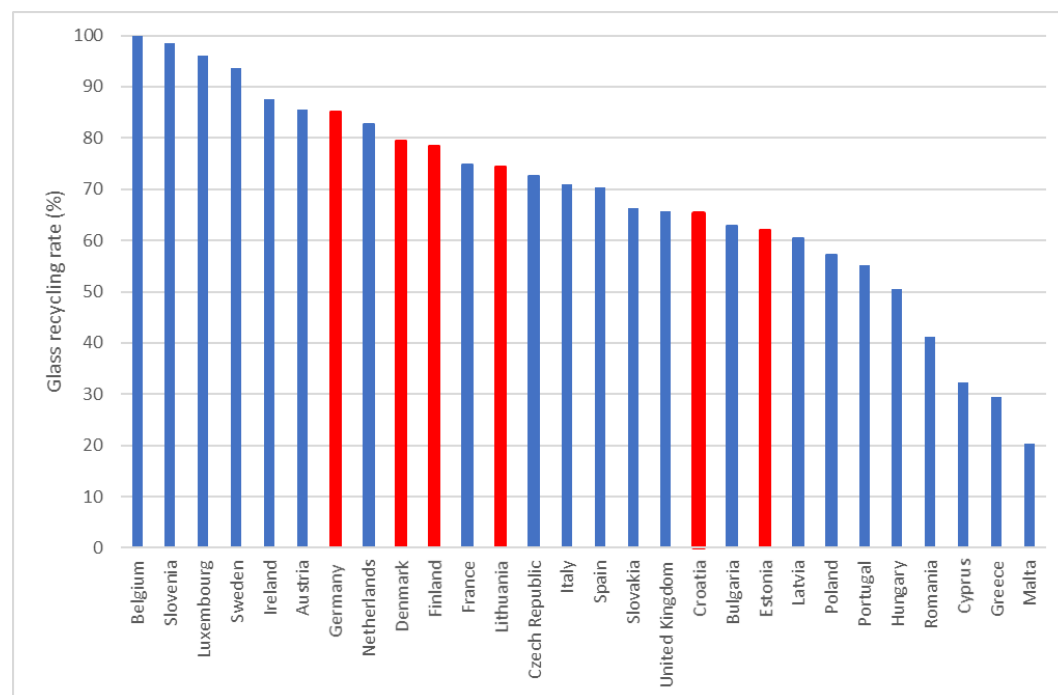
This section is split into the following subsections:

- A review of the overall glass packaging recycling rates within the EU-28MS.
- A review of the return rates for the DRS.
- A review of the poor performing Member States.
- A review of recycling rates from a circular economy perspective.

### 4.1 Overall glass packaging recycling rates within the EU-28MS

Figure 7 shows the recycling rates for glass packaging in 2015 as reported to Eurostat. The countries shown in red are those that currently operate a deposit scheme which includes one-way glass beverage containers. The figure shows that the six best-performing countries, all of which have already met the 2030 CEP glass recycling target of 75%, do not operate a deposit scheme for glass. The figure also shows that the seven worst-performing countries recycled less than the PPWD target of 60%, in 2015.

Figure 7: Recycling rate for glass packaging in 2015 in the EU-28MS



Source: Eurostat. Cyprus and Malta = 2014 data.

Key: Red = MS operates a DRS for one-way glass; Blue = MS does not operate a DRS for one-way glass

Note: Lithuania is highlighted in red, but the DRS was not introduced until 2016, and hence the 74.3% recycling rate in 2015 pre-dates the introduction of the DRS.

### 4.2 Return rates for the DRS

Table 4 shows that the countries operating a DRS are not the best performers overall. However, this is not due to the return rates for the DRS, but is because typically only a limited number of product categories are included within the DRS.

Table 4: Product categories included in deposit schemes for one-way beverage containers across the EU-28MS

Country	Product categories included in the DRS
<b>Croatia</b>	Juices; mineral water; other waters; beer; wine; hard liquor and milk drinks in volume < 0.2l
<b>Denmark</b>	Beer (alcohol content > 0.5% by volume); carbonated soft drinks (alcohol content of 0-0.5%); energy drinks; mineral water; iced tea; ready-to-drink beverages (incl. lemonade, alcopops, energy drinks and cider products); mixer products where spirits, wine or other fermented products are mixed with other beverages such as soft drinks, cider, chocolate or juice (alcohol content 0.5-10%)
<b>Estonia</b>	Soft drinks; water; beer; cider; juice; juice concentrates; nectars; low-ethanol alcoholic beverages (up to 6% volume)
<b>Finland<sup>21</sup></b>	Almost all soft drinks; water; beer; cider; long drinks; sport drinks; juice; liquor/spirits/wine sold by Alko
<b>Germany</b>	Water (mineral water carbonated or non-carbonated, spring water, healing water, table water, water with additives, e.g. aroma, caffeine, oxygen, all other drinkable waters); beer & mixed drinks containing beer (incl. alcohol free beer); carbonated / noncarbonated soft drinks; mixed alcoholic drinks
<b>Lithuania</b>	Beer and beer cocktails; cider and other fermented beverages; mixed alcoholic and non-alcoholic beverages; all types of water; juice and nectars sold in glass, plastic, and metal (tin) packaging. Fruit wines and wine-product cocktailers are included when sold in plastic and metal packaging.

Source: The Reloop Platform, deposit systems for one-way beverage containers: global overview 2016 and 2018

Table 5 shows the comparison between the return rates within the DRS and the overall glass recycling rates. Estonia represents a particularly interesting case with an overall recycling rate for glass of 62.1% and a return rate of the deposit scheme of 87% in 2015. Estonia introduced a mandatory DRS in 2004 for beer, low alcohol drinks, soft drinks, water, juice, cider and perry on all (refill and one-way) glass, metal and PET containers and is operated by Eesti Pandipakend LLC. The exclusion of strong alcohol in glass, such as vodka, wine, whisky, cognac, etc, is a significant contributing factor and it would require a significant investment to include these product categories within the DRS.<sup>22</sup>

Table 5: Glass return rates versus overall glass recycling rates across the EU-28MS and EFTA

Country	Glass return rate (%)			Overall glass recycling rate in 2015 (%)
	2015	2016	2017	
<b>Croatia</b>	Not available			65.2
<b>Denmark</b>	89	90		79.5
<b>Estonia</b>	87		88	62.1
<b>Finland<sup>21</sup></b>	88	88	87	78.4
<b>Germany</b>	Not available			85.2
<b>Lithuania</b>			83	74.3

Source: The Reloop Platform, deposit systems for one-way beverage containers: global overview 2016 and 2018

<sup>21</sup> [www.palpa.fi/beverage-container-recycling/deposit-refund-system/](http://www.palpa.fi/beverage-container-recycling/deposit-refund-system/)

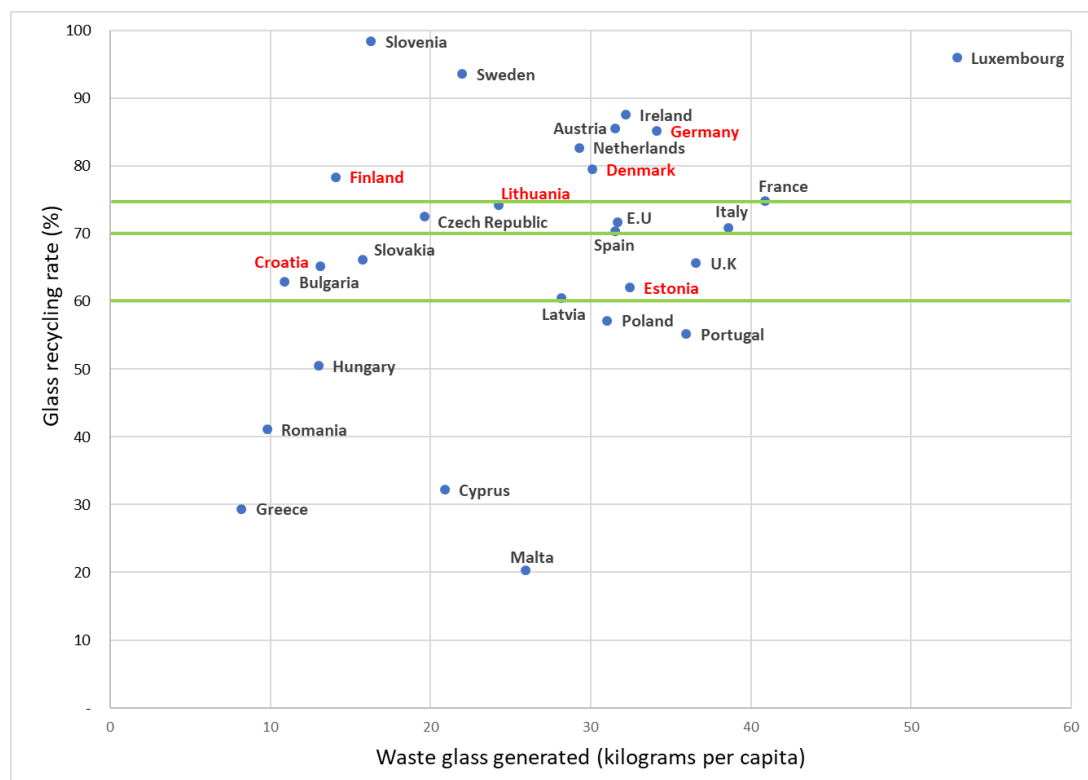
<sup>22</sup> Earth Care Ltd. Personal communication 14 August 2018.



### 4.3 Poorly performing Member States

Among countries with a recycling rate below 60% in 2015, Portugal and Poland are of most concern due to the high levels of waste glass per capita being generated, as shown in the scatterplot in Figure 8<sup>Error! Reference source not found.</sup>. Portugal generated 35.98 kg of glass waste per capita and Poland 31.03 kg per capita. Countries such as Greece, also fall under the 60% recycling rate, but represent a different challenge since they only generate 8.21 kg per capita of waste glass.

Figure 8: A scatterplot of the waste glass generated per capita versus the glass recycling rate in 2015 by EU-28MS



Source: Adapted by Oakdene Hollins using Eurostat data

The September 2018 report by the European Commission<sup>23</sup> “on the implementation of EU waste legislation, including the early warning report for Member States at risk of missing the 2020 preparation for re-use/recycling target on municipal waste” included conclusions for the poor performance of the seven Member States that fell under the 60% recycling rate for glass in 2015 (Table 6). This shows the following common issues associated with the poor recycling performance: lack of recycling infrastructure and collection systems, ineffective EPR, lack of financial incentives to improve recycling and the lack of incentives for households to participate in separate collection.

<sup>23</sup> [ec.europa.eu/environment/waste/pdf/waste\\_legislation\\_implementation\\_report.pdf](https://ec.europa.eu/environment/waste/pdf/waste_legislation_implementation_report.pdf)

Table 6: Summary of the conclusions from the Early Warning Reports

Member State	Reasons for poor recycling performance
<b>Cyprus</b>	The lack of infrastructure and collection systems for recyclables and for diverting biodegradable waste away from landfills; the lack of coordination between different administrative levels and insufficient capacity at the local level; the lack of incentives (including the absence of economic instruments) to prevent waste and improve recycling.
<b>Greece</b>	The absence of the infrastructure needed for source separation of recyclables; the general public's low level of awareness; a lack of financial incentives; the absence of relevant economic instruments, e.g. landfill tax.
<b>Hungary</b>	Lack of incentives for households to participate in separate collection; insufficient economic instruments to drive significant improvements in the sector.
<b>Malta</b>	Lack of infrastructure and collection systems for recyclables and bio-waste. Progress is also hampered by the lack of coordination between different administrative levels and insufficient capacity at the local level, and more generally by a lack of incentives (including economic instruments) to prevent waste and improve recycling. Moreover, the EPR scheme for packaging in Malta, along with its monitoring and enforcement, have been somewhat ineffective.
<b>Poland</b>	The separate collection of recyclables is not yet effective, that economic incentives for citizens to separate waste are missing and that the EPR schemes in Poland do not operate efficiently. In addition, some questions regarding the quality of waste data undermine the reliability of the high recycling rates reported to Eurostat.
<b>Portugal</b>	The separate collection of recyclables, including bio-waste, is not yet effective and Portugal relies heavily on treatment of mixed municipal waste. In addition, the economic incentives to support recycling are insufficient and the EPR schemes in Portugal do not fully cover the costs of separate collection.
<b>Romania</b>	Romania's separate collection service, including for bio-waste, is not being sufficiently implemented; there are not enough economic incentives to move away from disposal; extended producer responsibility schemes for packaging are not efficient and do not fully cover the costs of separate collection; the necessary infrastructure is still lacking; more investment is needed in projects higher up the waste hierarchy (e.g. recycling) that go beyond treatment of residual waste; public engagement in separate collection is very low.

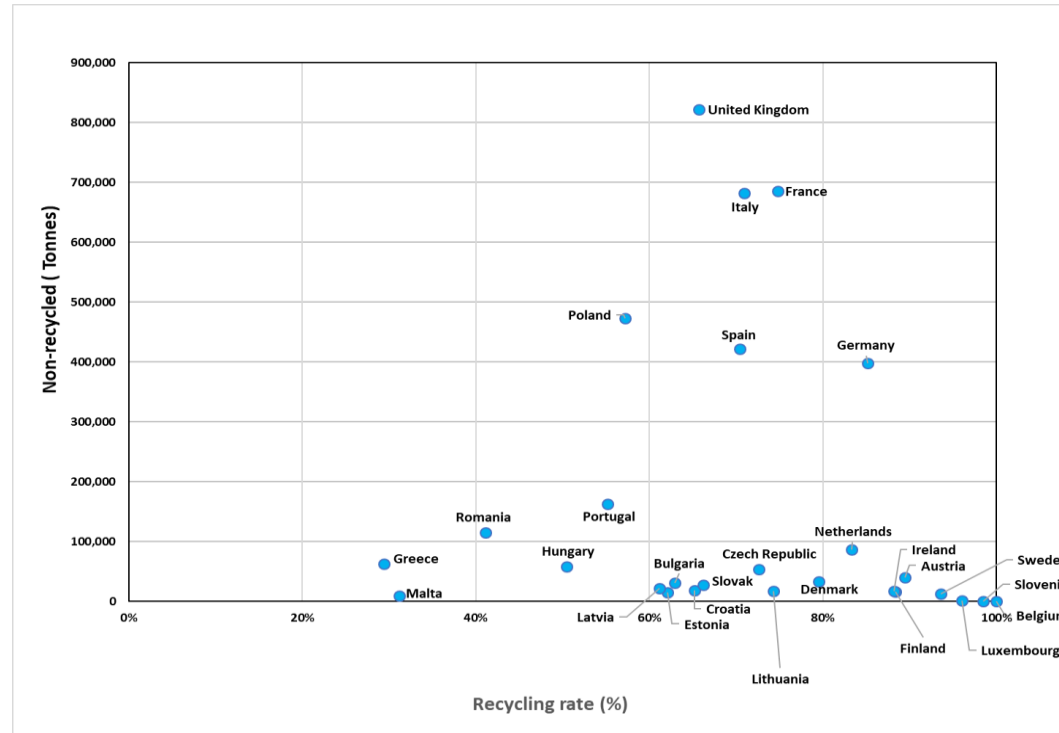
Source: [ec.europa.eu/info/news/commission-reviews-implementation-eu-waste-rules-proposes-actions-help-14-member-states-meet-recycling-targets-2018-sep-24\\_en](https://ec.europa.eu/info/news/commission-reviews-implementation-eu-waste-rules-proposes-actions-help-14-member-states-meet-recycling-targets-2018-sep-24_en)

#### 4.4 Recycling rates, from a circular economy perspective

Analysis of the Eurostat data showed that 4.28 million tonnes of waste glass were not recycled in 2015; Figure 9 shows a scatterplot comparing the quantity of non-recycled waste glass against the recycling rate (%). This shows that the UK, France and Italy together accounted for 2.19 million tonnes of the non-recycled glass, equivalent to 51.1% of the non-recycled glass across the EU-28MS. France and Italy have already met the 70% 2025 CEP target and the UK is on track, recycling 65.7% of glass in 2015. However, from a circular economy perspective this is a significant quantity of glass to be lost from the economy each year and raises the question of whether more can and should be done at a national level to increase recovery rates. For example, the tradeable permits scheme in place in the UK was developed to be the 'least cost option' in terms of meeting the PPWD recycling targets. However, the mechanism does not motivate any additional recycling beyond the targets, since the value of the tradeable permits becomes worthless once the target is reached.

Therefore, although the targets represent a significant driver, there is still a very long way to go before glass can be considered truly circular (in terms of the circular economy).

Figure 9: A scatterplot of the quantity of non-recycled glass versus recycling rate (%) by EU-28MS in 2015

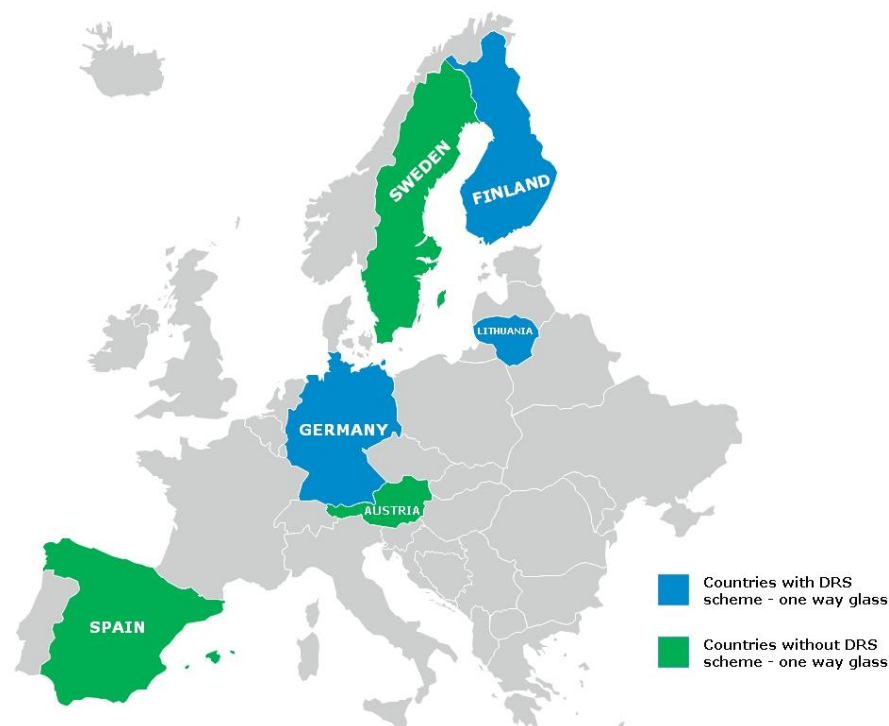


Source: Adapted by Oakdene Hollins using Eurostat data

## 5 Country level reviews

This section of the study describes and examines the institutional frameworks and recycling systems in use in six EU countries. Three of the countries have introduced deposit schemes on one-way glass beverage containers; namely, Germany (implemented in 2003), Finland (2012) and Lithuania (2016). By way of comparison, three further countries were selected that do not operate a deposit scheme for one-way glass: Austria (because it has a recycling rate for glass very similar to that of Germany; Sweden (because it excludes glass from its deposit scheme for one-way beverage containers but has a higher glass recycling rate than its neighbour Finland); and Spain (because its glass recycling rate increased significantly since 2002, much like Lithuania's). These six countries are mapped in Figure 10.

Figure 10: The countries reviewed in this study



The analysis for each country includes:

- Background to the policies.
- Impact on market share of one-way and refillable glass.
- The cost of implementation and operating the systems / schemes.
- The method of funding.
- The system operators.
- The quantity and quality of the glass being recovered.

The market analysis used the GlobalData data on the unit sales of beverages (beer, soft drinks and bottled water) by packaging material and format to determine the impact of the policy interventions on the market share of one-way and refillable glass.

Table 7 provides a summary of the policies in place in the six focus countries.

Table 7: Summary of national policies in place in the six countries of focus for one-way beverage containers and overall packaging

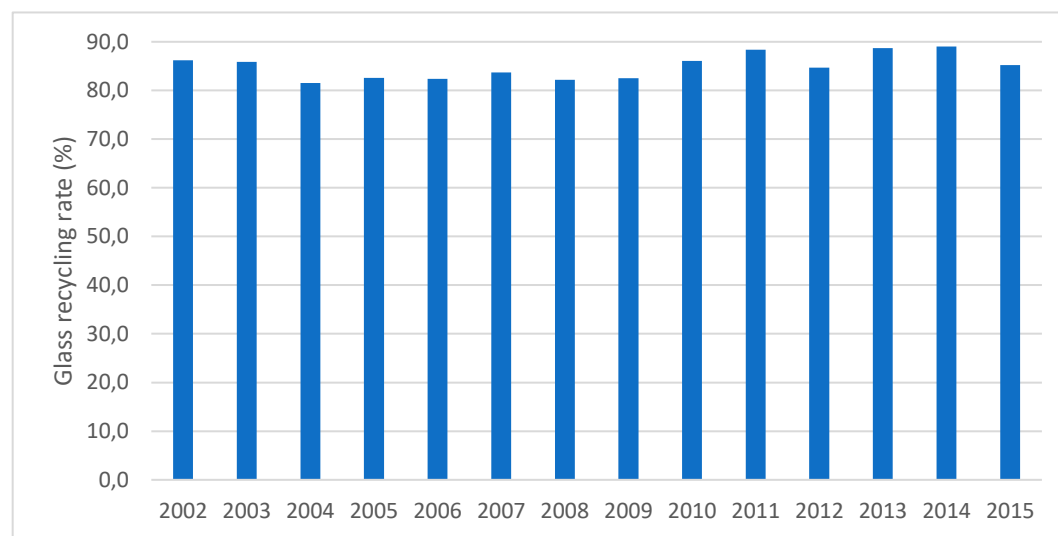
Country	Beverage containers	Packaging
<b>Austria</b>		EPR
<b>Finland</b>	DRS on PET, cans and glass	EPR
<b>Germany</b>	DRS on PET, cans and glass	EPR
<b>Lithuania</b>	DRS on PET, cans and glass	EPR (Tax)
<b>Spain</b>		EPR
<b>Sweden</b>	DRS on PET and cans	EPR (Tax)

## 5.1 Germany

### 5.1.1 Recycling rate

Figure 11 shows that in every year covered by this study the glass recycling rate in Germany has exceeded 80%; well above even the 2030 CEP target of 75%.

Figure 11: Glass recycling rate (%) in Germany 2002 to 2015



Source: Eurostat

### 5.1.2 A description of the policies

In 1991 Germany adopted the Packaging Ordinance 'Verpackungsverordnung' which imposed EPR for all sales packaging on first entering the market and set recycling targets for sales packaging waste. A mandatory deposit would be imposed on non-refillable drinks containers if either the recycling targets for sales packaging were not met or the market share of refillables fell below a quota of 72%.

Although the recycling targets were being met, the refillable quota was not reached in 1998 and 1999, triggering the introduction in January 2003 of a mandatory deposit scheme for one-way containers for beer, waters and carbonated soft drinks.

### ***The mandatory deposit scheme***

The mandatory deposit scheme is operated through the Deutsche Pfandsystem GmbH (DPG) and is financed by membership fees paid by fillers and collectors. Beverage containers are either returned manually, or via RVMs, at shops and supermarkets. An example of the RVMs can be seen in Figure 12. The material is owned by the retailers to whom the containers are returned, and material is sold back to container manufacturers or to other glass recyclers. The deposit is 25 eurocents on each non-refillable container, which is higher than the 8 eurocent deposit on refillable glass beer bottles and 15 eurocents for other refillables (e.g. for water and soft drinks), in order to encourage consumers to buy the refillable container.

*Figure 12: An example of the RVMs used in Germany*



*Source: Oakdene Hollins*

Originally retailers were only obliged to take back their own containers, and this led to the so-called 'island solution' in which retailers - especially the discounters - were heavily selective on the containers they would stock. After losing two cases in the European Court of Justice, brought by two Austrian drinks producers, the deposit provisions were re-stated in 2006. The new provisions set clearer obligations for producers and retailers to charge and refund the deposit and clarified the categories of container and drink subject to the deposit. For example, suppliers of drinks in PET must refund the deposit on all PET containers, regardless of brand.

An amendment to the Packaging Ordinance, including a name change to the Packaging Act, will come into force on 1 January 2019 and the changes include higher recovery targets for packaging materials: 63% for plastic and 90% for metal, glass and paper by 2022. In addition, reusable packaging will be promoted with the aim of reaching a target of 70% reusable beverage packaging. This target applies to glass and PET beverage packaging for the products included in the current deposit scheme; namely, beer, water and carbonates. A review will be undertaken in 2021 to determine whether new measures are required to meet the refill target.

As elsewhere in Europe, RVMs in Germany are owned by the retailer. DPG reports that around 40,000 RVMs are available in Germany, with a bewildering variety of machines on the market - ranging from highly sophisticated units sorting containers into four separate streams (e.g. PET clear, PET coloured, aluminium cans, glass), which cost 40,000-60,000 euro, to cheaper ones (less than 20,000 euro) where everything is mixed together. The advantage of investing in a more expensive machine is that the retailer gets paid more for the pre-segregated material streams. There are about five suppliers of RVMs in Germany, each offering between five and ten types of machine, each of which can have four or five different 'set-ups'. All these RVMs can take one-way packaging, with a smaller number also able to take refillable packaging. Retailers selling products in refillable containers are likely to have RVMs able to take refillable containers. Customers returning a crate of beer simply put the whole crate, full of empty bottles, into the bottom of the machine which, before delivering the deposit, scans the crate to verify all the bottles are there.

### ***The EPR scheme***

The EPR scheme for sales packaging represents a market-based full-cost model where the obligated companies are fully responsible for funding the scheme, with a significant proportion of the collected money being used to cover the costs of collection, sorting and recycling/recovery of the packaging waste. The scheme coordinators are Gemeinsame Stelle dualer Systeme Deutschlands GmbH. Previously there was a single compliance scheme (Duales System Deutschland GmbH) but since moving from a monopoly to a competitive system in 2005, the costs have halved from 2 billion to 1 billion euro per year.<sup>24</sup>

Bottle banks are the most popular means of capturing non-DRS glass, including food jars, wines, sauce bottles and spirit bottles.

#### ***5.1.3 Impact of the policies on the market share of glass packaging***

The impact of the introduction of the deposit in 2003 can clearly be seen in Figure 13, which shows a significant increase in refillable glass and non-refillable PET in 2003, at the expense of non-refillable metal (cans). However, the chart shows that, in the case of refillable glass containers, the impact was very short lived with a steady decline in refillables every year thereafter until 2013. Conversely, non-refillable PET has shown steady growth year on year. Figure 13 also shows that one-way glass did not have a significant market share prior to the adoption of the deposit system in 2003, but it did decline from 2000 to 2004 - from 2,889 million units (6.2% of the market) in 2000 to 845 million units (1.9% of the market) in 2004.

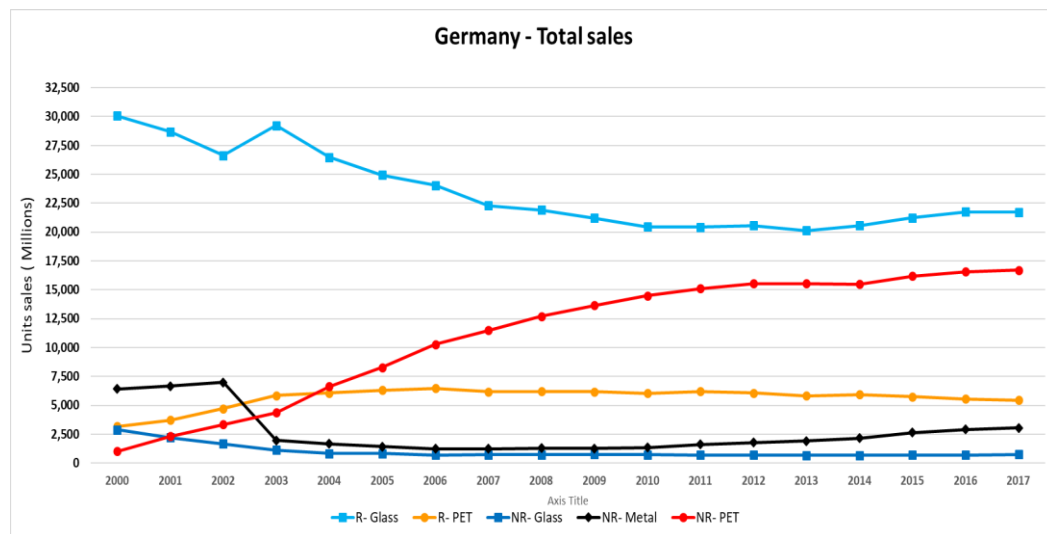
Figure 14 compares the market share of refillable containers in the beer, carbonates and bottled water categories in 2000 and 2017. It shows that, unlike many other countries, the decline in the use of refillables was less pronounced in Germany and the introduction of the one-way DRS can be considered a significant causative factor.

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<sup>24</sup> CIWM Presidential report 2016. *Packaging waste recovery – a European comparison.*

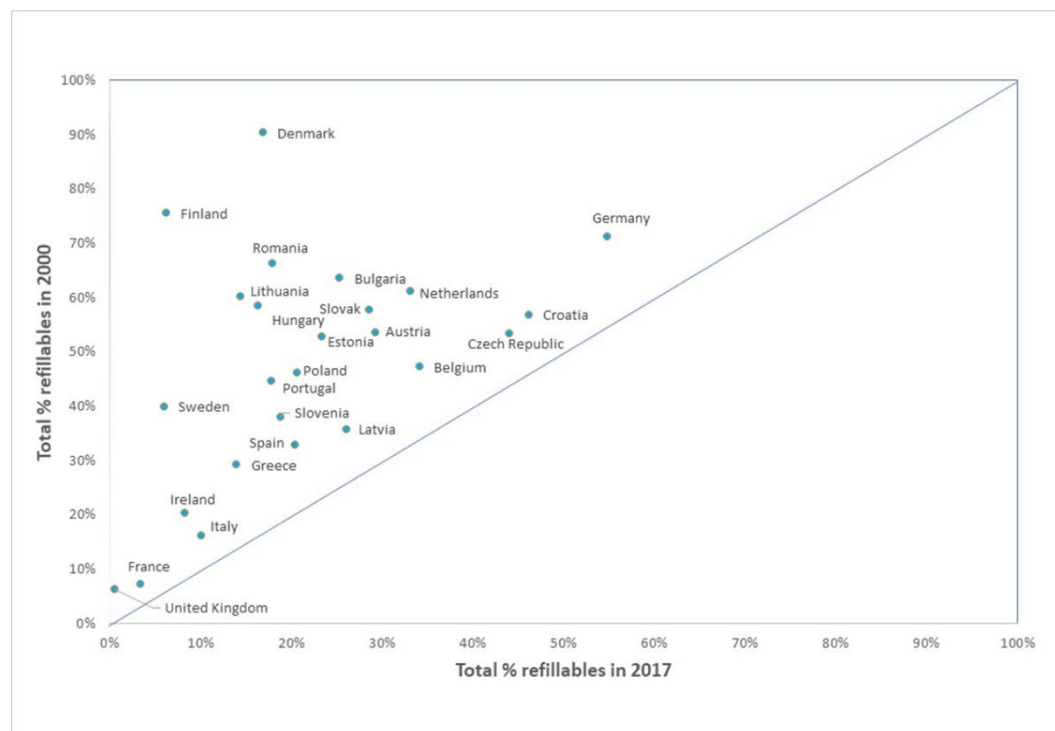


Figure 13: Germany – total sales



Source: Produced by Oakdene Hollins using data from Global Data

Figure 14: Scatterplot of the market share of refillables in beverage containers (beer, carbonates and bottled water) in the EU-28MS

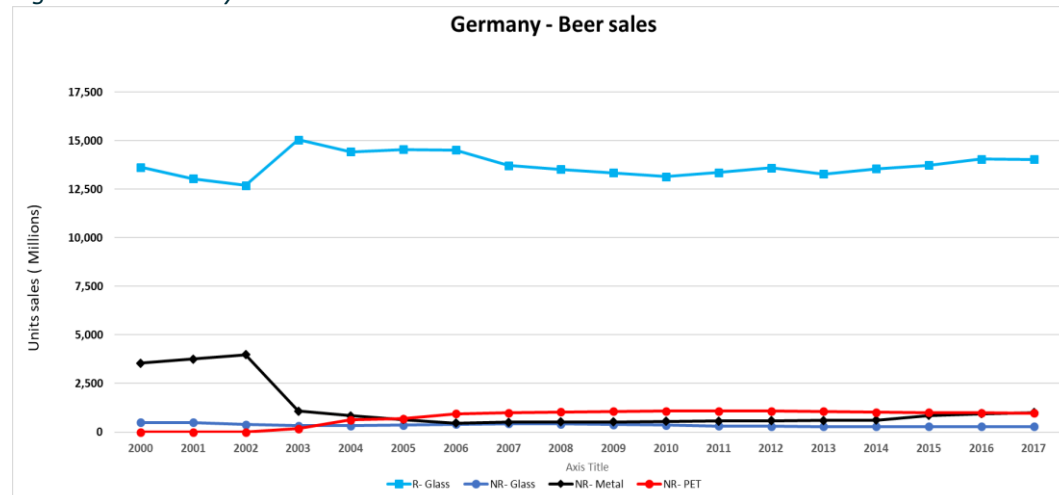


Source: Produced by Oakdene Hollins using data from Global Data

Figure 15 shows that the German beer market has long been dominated by refillable glass, with sales of 14,040 million units and a market share of 86.0% in 2017. However, the comparatively modest market share of beer in non-refillable glass in 2000 (483 million units or 2.7% of the market) reduced to 318 million units or 1.9% by 2003. Cans showed the most significant drop, and BV Glas reports that this was due to hygiene issues: cans are not recloseable and thus the residues in the post-consumer open cans can become malodorous when stored at retail outlets.

Figure 15 also shows that the market share of non-refillable PET grew from 2003 to 2006. Holsten Pils<sup>25</sup> reported making the decision in February 2003 to introduce one-way PET packaging, and introduced the first PET beer installation in Germany in July 2003. The installation ran at 36,000 bottles per hour, and hence was highly cost-effective. However, Figure 15 shows that the market share of beer in non-refillable PET has remained relatively steady between 2006 and 2017.

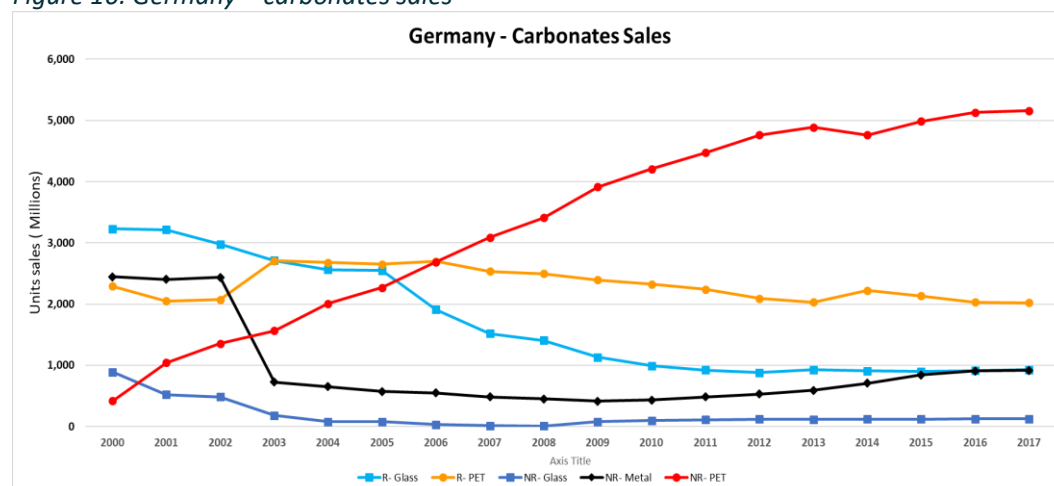
Figure 15: Germany – beer sales



Source: Produced by Oakdene Hollins using data from Global Data

Non-refillable glass shows a significant decline in the case of both carbonates (between 2000 and 2004, Figure 16) and water (between 2000 and 2002, Figure 17). BV Glas reports that this is due to an increase in the popularity of the discount retailers who did not sell one-way glass. The discounters favoured non-refillable PET, which can be seen to show long-term growth in both markets, and the policy intervention in 2003 is likely to have accelerated the trend. In the case of refillable glass in the carbonates and water market, the policy could not stop the decrease in market share, but the same short-term increase in sales in 2003 - as in the case of total sales and beer sales - can be seen in the water market.

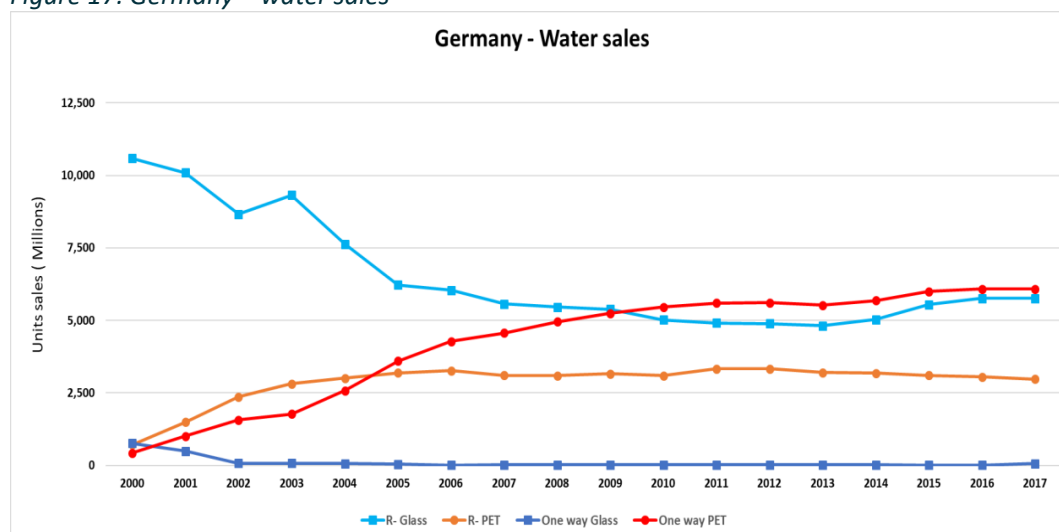
Figure 16: Germany – carbonates sales



Source: Produced by Oakdene Hollins using data from Global Data

<sup>25</sup> [www.equitystory.com/Download/Companies/holsten/Annual%20Reports/DE0006081003-JA-2003-EQ-E-00.pdf](http://www.equitystory.com/Download/Companies/holsten/Annual%20Reports/DE0006081003-JA-2003-EQ-E-00.pdf)

Figure 17: Germany – water sales



Source: Produced by Oakdene Hollins using data from Global Data

#### 5.1.4 The quantity and quality of recovered glass

Table 8 shows that most of the glass recovered in Germany is via the EPR scheme; for example in 2015 more than 1.9 million tonnes of glass, equivalent to 84.3% of the total glass recycled, were recovered through the EPR schemes. No breakdown of the composition of this material by product category is available and hence the BV Glas production statistics were used to highlight the possible composition of this material, i.e. the German glass packaging sales in 2015 excluding beer, water and carbonated soft drinks were:

- Wine and sparkling wine, 40.2%
- Spirits, 16.9%
- Jars, 34.8%
- Flaconnage, 6.1%.

The quantity of glass recovered through the one-way deposit scheme is much lower: at most only 104,900 tonnes (4.6% of total recycled glass volume) were captured through the one-way deposit scheme. This would appear to confirm that the purpose of the deposit scheme on one-way glass containers is to protect the share of the beverage container market in refillables rather than to meet the overall PPWD targets for glass recycling.

Table 8: Recycling volumes for glass packaging in Germany 2010 to 2015 in '000 tonnes

Recycling method	2010	2011	2012	2013	2014	2015
<b>Recycling amount dual systems</b>	1,888	1,906	1,913	1,945	1,921	1,933
<b>Recycling via other return paths<sup>1</sup></b>	189	191	202	252	282	105
<b>Amount of commercial glass</b>	255	264	261	249	242	254
<b>Total Recycling</b>	<b>2,332</b>	<b>2,361</b>	<b>2,376</b>	<b>2,446</b>	<b>2,445</b>	<b>2,292</b>

1: Industry solutions, self-take back solution (until 2014), one-way deposit bottles (water, beer, soft drinks)

Although the quantity of glass collected through the DRS is modest, the quality of the glass (in terms of contamination with ceramics, pharmaceutical glass and other unwanted materials) recovered through the RVMs is higher than that of the glass recovered through the EPR scheme via the bottle banks. This is because RVMs only accept containers that bear deposits. Figure 18 shows the material flows for the EPR scheme, with the reject rates at

18-26%, which includes a significant portion of glass disposed of as residual waste (not collected through the bottle bank system) and glass contaminants estimated at 2.5-10%. The closed-loop recycling rate is about 75-81%.<sup>26</sup> The relatively high yield losses are due to factors associated with collection and reprocessing rather than due to the quality of the glass being recovered. Figure 19 shows the material flows for the deposit-bearing one-way glass bottles, with the reject rate at 1-4% and the closed-loop recycling rate of 95-98%.

Figure 18: Material flows for one-way glass bottles disposed of through the dual system<sup>26</sup>

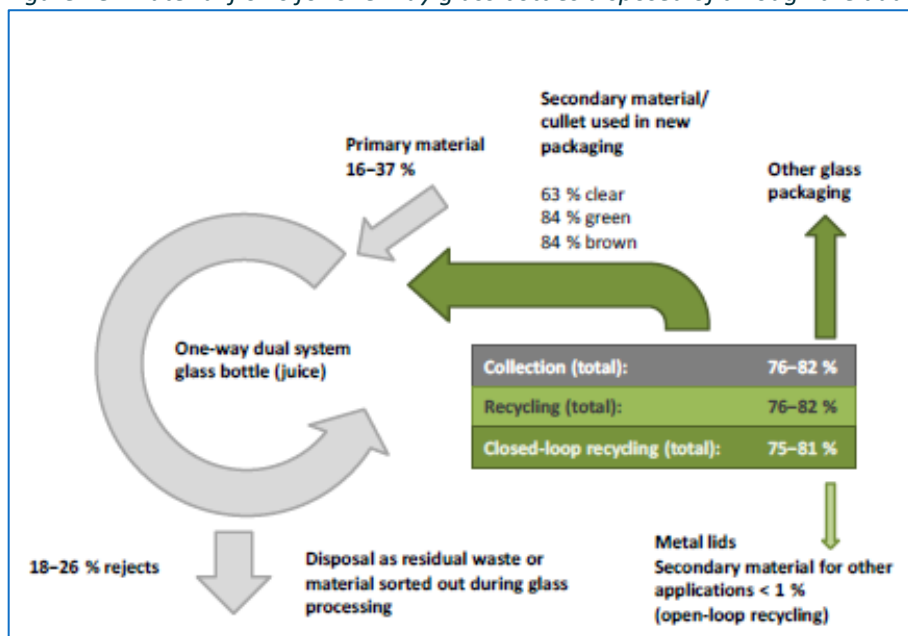
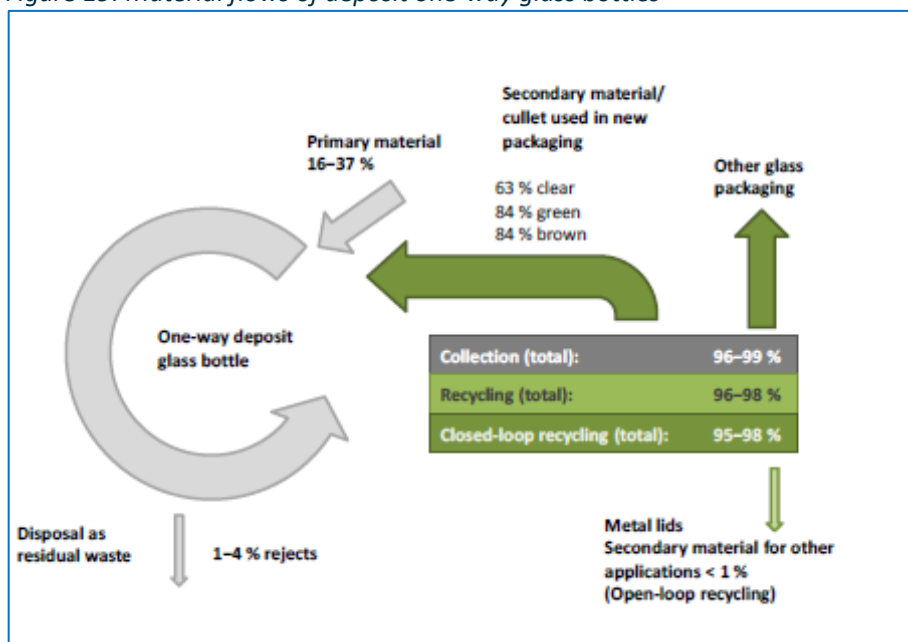


Figure 19: Material flows of deposit one-way glass bottles<sup>26</sup>



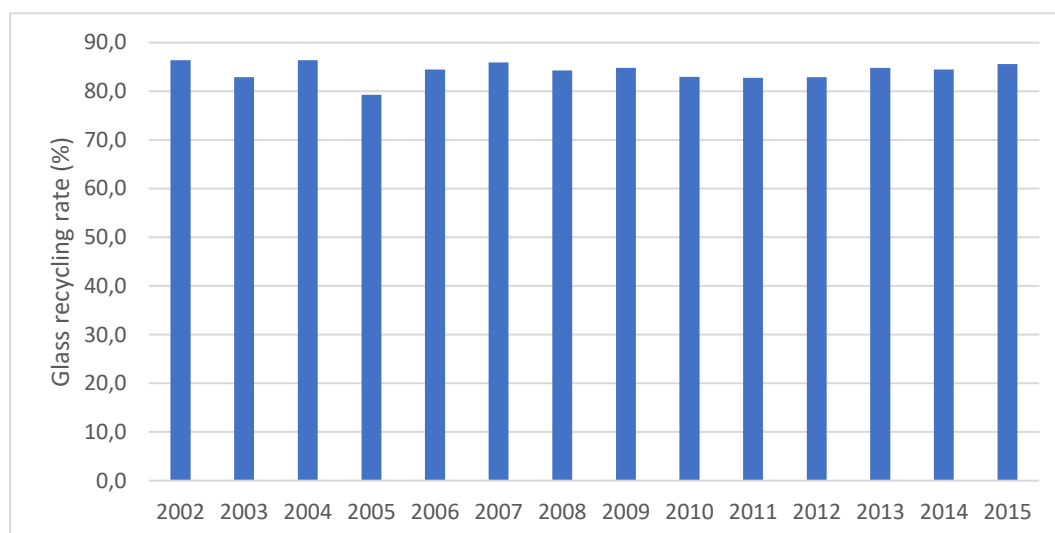
<sup>26</sup> Reuse and recycling systems for selected beverage packaging from a sustainability perspective. PWC 2011

## 5.2 Austria

### 5.2.1 Recycling rate

Figure 20 shows that Austria has exceeded the 75% glass recycling rate and 2030 CEP target in all of the years covered by this study.

Figure 20: Glass recycling rate (%) in Austria 2002 to 2015



Source: Eurostat

### 5.2.2 A description of the policies

Austria introduced its first legislation on packaging in 1992. The Packaging Ordinance was modelled on the German EPR scheme introduced in 1991. Companies affected by the Packaging Ordinance are: manufacturers, importers and dealers of glass packaging, fillers and packers who pay a recycling fee with respect to the weight of packaging they place on the market. It has been amended many times, including the amendment in 1996 to better align with the EC PPWD (1994). The policy included combined refill/recycling targets for individual beverage product categories, giving beverage producers the choice between using refillables or using one-way containers with high recycling rates. In 2000 the legislation was replaced with a voluntary agreement. In the agreement, industry undertook to ensure that soft drinks would continue to be available in both refillables and one-way containers while beer would be supplied predominantly in refillables.

The amendment to the Ordinance in 2006 resulted from the revision of the EC PPWD in 2004 (2004/12/EC) (made Austrian Law through VVO 364/2006). This included the obligation on companies, or recovery organisations acting on their behalf, to meet the material-specific recycling targets in the Directive.

It was amended again in 2014 and adopted into Austrian Law on 1 January 2015. AT VVO 2014 requires all manufacturers, distributors and importers that place packaging or packaged goods on the Austrian market to take these packaging materials back free of charge and ensure their recovery or reuse. The revised targets for glass in the household waste stream were: 80% had to be collected separately and 100% should be sent to recycling facilities.

The overall EPR is managed through Altstoff Recycling Austria (ARA), and the ownership structure is one-third packaging producer companies, one-third beverage industry and one-third fillers. Austria Glas Recycling operates the recycling systems and services for glass across Austria; ARA owns 51% of its shares.

More than 80% of the collected material is recycled domestically by Vetropack Austria GmbH (in Pöchlarn, Lower Austria, and Kremsmünster, Upper Austria) and by Stölzle Oberglas GmbH (in Köflach, Styria); the remaining cullet is exported to glass reprocessors in Germany, Italy, Croatia, Slovakia and the Czech Republic.

Table 9 shows the breakdown of the costs of operating the scheme (across all packaging) and the recovered material. In 2014, glass accounted for 221,733 tonnes of the total packaging recovered, or 27.5% of the total. Most of it was collected via the 74,900 waste glass containers<sup>27</sup> across Austria, in which clear glass and coloured glass are collected separately.

*Table 9: The breakdown of the costs of operating the EPR scheme in Austria, 2012 to 2014*

	2012	2013	2014
<b>Number of licence partners</b>	15,550	16,035	16,341
<b>License fee revenues in million euro</b>	143.8	135.8	132.7
<b>Waste managed, tonnes</b>	829,607	835,465	844,948
<b>Waste recovered, tonnes</b>	778,240	782,781	805,142
<b>Cost of waste recovered in euro/tonne</b>	184.8	173.5	164.8

Source: ARA: Sustainability report 2014

Table 10 shows the license rates as of 1 January 2015, and it is reported that the rates reflect the expenses the various materials cause in the collection and recovery cycle.

*Table 10: The breakdown of the material specific packaging tariffs in Austria in 2014*

Material	Packaging tariff (€/kg)	
	Household	Commercial
<b>Paper</b>	0.095	0.035
<b>Glass</b>	0.082	0.05
<b>Ferrous metal</b>	0.24	0.06
<b>Aluminium</b>	0.29	0.08
<b>Plastic</b>	0.565	
<b>Beverage cartons</b>	0.59	
<b>Other composite materials</b>	0.565	0.1
<b>Ceramics</b>	0.14	0.14
<b>Wood</b>	0.018	0.008
<b>Textile fibres</b>	0.2	0.2
<b>Biodegradable materials</b>	0.45	0.1

Source: ARA: Sustainability report 2014

The table shows that the tariff for glass is one of the lowest, signifying that from a weight-based perspective it is one of the cheapest materials to recover using this system. For

<sup>27</sup> According to the ARA website there were 80,600 glass waste containers in Austria in 2017.

example, the 0.082 euro/kg tariff for household glass equates to 82 euro/tonne which is much lower than the average cost of waste recovery of 164.8 euro/tonne shown in Table 9.<sup>28</sup>

The revenue for the glass cullet sold to the glass industry accounts for 25% of the total costs, and 75% is covered by the EPR contributions.

EPR revenue is also used to fund the anti-littering campaign.<sup>29</sup> Founded in 2012, "Reinwerfen statt Wegwerfen" (English: "Toss it in the bin") is a voluntary initiative of Austrian businesses, based on an agreement between Austrian social partners and the Federal Ministry of Sustainability and Tourism to improve the ecological performance of packaging (mainly beverage containers) by creating public awareness, preventing and reducing littering and promoting the separate collection and recycling of packaging. Packers/fillers and retailers agreed to spend 700,000 to 1 million euro annually for a nationwide anti-littering campaign. The operation and project management is run by ARA, supported by the ARGE Sustainability Agenda of the Austrian Economic Chambers.

Reinwerfen statt Wegwerfen provides:

- Support for projects related to waste minimization, littering-prevention, and separate collection.
- Financial and organizational support for local clean-up activities.
- A web platform for the promotion of related activities and exchange of best practices.
- Active promotion of anti-littering online and at public events.
- Public relations.

Austria Glas Recycling asserts that a DRS has not been introduced in Austria due to the success of the EPR and the concern that a DRS would rob the EPR of high-value products, jeopardising the cost-effectiveness of the overall EPR scheme.

### 5.2.3 The quantity and quality of recovered glass

Currently 85% of glass (around 240,000 tonnes) is collected through the EPR scheme. Vetropack reports that there is no kerbside collection of glass from households, although a bring bank is, on average, located within 300-400 metres of every household. The glass is not typically colour-separated at bring banks, but Vetropack collects, colour-sorts and reprocesses it at one of its two factories in Austria. Vetropack reports that the contamination rate is 5-6% in the glass collected from the bring banks.<sup>30</sup> According to Austria Glas Recycling<sup>31</sup>, the high recycling rate and the low contamination rate in Austria is explained by very strong educational messages targeted at the primary school level. However, there is a marked rural/urban split, with high contamination rates in Vienna while the quality of glass collected in rural settings approaches 100%.

Figure 21 shows an example of the bring bank (double) containers used in Austria that are colour-specific and Figure 22 shows an example of the associated double compartment collection vehicle.

<sup>28</sup> The weight-based tariffs also motivate producers to lightweight their containers.

<sup>29</sup> [circulareconomy.europa.eu/platform/en/good-practices/toss-it-bin-anti-littering-initiative-altstoff-recycling-austria](https://circulareconomy.europa.eu/platform/en/good-practices/toss-it-bin-anti-littering-initiative-altstoff-recycling-austria)

<sup>30</sup> Vetropack Austria GmbH. Personal communication 27 August 2018.

<sup>31</sup> Austria Glas Recycling GmbH. Personal communication 27 July 2017.



Figure 21: An example of the bring bank (double) containers used in Austria



Source: Austria Glas Recycling

Figure 22: An example of the glass collection vehicles used for the double containers

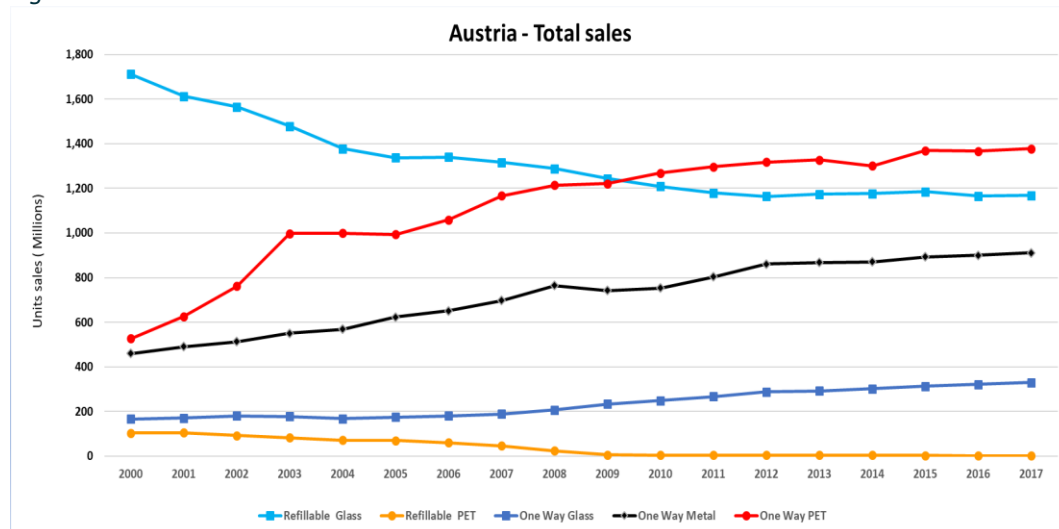


Source: Austria Glas Recycling

### 5.2.4 Impact of the policies on the market share of glass packaging

Figure 23 shows that the general trend in Austria has been a decline in the refillable containers (glass and PET) and a growth in all three forms of one-way container. For example, the market share in one-way glass increased from 5.6% in 2000 to 8.7% in 2017, whereas refillable glass dropped from 57.6% of the market in 2000 to 30.8% in 2017.

Figure 23: Austria – total sales



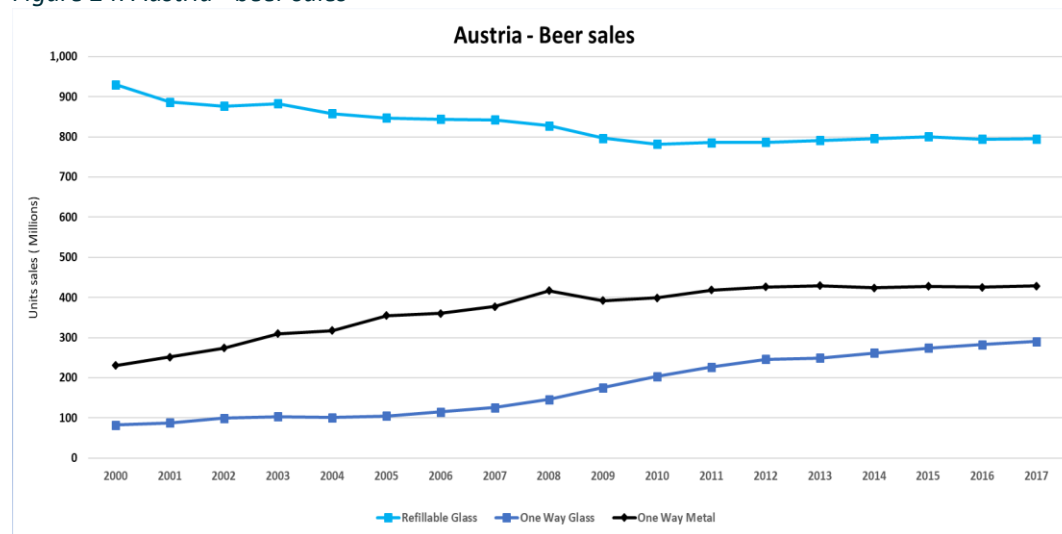
Source: Produced by Oakdene Hollins using data from Global Data

Figure 24 shows that, for beer, there has been a significant growth in the use of one-way glass and cans. In the case of one-way glass, sales have increased from 82 million units in 2000 (6.6% market share) to 290 million units (19.1% market share) in 2017. Meanwhile, the sale of beer in refillable glass reduced from 930 million units (74.4% market share) in 2000 to 795 million units (52.2% of the market) in 2017. However, this is a much lower decline than was observed in the total market (Figure 23) which shows that the focus on maintaining the market share of beer in refillable glass containers has to some extent worked. Brau Union Österreich provides a useful example of how the voluntary refill system works in Austria, having signed an agreement in 2012 with representatives of the retail trade which includes a commitment to supply beer in refillables. With 57% of its beer sold in refillable glass it boasts the highest market share in Austria. Austria Glas Recycling<sup>32</sup> reports that it is predominantly the local brand beers that operate refillables and the national brands, such as Heineken Group, offer it in one-way glass.

Additionally, over the last 10 years there has been an increase in the popularity of 0.33-litre 'mixed beer' products, such as 'beer-with-orange', 'beer-with-lemon', etc., sold in one-way packaging, the main trade channel being the discount retailers like Aldi and Lidl. This trend is clearly shown in Figure 25.

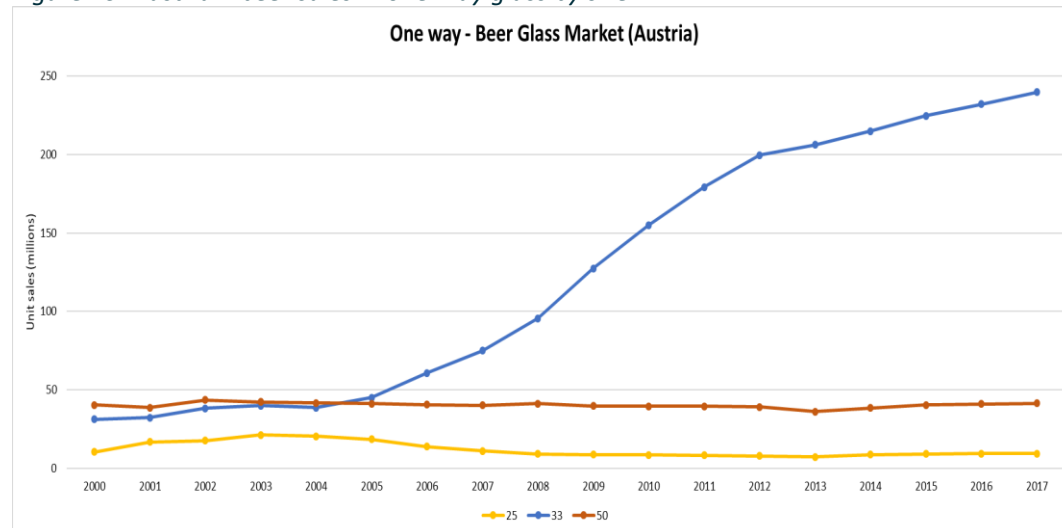
<sup>32</sup> Austria Glas Recycling GmbH. Personal communication 27 July 2017.

Figure 24: Austria - beer sales



Source: Produced by Oakdene Hollins using data from Global Data

Figure 25: Austria – beer sales in one-way glass by size

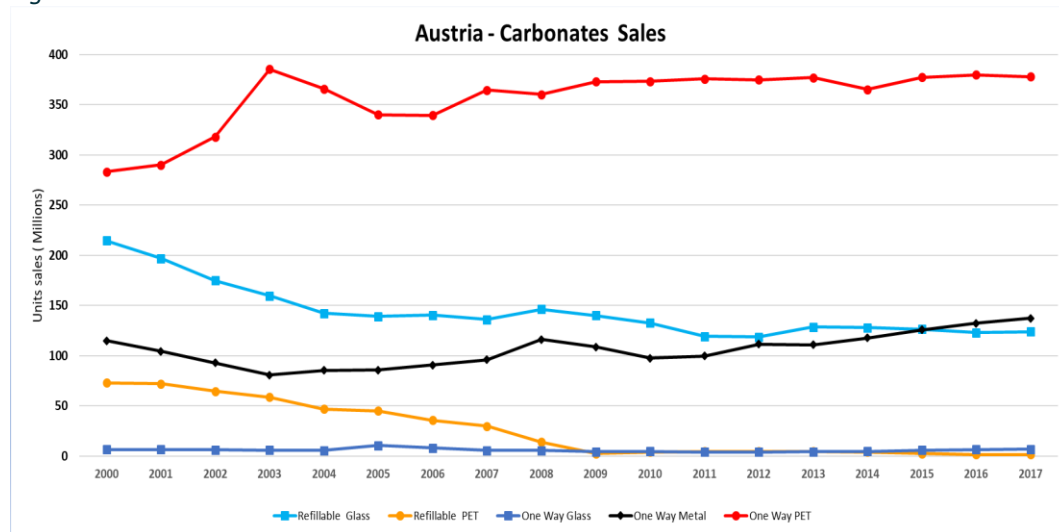


Source: Produced by Oakdene Hollins using data from Global Data

Figure 26 shows that the refillables market (glass and PET) declined rapidly between 2000 and 2009 and one-way glass never had a foothold in the market. Conversely, refillable glass has maintained a significant market position, accounting for a market share of circa 20% from 2012 to 2017. The chart shows a spike in the sales of one-way PET in 2003, and Vetropack reports that this coincides with major fillers, such as Coca-Cola, switching from refillable glass to PET, and then the level of investment in new filling lines reduced, resulting in the stabilising of the share of PET containers.<sup>33</sup>

<sup>33</sup> Vetropack Austria GmbH. Personal communication 27 August 2018.

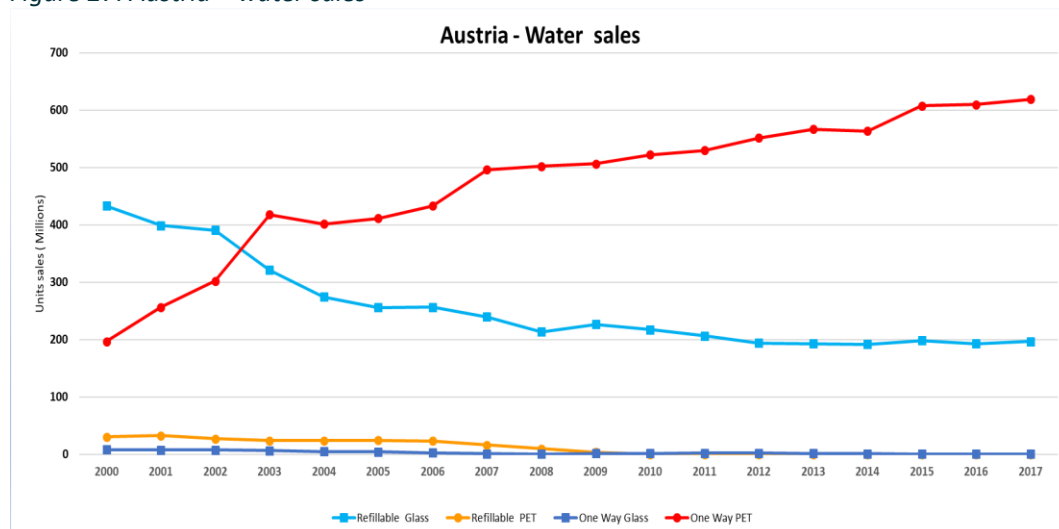
Figure 26: Austria – carbonates sales



Source: Produced by Oakdene Hollins using data from Global Data

Figure 27 shows the rapid switch from refillable glass to non-refillable PET that occurred in the water market, especially between 2000 and 2003.

Figure 27: Austria – water sales



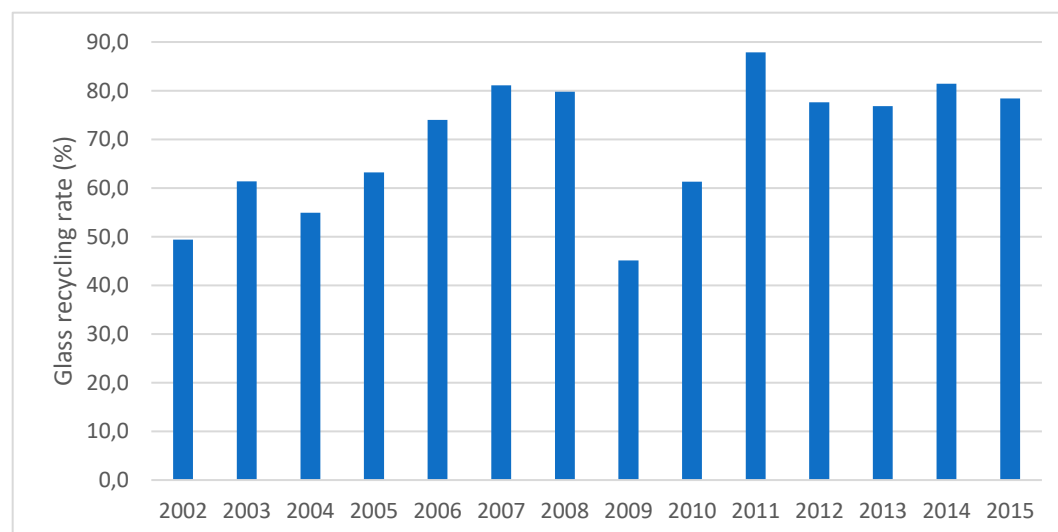
Source: Produced by Oakdene Hollins using data from Global Data

## 5.3 Finland

### 5.3.1 Recycling rate

Figure 28 shows the glass recycling rate in Finland between 2002 and 2015. Although there was steady growth in the recycling rate between 2002 and 2007, it dropped dramatically in 2009 and 2010, but since 2010 it can be seen that the recycling rate has exceeded the 2030 recycling target of 75% set within the EU's CEP.

Figure 28: Glass recycling rate (%) in Finland 2002 to 2015



Source: Eurostat

Figure 28 shows that in 2015 a glass recycling rate of 78% was achieved and Table 11 provides a breakdown of the performance of the two systems used in Finland. This shows that the deposit scheme accounts for 68.5% of the glass - much higher than the 4.6% in Germany (Table 8) - and recorded a recycling rate of 99%. However, the non-deposit glass, which accounted for the remaining 31.5% of the glass, had a recycling rate of just 33%.

Table 11: Summary of glass recycling in Finland in 2015

System	Put on the market (Tonnes)	Recycled (Tonnes)	Recycled (%)
<b>RINKI's customers (non-deposit glass)</b>	23,900	8,000	33
<b>Other systems (mostly deposit system)</b>	51,900	51,500	99
<b>Total</b>	<b>75,800</b>	<b>59,500</b>	<b>78</b>

Source: Finnish Packaging Recycling RINKI Ltd. EPR of non-deposit glass packaging in Finland. FERVER, General Assembly, 7 June 2018, Helsinki.

RINKI, the operator of Finland's EPR scheme, reports that since 2015 the glass recycling rate for non-deposit glass has increased significantly from 33% in 2015 to 94% in 2017 (Table 12).

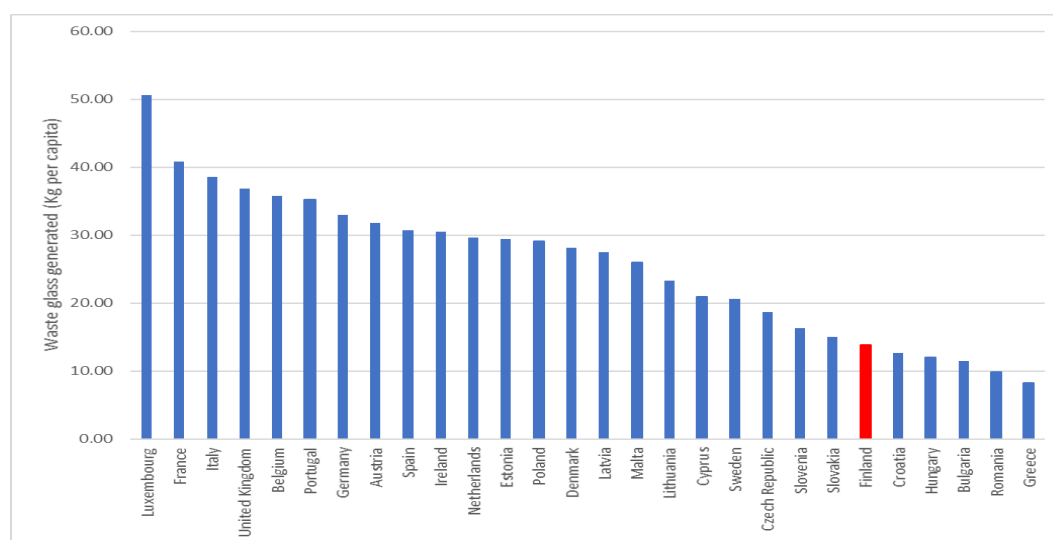
Table 12: The glass recycling rate for non-deposit glass in Finland 2015 to 2017

Year	Put on the market (Tonnes)	Recycled (Tonnes)	Recycled (%)
2015	23,900	8,000	33
2016	24,000	15,200	63
2017	24,000	22,600	94

Source: Finnish Packaging Recycling RINKI Ltd. EPR of non-deposit glass packaging in Finland. FERVER, General Assembly, 7 June 2018, Helsinki.

Note that Finland has one of the lowest rates of glass waste generation in Europe (Figure 29) and this may be a significant factor in terms of the relative performance of the systems; for example, it enables the deposit scheme to handle a much larger percentage of the glass than in somewhere like Germany or Austria that sees over double the amount of glass waste generated per capita.

Figure 29: Glass waste generated (kilograms per capita) in EU-28MS



Source: Eurostat

### 5.3.2 A description of the policies

Finland has operated various policies that impact on beverage containers: a voluntary DRS for refillables, a mandatory DRS for one-way containers and eco-taxes (a tax on one-way packages and an overall packaging tax). In addition, an EPR for packaging waste came into force in May 2015 obligating producers to establish a minimum of 1,850 collection points for consumer packaging (glass, metal and fibre).

#### Eco-tax

The eco-tax (Finnish tax on beer and carbonated soft drinks containers) was introduced in 1994 and included an exemption for companies that are part of the refillable deposit scheme: for products not in any deposit scheme the tax stood at 0.67 euro/litre, for one-way containers within a registered deposit scheme it was 0.17 euro/litre and for refillable containers in a deposit scheme it was zero. The tax was effectively promoting refillables and, in 1995, refillables had a market share in beer, soft drinks and water of 87%, dropping down



to 84% in 1999.<sup>34</sup> An amendment to the Finnish Waste Act in 2004 resulted in the tax being halved (to 0.085 euro/litre) for one-way containers that were included in a deposit-return system from 2005. In 2008, one-way containers were also fully exempt from the tax if in a deposit scheme. This meant that refillable beverage containers and recyclable beverage containers were now subject to the same terms and conditions of taxation.

*Note: since the recycling schemes are funded through a combination of material sales and recycling fees (taxes) the reduction in the revenue from this tax could have contributed to the dip in the glass recycling rate observed in 2009 and 2010 (Figure 28).*

### **Mandatory DRS for one-way containers**

In terms of the management of the mandatory DRS for one-way containers, Palpa<sup>35</sup> was established in 1996 as a non-profit company, to collect and recycle end-of-life aluminium cans in Finland. There was then no system in place for recovering cans and significant littering was occurring despite a tax on cans imposed since 1994.<sup>36</sup> By 1998 Palpa was also handling PET, and in 2012 began to collect one-way glass. Before 2012, one-way glass had been recovered through a voluntary DRS, since the 1980s, by ALKO (one of the owners of Palpa), but ALKO decided that recovering one-way glass was not its core business.

Today, Palpa coordinates four separate systems for beverage containers:

- one-way aluminium cans
- one-way PET
- refillable glass
- one-way glass.

More than 90% of the containers returned to Palpa are returned through Finland's network of 4,000 RVMs which provide consumers with a credit receipt. In order to support anti-littering objectives, the system will also accept non-deposit bearing glass packaging, although in such cases won't refund any deposit.

Palpa concedes that there is a degree of disintegration in the systems, resulting from the staggered introduction of the materials to the scheme. However, the organisation argues that some disintegration is inevitable given that the logistics and economic costs of managing a PET/cans scheme differ considerably from those inherent in a glass scheme: PET and cans can be compacted and hence greater tonnages can be transported and, in Finland, PET and aluminium cans have a positive market value whereas glass (originally) had a negative value.<sup>36</sup>

The Government Decree on a return system for beverage containers (526/2013) states the minimum deposits on beverage containers included in the return system for beverage containers are:

1. 0.15 euro for metal containers
2. 0.20 euro for plastic containers larger than 0.35 litres but smaller than 1.0 litre
3. 0.40 euro for plastic containers of at least 1 litre
4. 0.10 euro for containers other than those referred to in 1-3 above.

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<sup>34</sup> [ec.europa.eu/environment/waste/studies/packaging/050224\\_final\\_report.pdf](http://ec.europa.eu/environment/waste/studies/packaging/050224_final_report.pdf)

<sup>35</sup> Suomen Palautuspakkaus Oy; Finland Return Packaging Co

<sup>36</sup> Palpa Lasi. Personal communication 8 August 2018.

Therefore, for glass the minimum deposit is 0.10 euro per container irrespective of the size of the container.

The Decree also states the reuse and recycling targets:

1. At least 90% by weight of reusable beverage containers shall be reused.
2. At least 90% by weight of non-refillable beverage containers shall be recycled.

Section 3(1)(2) of the Decree applies to the reception and recycling of non-metal non-refillable beverage containers from 2015 onwards. Until then, the recycling rate requirement for these containers was 80% by weight. Table 5 shows that the capture rate for one-way glass containers within the deposit scheme was 88% in 2015 and 2016 and 87% in 2017 and hence, in the case of glass, the 90% target was missed. However, Palpa reports<sup>37</sup> that this did not cause any policy implications since the recycling rate was above 90% when the non-DRS containers that had been recovered through the scheme were also taken into consideration.

### ***The EPR scheme for non-DRS containers***

Recycling stations are the main collection system for Finland's EPR scheme, financed by the producers and managed through a central system (RINKI Ltd). The manufacturers and importers of beverage packaging pay a membership fee and package-specific recycling fees to cover the system costs.

The EPR for packaging waste came into effect in May 2015 and obliged producers to establish a minimum of 1,850 collection points for consumer packaging (glass, metal and fibre), and RINKI reports that in May 2018 there were 1,856 collection points (bring banks) for glass. Figure 30 shows an example of a typical collection point and, in Finland in 2016, 70.3% of the Finnish population were reliant on the 'bring' type bottle banks and only 29.7% had kerbside collections.

*Figure 30: An example of the RINKI-operated glass collection points*



Source: Finnish Packaging Recycling RINKI Ltd. EPR of non-deposit glass packaging in Finland. FERVER, General Assembly, 7 June 2018, Helsinki.

<sup>37</sup> Palpa Lasi. Personal communication 8 August 2018.



### Cost comparison between the DRS and EPR schemes

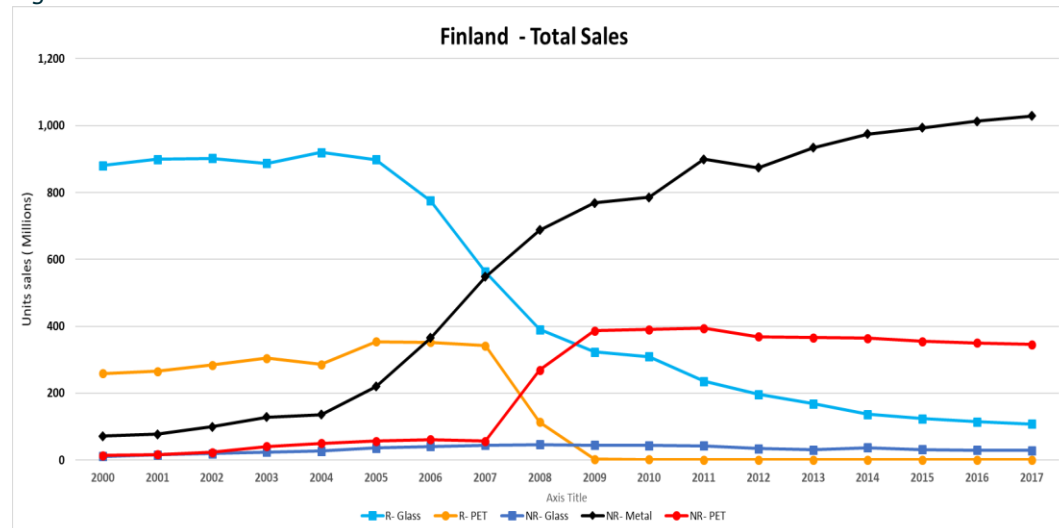
RINKI reports that the non-DRS (EPR) glass recycling fee currently stands at 112 euro per tonne in 2018, a reduction from the 135 euro per tonne figure for both 2016 and 2017.<sup>38</sup> The DRS recycles 130-140 million one-way glass units per year with recycling fees<sup>39</sup> in the range of 0.0792 to 0.2205 euro per container. Therefore, the glass recycling fees in the DRS are much higher at between 205.92 and 617.4 euro per tonne.

RINKI suggests<sup>40</sup> that the DRS is more expensive than the EPR system because the DRS infrastructure is more expensive (i.e. expensive RVMs versus cheap bring banks) and because of the far greater number of collection points.

### 5.3.3 Impact of the policies on the market share of glass packaging

Figure 31 shows the transition from refillable glass to metal cans that occurred in 2004, and the transition from refillable PET to non-refillable PET that occurred in 2008. The market share of refillables in the beer, carbonates and bottled water markets dropped from 75.5% in 2000 to just 6.2% in 2017: the abolition of the eco-tax on one-way containers is a significant causative factor.

Figure 31: Finland – total sales



Source: Produced by Oakdene Hollins using data from Global Data

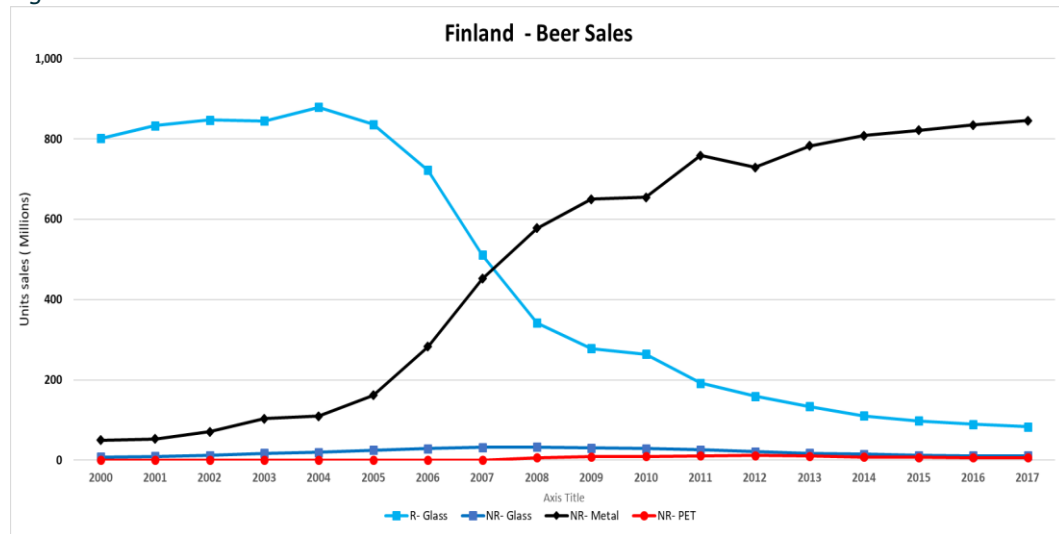
The transition from refillable glass to cans seen in 2004 was most prominent in the beer sector (Figure 32).

<sup>38</sup> Finnish Packaging Recycling RINKI Ltd. EPR of non-deposit glass packaging in Finland. FERVER, General Assembly, 7 June 2018, Helsinki.

<sup>39</sup> [palpa.fi/static/studio/pub/Materiaalipankki/Hinnastot/Price+list\\_Glass+bottle\\_2018-01-01.pdf](http://palpa.fi/static/studio/pub/Materiaalipankki/Hinnastot/Price+list_Glass+bottle_2018-01-01.pdf)

<sup>40</sup> Finnish Packaging Recycling RINKI Ltd. Personal communication 21 August 2018.

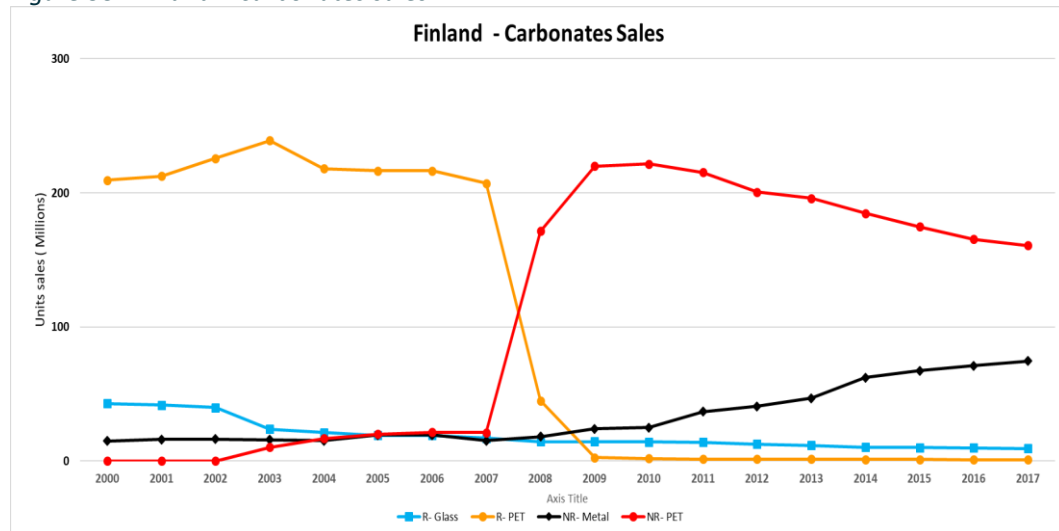
Figure 32: Finland – beer sales



Source: Produced by Oakdene Hollins using data from Global Data

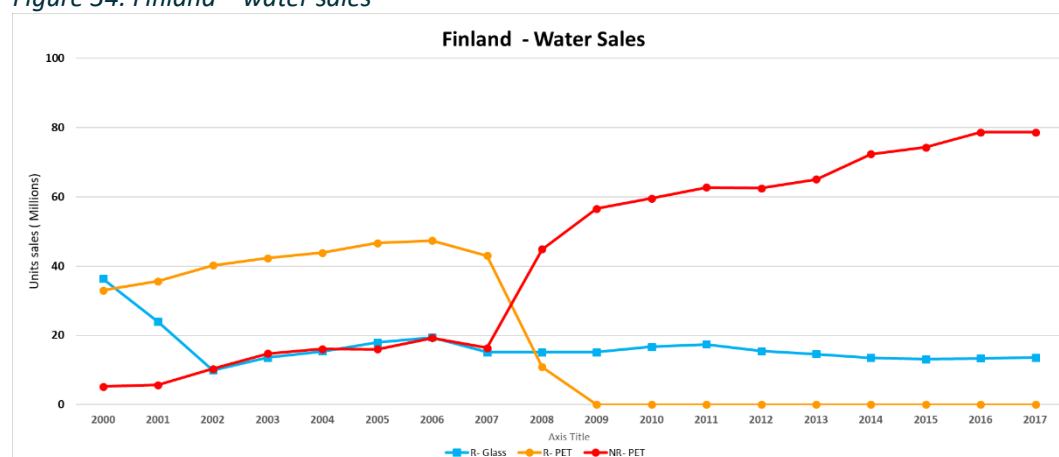
Conversely, the transition from refillable to non-refillable PET occurred in the carbonates and water markets (Figure 33 and Figure 34). The refillable PET was available in one standard bottle only, and manufacturers could only differentiate themselves in the market through labels. Manufacturers liked the idea that they could now design their own distinctive bottle sizes and shapes.

Figure 33: Finland – carbonates sales



Source: Produced by Oakdene Hollins using data from Global Data

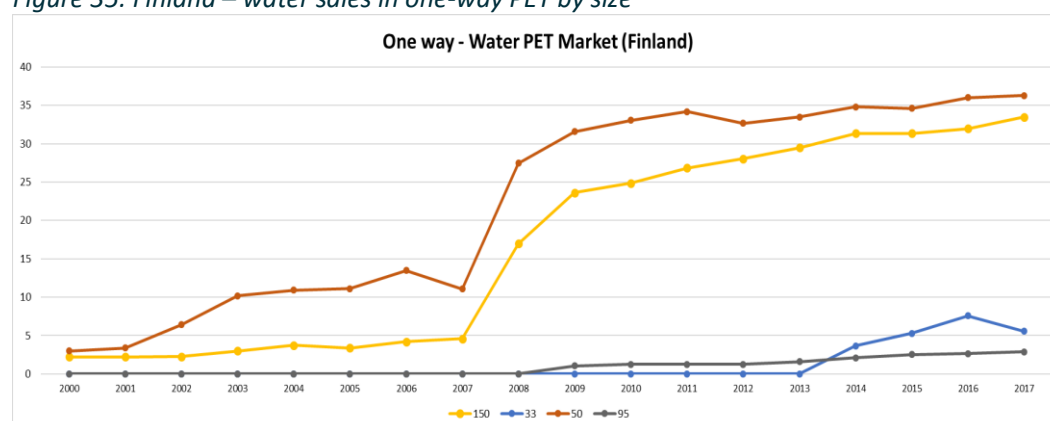
Figure 34: Finland – water sales



Source: Produced by Oakdene Hollins using data from Global Data

Olvi Plc reacted to the change in the bottle tax by introducing a new 95cl container in addition to the 50cl, 150cl, and 200cl non-refillable PET bottle. By law in Finland, consumers pay a higher deposit on PET bottles larger than 100cl (0.40 euro instead of 0.20 euro per container). As a result, the retail price for 95cl non-refillable PET bottles is proportionally less than the 100cl size, and sales are said to reflect this.<sup>41</sup> Figure 35 shows the introduction of the 95cl unit to sales of water in 2008, alongside the rapid growth in 50cl and 150cl one-way PET containers in 2007.

Figure 35: Finland – water sales in one-way PET by size



Source: Produced by Oakdene Hollins using data from Global Data

### 5.3.4 The quantity and quality of recovered glass

Palpa reports that the quality of the glass being recovered through the DRS is much better than that of the EPR scheme since the DRS only accepts the approved packages based on the EAN code (the barcode).<sup>42</sup> Likewise, RINKI states<sup>43</sup> that the glass collected by them is poorer quality than the DRS glass with a 5% contamination rate which has to be dealt with in the sorting facilities. However, according to RINKI, when a whole value chain approach is taken the EPR scheme is still better value for money than the DRS scheme.

<sup>41</sup> [www.scandbrewrev.dk/uf/20000\\_29999/22215/aadcac4857e07af21d429e9bdffc08eb.pdf](http://www.scandbrewrev.dk/uf/20000_29999/22215/aadcac4857e07af21d429e9bdffc08eb.pdf)

<sup>42</sup> Personal communication 8 August 2018.

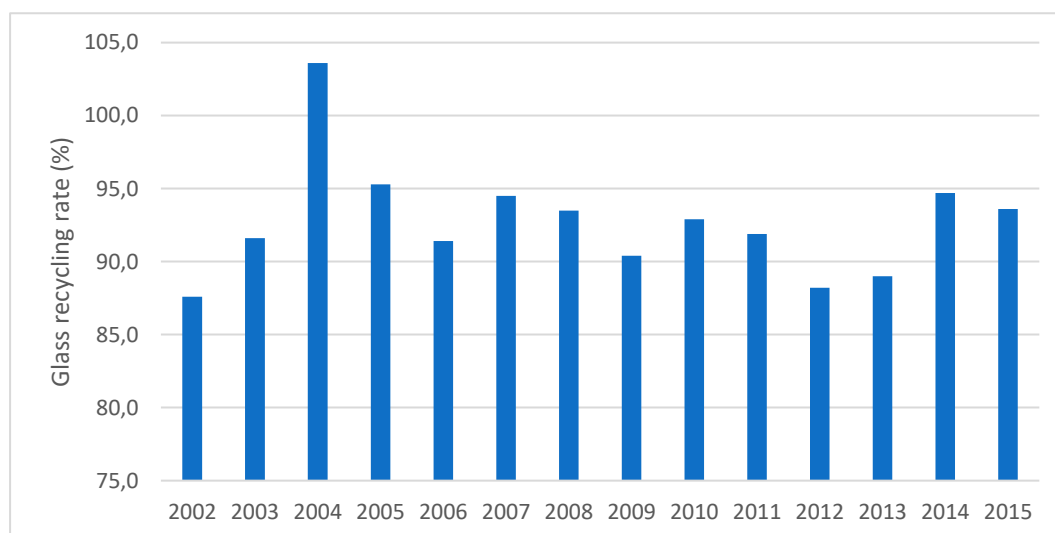
<sup>43</sup> Finnish Packaging Recycling RINKI Ltd. Personal communication 21 August 2018.

## 5.4 Sweden

### 5.4.1 Recycling rate

Figure 36 shows the recycling performance of Sweden. A key question here is whether the high performance of Sweden is due to leakage (transboundary activity) in the scheme: the recycling rate in Sweden in 2004 was above 100% which clearly implies that imports were not fully accounted for and recycling rates were overstated. However, Sveriges Bryggerier, the Swedish Brewers Association, reports<sup>44</sup> that border trade has little impact on glass trends in Sweden as almost all the beverages (cider, beer, carbonates, mineral water) sold across the border, mainly from Germany, are in metal cans.

Figure 36: Glass recycling rate (%) in Sweden 2002 to 2015



Source: Eurostat

### 5.4.2 A description of the policies

Both Finland and Sweden operate deposit schemes for one-way beverage containers but, unlike the Finnish scheme, the Swedish scheme excludes glass. In Sweden, there are two types of deposit-return systems for beverage containers: one is a voluntary scheme for refillable glass bottles that has been run by the breweries themselves since 1885 (overseen today by the trade association, Sveriges Bryggerier) and the other is for one-way metal cans and plastic bottles for consumption-ready drinks (operated mostly by Returpack Svenska AB, but also by Dela AB and PET-System AB). Sweden also adopted EPR legislation for non-beverage packaging in 1994.

The current Swedish deposit-and-refund scheme for one-way containers was introduced in 1984 (SFS 1982:349) for aluminium cans. The can deposit system was introduced in law after a multi-national producer started to manufacture cans in Sweden. Similarly, the growth of the market share of one-way PET resulted in the scheme being extended in 1994 (SFS 1991:336) and in 2005 the scheme was expanded to include steel cans and all types of plastic bottles. According to TOMRA, a leading supplier of RVMs, the staggered introduction of material DRSs resulted in retailers investing first in RVMs for cans only and then, eight years

<sup>44</sup> Sveriges Bryggerier. Personal communication 29 August 2018.

later, they had to invest in additional machines for PET.<sup>45</sup> So in Sweden, much like in Finland, the approach is not integrated as it is in countries (like Denmark and Germany) where the material DRSs were introduced in one go.

The Swedish scheme is regulated by the Ordinance on Deposit Scheme for Plastic Bottles and Metal Cans, introduced in 2005 (SFS 2005:220). The relatively early introduction of the deposit schemes, when the market share of one-way beverage containers was small, meant that costs could be kept down through the utilisation of the existing take-back networks used for refillable containers. In addition, unlike in many other countries, the mindset of returning bottles irrespective of whether they were refillable or one-way bottles was maintained during the transition from refillable to one-way bottles.

Around 3,000 retail outlets have RVMs that compact returned containers (PET bottles and cans), which handle 94% of returned containers.<sup>46</sup>

Sweden adopted EPR legislation in 1994 as a means of transposing the PPWD. The EPR scheme for glass packaging is managed by Svensk Glasåtervinning AB (part of the Förpacknings & Tidnings Insamlingen, FTI – Swedish Packaging and Newspaper Collection scheme) and is volume based, i.e. a packaging fee is paid by the producers according to the fill volumes of the products they place on the market.

*Table 13: Volume based packaging fees for 'other glass packaging' in Sweden in 2017*

Fill volume	Fee in SEK	Fee in euro
Empty – 250ml	0.07	0.00658
251 – 500ml	0.16	0.01504
501 – 699ml	0.20	0.0188
700ml and above	0.30	0.0282

*Source: Förpacknings & Tidnings Insamlingen. Annual Review 2017.*

The revenue generated through the EPR is used for<sup>47</sup>:

- Establishing, operating, cleaning recycling stations for households and drop-off points for companies, and collecting from them.
- Subsidizing kerbside collection services for households.
- Transportation.
- Sorting and recycling.
- Information campaigns – to encourage more households to recycle.
- Administration and information about the recycling system. This includes annual consultation with all Swedish municipalities and reporting recycling results to the Swedish EPA.
- Permit fees.

<sup>45</sup> TOMRA Group / TOMRA Systems ASA. Personal communication 27 July 2018.

<sup>46</sup> PMCA Economic Consulting. A deposit-refund system for Ireland? Experiences from other European countries. December 2017.

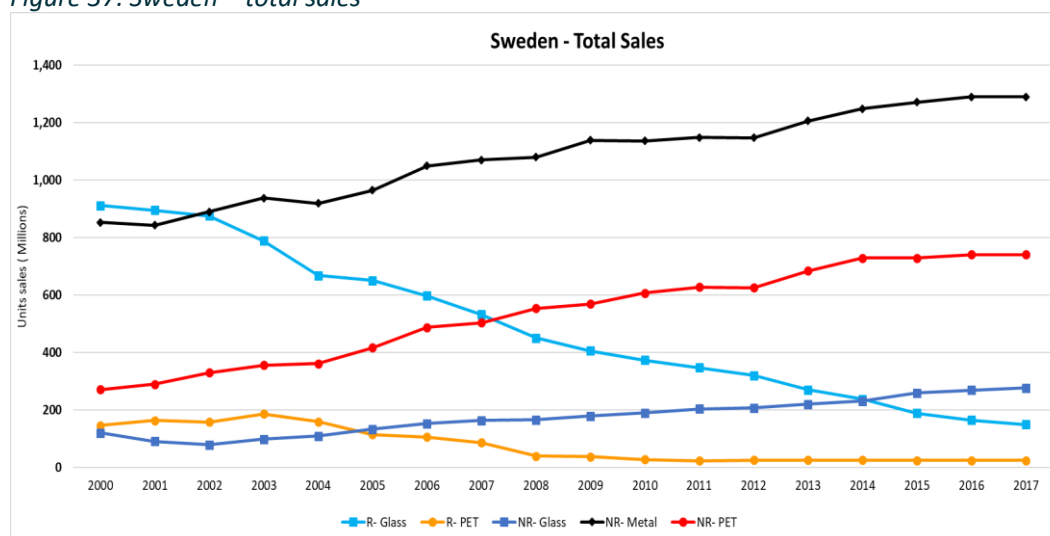
<sup>47</sup> FTI. Packaging recycling for a more sustainable society

Household packaging is mainly collected through a national network of 5,800 bring sites, where clear and coloured glass are collected separately. Only one-third of households have access to 'close to home' collection, mainly in apartment buildings, but the plan is to increase this in line with higher recycling targets for 2020 set out by revised legislation in 2014.<sup>48</sup> The bring sites (recycling stations) are primarily financed by producer fees and supplemented with incomes from the sale of secondary raw materials.

### 5.4.3 Impact of the policies on the market share of glass packaging

Figure 37 shows that refillables (glass and PET) fell dramatically between 2000 and 2017 with non-refillable cans, PET and glass all gaining market share.

Figure 37: Sweden – total sales



Source: Produced by Oakdene Hollins using data from Global Data

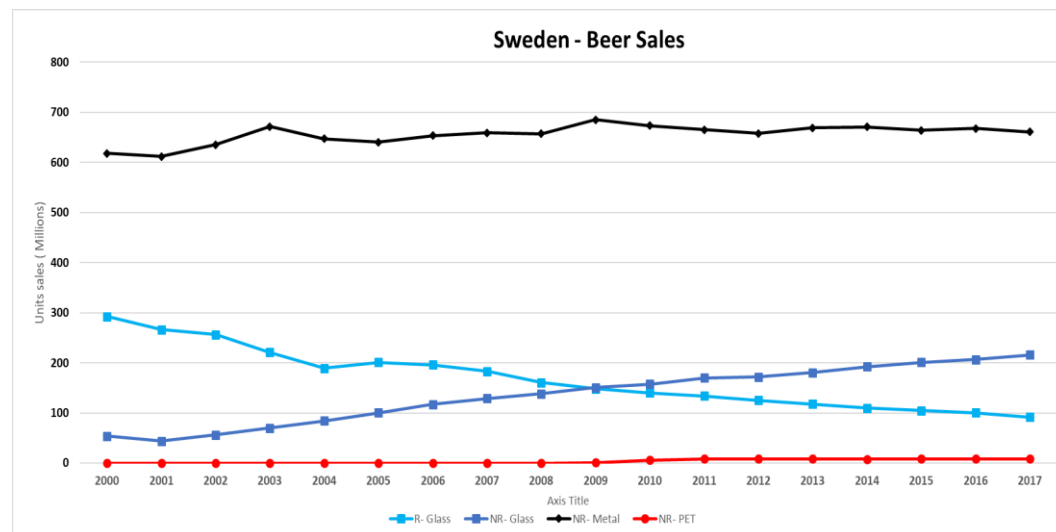
Svensk Glasåtervinning (SGÅ)<sup>49</sup> says, the cost of collecting, ensuring sterilisation etc. is too high for the brewers. The micro-breweries generally all use one-way packaging, and there is little evidence of them co-operating with the larger breweries who have washing and refilling plants. Figure 38 shows that metal cans have been the market leaders in the Swedish beer market at least since 2000, but there has also been a significant incremental switch from refillable to non-refillable glass. Sveriges Bryggerier reports<sup>50</sup> that this is largely due to a change in consumer preferences, with a switch from 'light beer' with less than 2.25% alcohol by volume that was sold in refillables to stronger beer sold in one-way packaging. There has also been a significant proliferation of the brewery industry from seven big brewers in the 1980s. There are now 350 breweries, with a ten-fold increase in the last ten years and the majority of the new breweries use one-way packaging.

<sup>48</sup> PMCA Economic Consulting. *A deposit-refund system for Ireland? Experiences from other European countries.* December 2017.

<sup>49</sup> Svensk Glasåtervinning (SGÅ). *Personal communication 15 September 2017*

<sup>50</sup> Sveriges Bryggerier. *Personal communication 29 August 2018.*

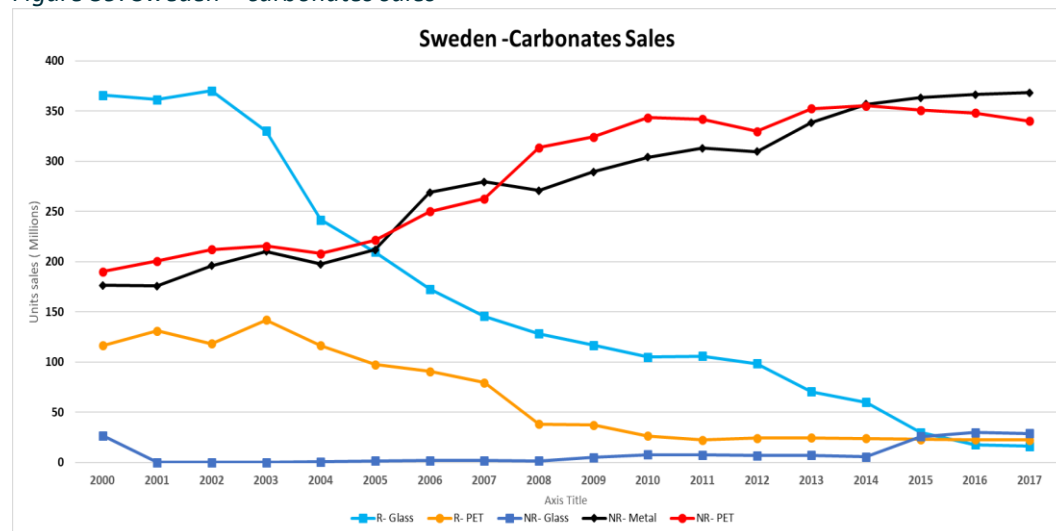
Figure 38: Sweden – beer sales



Source: Produced by Oakdene Hollins using data from Global Data

Unlike in many of the other countries where refillable glass containers was most prominent in the beer sector, there were higher sales of refillable glass containers in the Swedish carbonates market (Figure 39) in 2000 than in the beer market (Figure 38). Although the major trend is in the decline of refillables and the growth of non-refillable PET and metal containers, a smaller trend observable since 2014 is the switch from non-refillable PET to non-refillable glass. SGÅ states that the overall use of one-way glass in Sweden is increasing, largely as the public perception of aluminium cans - and especially PET (the plastic in the oceans issue) - has worsened. The popularity of bag-in-box for wine has also stagnated.

Figure 39: Sweden – carbonates sales

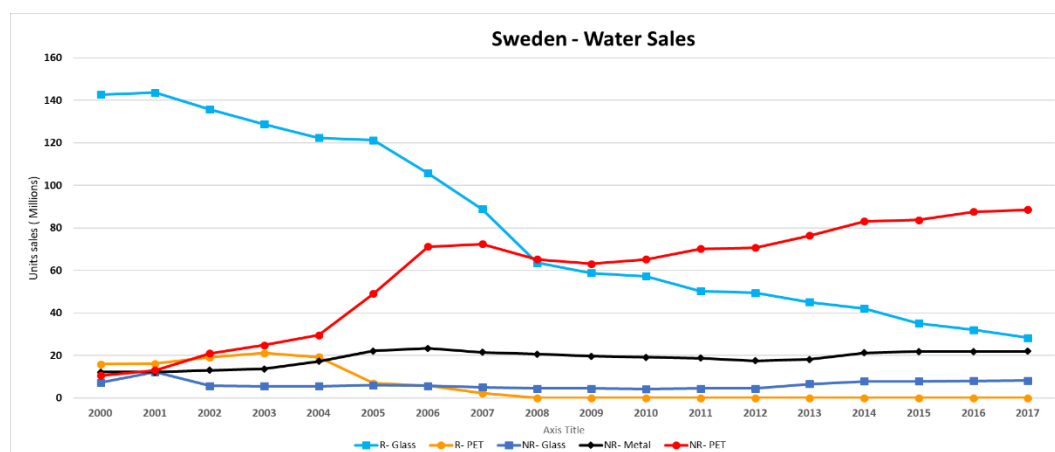


Source: Produced by Oakdene Hollins using data from Global Data

Sveriges Bryggerier reports<sup>51</sup> that Sweden was one of the first countries to experience public concern about plastic waste in 2006, with many consumers rejecting water bottled in PET in favour of tap water (Figure 40).

<sup>51</sup> Sveriges Bryggerier. Personal communication 29 August 2018.

Figure 40: Sweden – water sales



Source: Produced by Oakdene Hollins using data from Global Data

#### 5.4.4 The quantity and quality of recovered glass

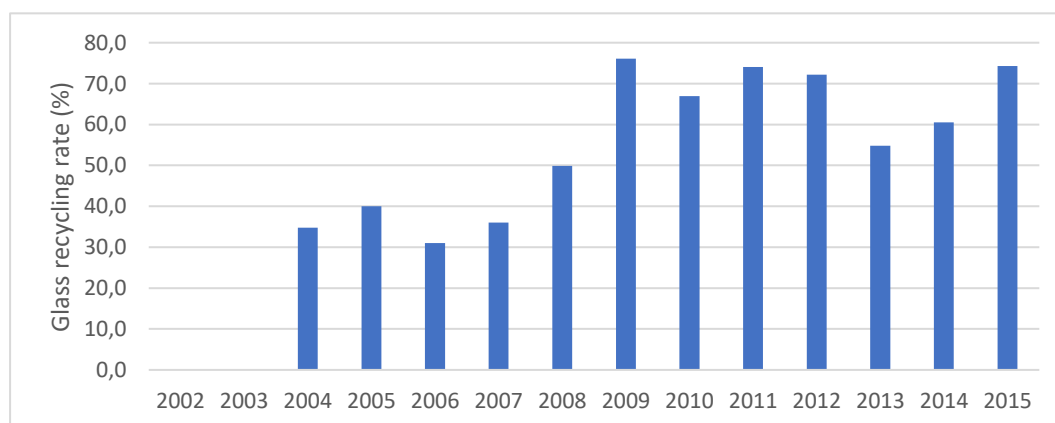
Sveriges Bryggerier reports<sup>51</sup> that the quality of glass recovered by the SGÅ is extremely high due to Sweden's long experience (since the 1950s) with recycling waste packaging at bring banks.

## 5.5 Lithuania

### 5.5.1 Recycling rate

Figure 41 shows that the recycling rate in Lithuania grew from 34.8% in 2004 to 74.3% in 2015 and that the PPWD 60% recycling target in 2012 was achieved by 2009. However, the fall in the recycling rate in 2013 led to concern over the effectiveness of the EPR scheme in meeting future targets leading to the introduction of the country's first DRS in 2016.<sup>52</sup>

Figure 41: Glass recycling rate (%) in Lithuania 2004 to 2015



Source: Eurostat

<sup>52</sup> A scandal, which broke in 2016 and 2017, over alleged falsification of recycling certificates by participants in Lithuania's existing Green Dot (EPR) scheme, added further public support for the new deposit scheme, which is regarded as harder to cheat.



### 5.5.2 A description of the policies

In 2001, to comply with the PPWD Lithuania implemented the *Law on the management of packaging and packaging waste* which included the introduction of an EPR – Green Dot system. In April 2013 the Lithuanian Ministry of Environment passed amendments to the packaging law to introduce a deposit scheme. The key reasons for introducing the scheme were to combat litter and increase recycling rates.<sup>53</sup> However, anecdotal evidence suggests that an additional reason for introducing the deposit scheme was that Latvia planned to have a deposit and there was concern that aluminium and PET would be diverted to Latvia to claim the deposit. The new deposit scheme for beverage containers was introduced in 2016. A standard container deposit of 0.10 euro per container is applied across the full range of glass and non-refillable plastic and metal beverage containers from 0.1 to 3 litres in size.

Užsątao Sistemų Administratorius (USAD) was named as the non-profit organisation tasked with operating the new deposit system. USAD was established by the Lithuanian Association of Brewers, the Association of Lithuanian Trade Enterprises and the Lithuanian Natural Mineral Water Manufacturers' Association. Through a public tendering process, TOMRA was selected as the company to provide the reverse vending infrastructure for seven years. Unlike other schemes in which retail outlets are required to invest in the RVM infrastructure, in this case TOMRA retains ownership of the machines (900 machines and 300 kiosks) and USAD pays TOMRA a 'throughput' fee for each container collected through an RVM.

The cost and funding to pay for the overall DRS scheme is split between three income streams:

- Material sales – circa 30-35%.
- Unredeemed deposits – circa 40%.
- Industry fee – 35%.

However, the proportion of each income stream depends on the material. For example, for glass, the industry fee will usually be higher due to the lower material value and the fewer unredeemed deposits.<sup>54</sup>

### 5.5.3 The quantity and quality of recovered glass

It is estimated that the EPR scheme collects circa 20-30,000 tonnes of glass and the DRS 10,000 tonnes.<sup>53</sup> However, although the EPR Green Dot scheme collects more, it is reported that DRS has a very important part to play in targeting the sort of product groups which people might consume away from home with a high risk that they will be discarded as litter.

It is reported that the average return rate from the deposit scheme reached 91.9% by the end of 2017, with the material specific recovery rates of 83% for glass, 92% for PET and 93% for cans. The PET recovery rate is considered a particular success since the recovery rate was only 34% prior to the implementation of the scheme.<sup>53</sup> However, the increase in recycling rate for glass is less pronounced since Figure 41 shows an overall glass recycling rate in 2015 of 74.3%, and the recycling rate for the type of beverage containers included in the deposit scheme would likely be higher than this overall recycling figure.

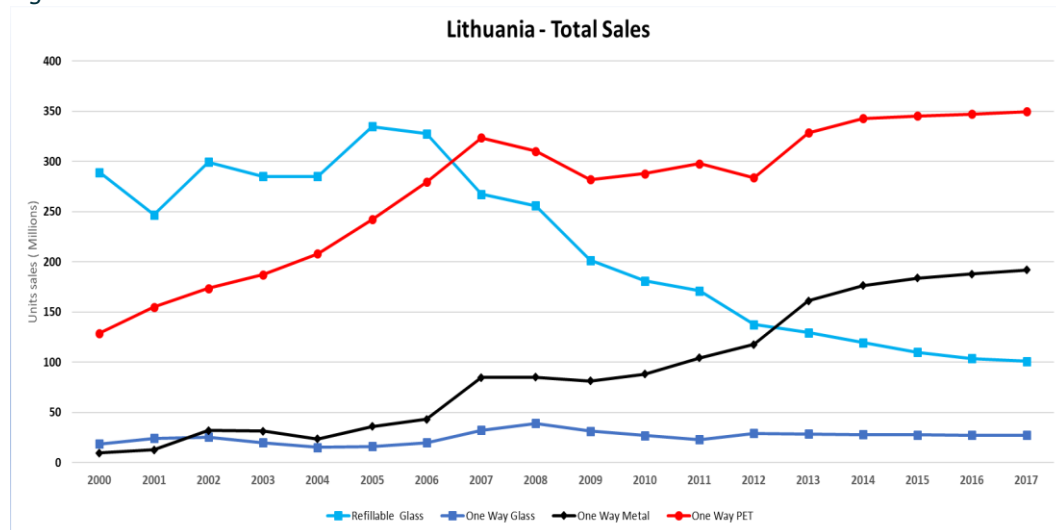
<sup>53</sup> [www.openaccessgovernment.org/recycling-lithuania-deposit-system-exceeds-all-expectations/45003/](http://www.openaccessgovernment.org/recycling-lithuania-deposit-system-exceeds-all-expectations/45003/) Accessed 17 July 2018

<sup>54</sup> Earth Care Ltd. Personal communication 14 August 2018.

#### 5.5.4 Impact of the policies on the market share of glass packaging

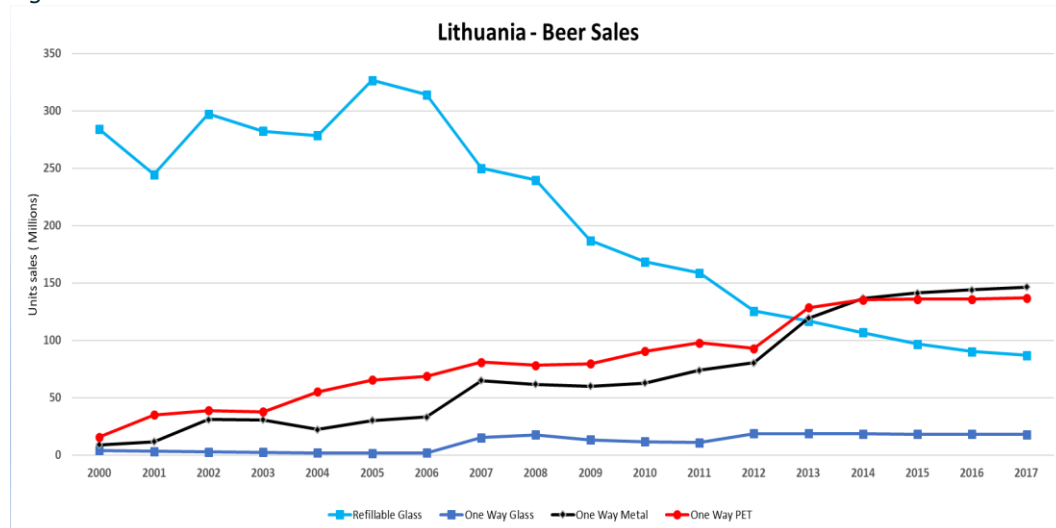
Figure 42 shows the very familiar growth in market share of one-way PET and metal at the expense of the refillable glass format. Figure 43 shows that it is the beer category where the decline in refillable glass was most prominent, with both one-way PET and cans growing in popularity. Figure 44 shows that it is one-way cans that have grown in popularity in the carbonates market and Figure 45 shows that the bottled water market is dominated by one-way PET.

Figure 42: Lithuania – total sales



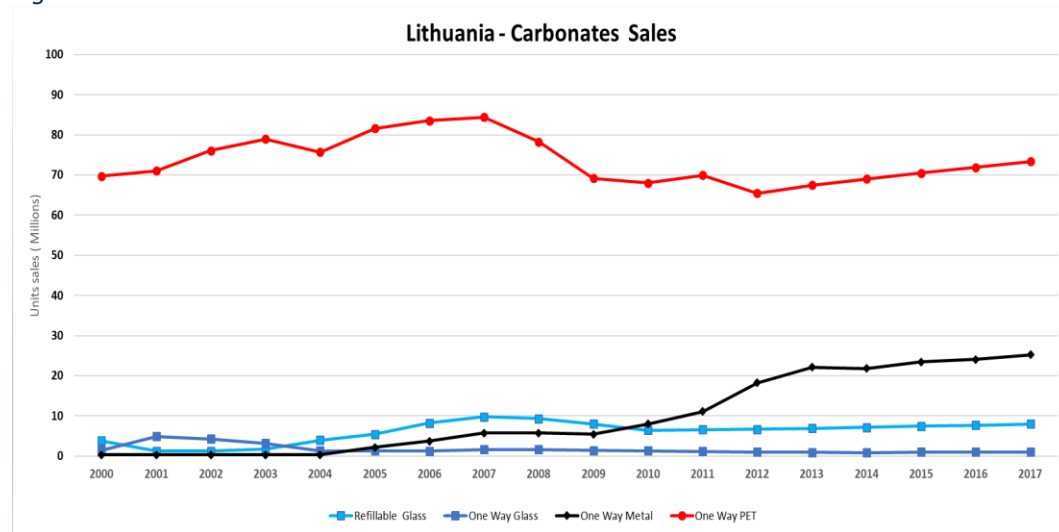
Source: Produced by Oakdene Hollins using data from Global Data

Figure 43: Lithuania – beer sales



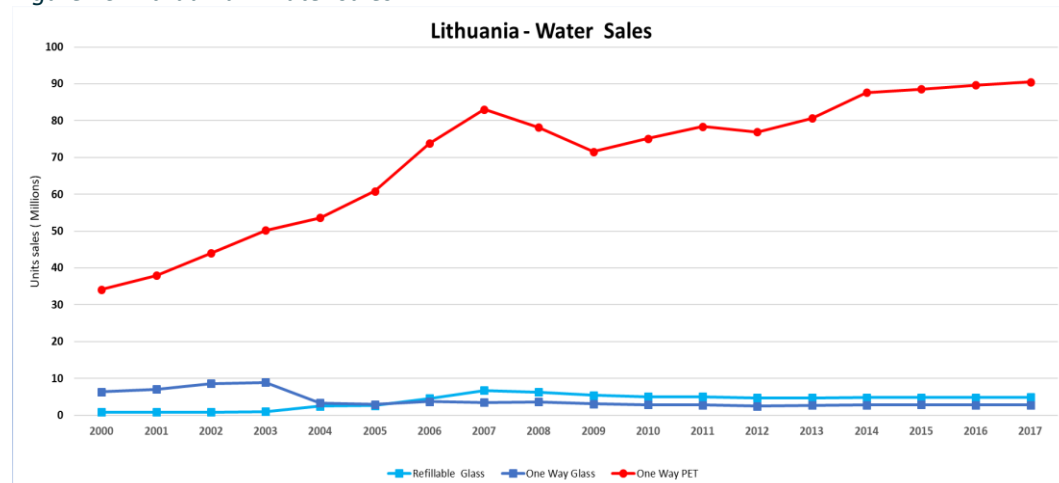
Source: Produced by Oakdene Hollins using data from Global Data

Figure 44: Lithuania - carbonates sales



Source: Produced by Oakdene Hollins using data from Global Data

Figure 45: Lithuania – water sales



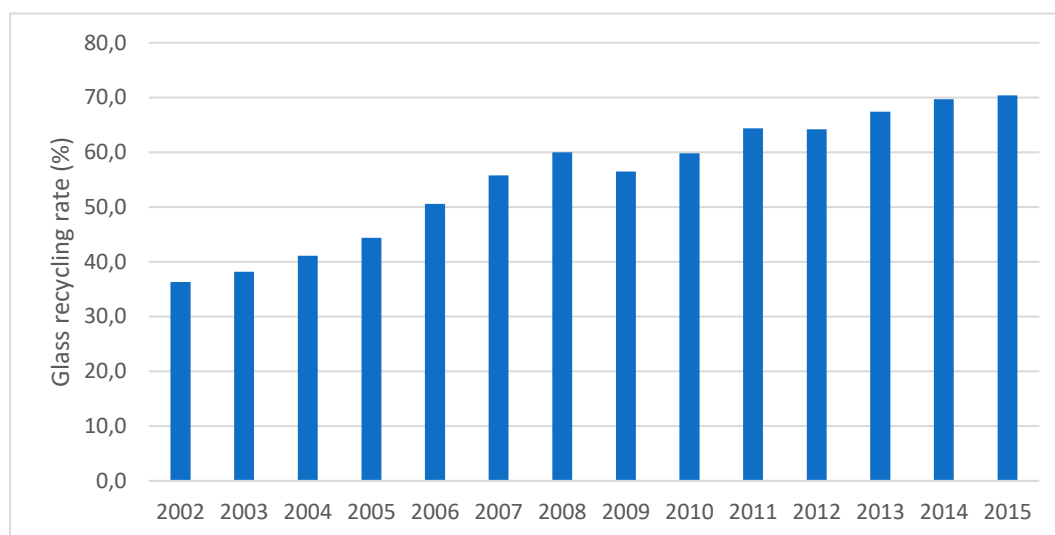
Source: Produced by Oakdene Hollins using data from Global Data

## 5.6 Spain

### 5.6.1 Recycling rate

Figure 46 shows that the recycling rate in Spain grew from 36.3% in 2002 to 70.4% in 2015. Spain met its PPWD target of 60% in 2008 with a recycling rate of 60%; however, the recycling rate dropped below 60% in both 2009 (56.5%) and 2010 (59.8%).

Figure 46: Glass recycling rate (%) in Spain 2002 to 2015

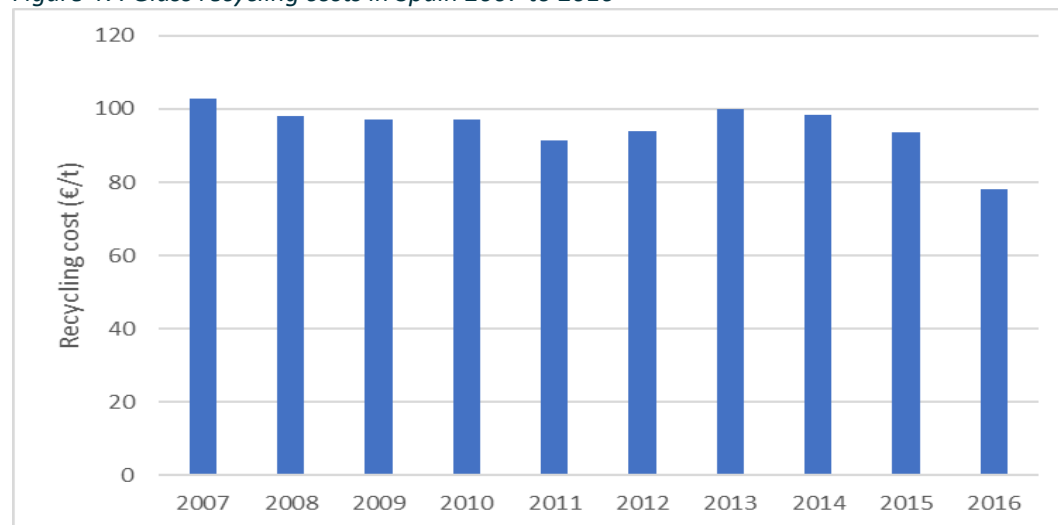


Source: Eurostat

### 5.6.2 A description of the policies

In 1997, the Packaging and Packaging Waste legislation (97/11) was introduced, which included the introduction of the extended producer responsibility scheme. Ecodrio is the non-profit organization that manages the recycling of all glass waste in Spain. The EPR scheme operates like many of the Green Dot schemes operated across Europe, whereby packaging companies finance the scheme based on the weight of material they place on the market. In 2016, this accounted for 44.5 million euro, which equates to 74% of the 60 million euro total costs of operating the scheme. The additional revenue was generated through the sale of recovered material. Figure 47 shows that the cost of glass recycling fluctuated between 90 and 100 euro/tonne between 2008 and 2015 and fell to 78 euro/tonne in 2016.

Figure 47: Glass recycling costs in Spain 2007 to 2016



Source: Ecovidrio

Ecovidrio<sup>55</sup> states that the key factors for the growth in glass recycling have been:

- Significant focus on the hotels, restaurants and catering (HORECA) sector. They are large generators of one-way glass containers and Ecovidrio has invested a lot of resources and effort in trying to recycle more and more. For example, special containers were introduced (self-loading, with a system that allows easy management of large amounts of waste), provision of resources (delivery of cubes etc), informative visits and training. Figure 48 shows an example of the bottle banks used for the HORECA channel in Spain.

Figure 48: An example of the bottle banks in operation for the HORECA channel in Spain



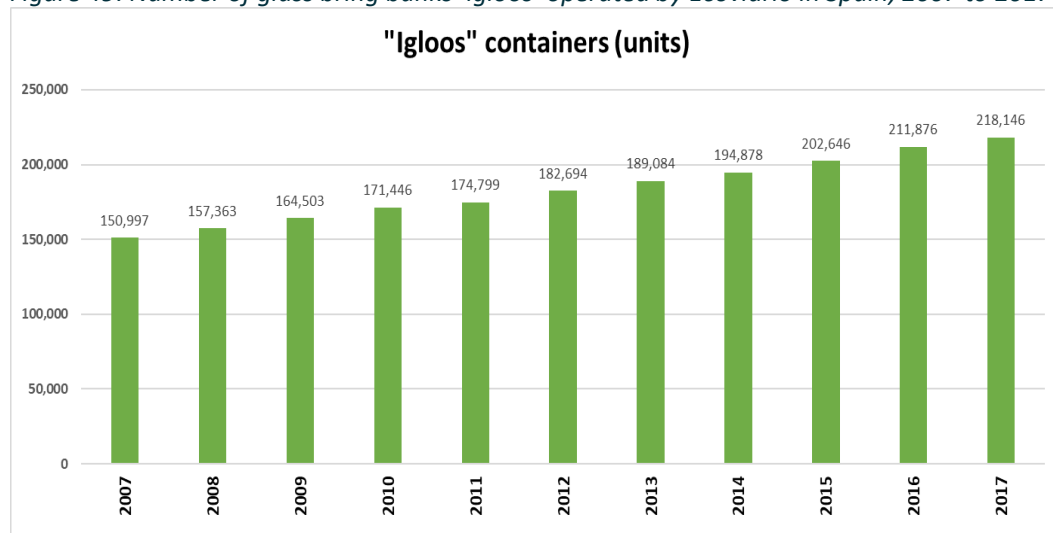
Source: Oakdene Hollins

<sup>55</sup> Ecovidrio. Personal communication July 2018.

- Promotion of direct collection. The Ecovidrio model is unique. Two options are offered to the local authorities: financing at zero cost for them with the selective collection of glass containers or (preferred by Ecovidrio) managing the system directly and taking care of collection, etc.
- Effort in supplying more containers ('igloos'). Spain has one of the highest concentrations of containers in Europe, with a ratio of 1 container per 213 residents. It is one of Ecovidrio's strategic plans, to continue investing in containers.
- 315 awareness campaigns per year. Ecovidrio is very well-known for campaigns in the media, on the streets, at parties, workshops in schools, social media, etc.

Figure 49 shows the steady growth in the number of glass bring banks 'igloos' in Spain between 2007 and 2017, which is correlated with the incremental growth in recycling rate shown in Figure 46.

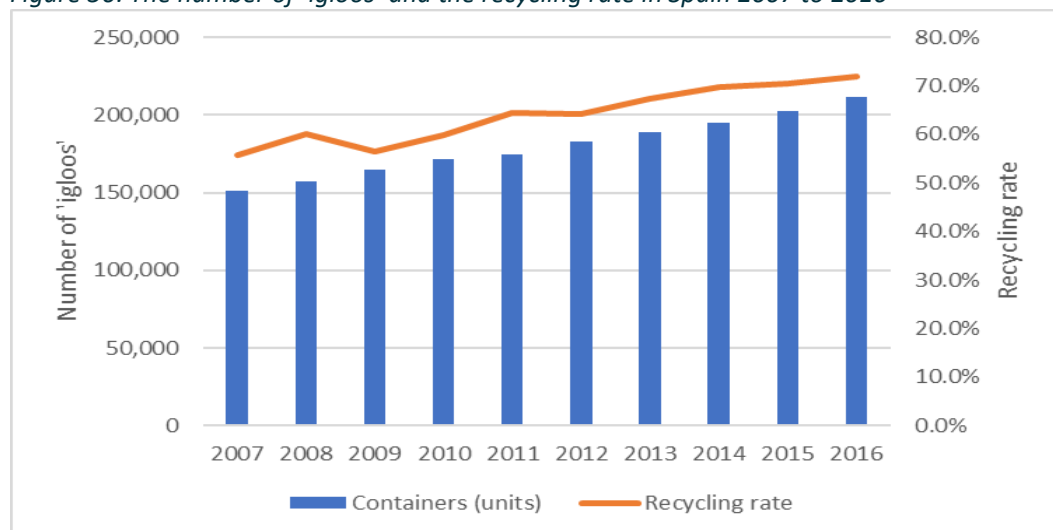
Figure 49: Number of glass bring banks 'igloos' operated by Ecovidrio in Spain, 2007 to 2017



Source: Ecovidrio

The 'igloo' infrastructure has been introduced incrementally. Figure 50 shows how the number of igloos have increased in Spain in line with the increase in glass recycling.

Figure 50: The number of 'igloos' and the recycling rate in Spain 2007 to 2016



Source: Produced by Oakdene Hollins using data from Ecovidrio

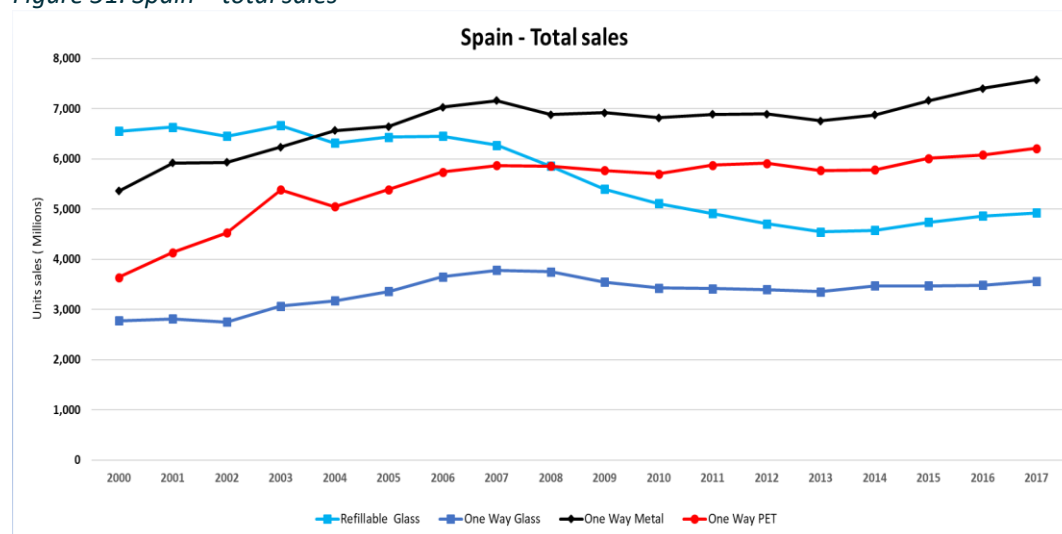
### 5.6.3 The quantity and quality of recovered glass

The contamination rate in the glass containers igloos in Spain is less than 2%. The mono-material container with its small mouth provides the highest quality material. The contamination in the containers (usually plastics, plugs, lids and in some cases ceramic or crystal) is easily removed at the treatment plants with manual or optical sorting: in the case of glass, it is reported not to be a problem at all.

### 5.6.4 Impact of the policies on the market share of glass packaging

Figure 51 shows that between 2000 and 2007 there was a growth in unit sales in all three one-way packaging formats, and they have all remained quite stable thereafter. However, refillable glass demonstrated a slow decline between 2000 and 2006 followed by a more pronounced decline between 2007 and 2013.

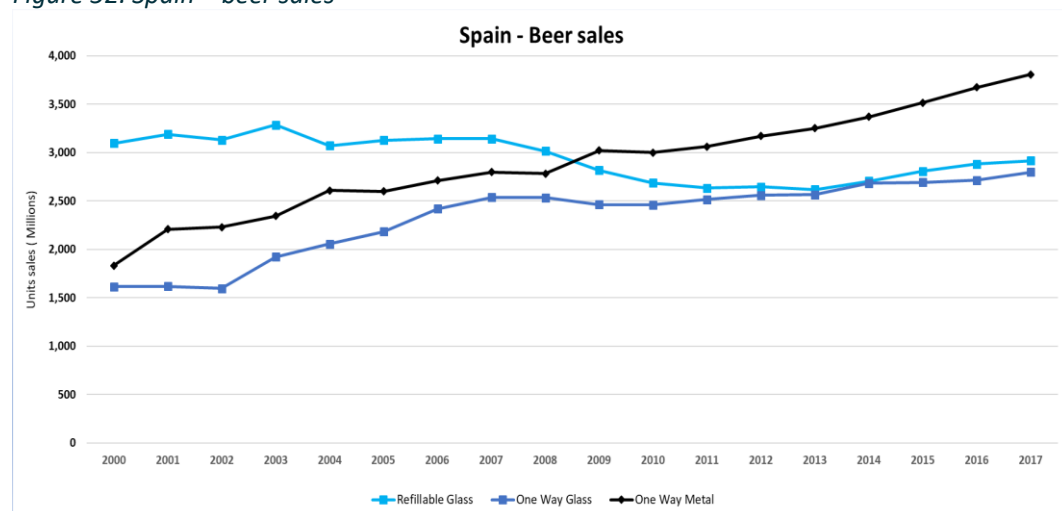
Figure 51: Spain – total sales



Source: Produced by Oakdene Hollins using data from Global Data

Figure 52 shows that, in the beer category, the market share of one-way cans has grown incrementally across the whole timeframe and one-way glass has also gained market share, especially between 2002 and 2007.

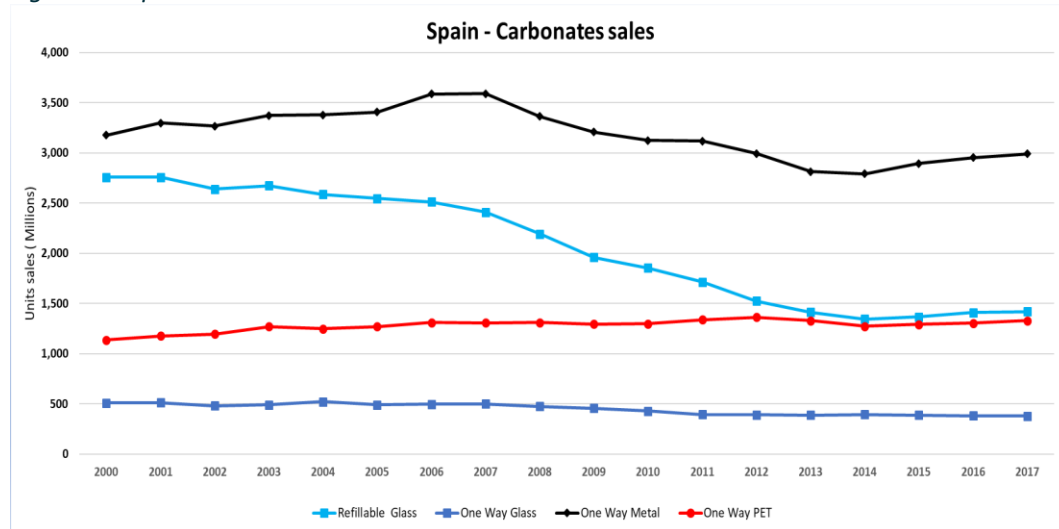
Figure 52: Spain – beer sales



Source: Produced by Oakdene Hollins using data from Global Data

Figure 53 shows that all but one-way PET have shown a decline in unit sales, with refillable glass being the most pronounced.

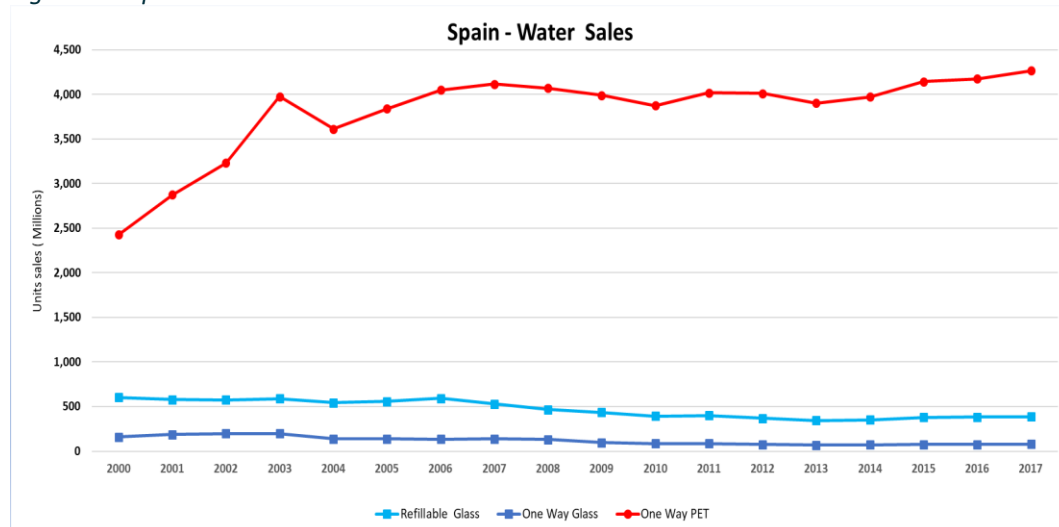
Figure 53: Spain – carbonates sales



Source: Produced by Oakdene Hollins using data from Global Data

Figure 54 shows the rapid growth in bottled water sales in one-way PET between 2000 and 2007 and that sales in both glass formats have shown a very slight decline

Figure 54: Spain – water sales



Source: Produced by Oakdene Hollins using data from Global Data



## 6 Conclusions

Traditionally, the mandatory DRS on single-use packaging has been introduced in countries that had a well established voluntary DRS for refillable beverage containers. The existing infrastructure and established consumer 'bring-back' culture enabled the switch from collection of refillables to collection of single-use beverage containers.

Currently, national debates on DRS are no longer focused on refillables, but on solving the relatively poor recovery rates for plastic, especially with the rise of the on-the-go market for beverages. Some DRS schemes include one-way glass, others do not. It shows that there is no single ideal DRS system, and the case for each needs to be analysed separately.

The study shows that where one-way glass has been included in a deposit return scheme, it has not been a decisive measure in increasing the recycling rates. The highest recycling rates for glass are achieved where there is source-separated collection of glass packaging, good governance of waste management systems, and effective public communication initiatives.

While the average EU glass recycling rate is high, at 74%, there is still a huge potential for improvement on the overall performance in glass recycling. From a circular economy perspective, whether it is in absolute terms (volume of waste not recycled per country) or in relative terms (glass waste generated per capita), there remains a noticeable leakage of glass from the economy.

This study emphasises the need for glass packaging manufacturers to actively support source-separated collection systems in Member States.

## About the authors



### **Peter Lee PhD, Head of Operations**

Peter has project-managed and written major studies on resource efficiency, sustainability, carbon reduction and energy, with much of his focus being on the food manufacturing and retail sectors. His specialisms include: waste prevention, waste logistics and reverse supply chains, packaging and waste management in the food and drink industry, environmental impact assessments, and recycling technologies. An expert in Lean techniques, he has worked with manufacturing clients to implement waste prevention.



### **Dan Eatherley MSc**

Dan has been associated with Oakdene Hollins for over a decade, carrying out research and technical & market studies on: food and drink manufacturing; environmental labelling schemes, materials recovery & recycling facilities; rubber, foam and leather recycling; the textiles and WEEE sectors; carbon footprinting & transport emissions; resource efficiency; sustainability policy; environmental economics; global materials security; clean technologies; reuse and remanufacturing.



### **Tania Garcia MAAT**

Tania joined Oakdene Hollins' Finance team in 2015, and has since gained membership of the Association of Accounting Technicians. Her data analysis skills, and her expertise in graphics and infographics, have been invaluable in the production of this report.

From its offices in Aylesbury and Brussels, Oakdene Hollins provides research and consulting services to clients under three main themes:

- Circular Economy
- Sustainable Products
- Innovative Technologies & Materials

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