



Closing the loop

Four steps towards 100%
aluminium packaging recycling

Executive summary

Resources and waste policy in England is undergoing its first major shake up in a generation. Following the release of its new strategy, the government has published a series of consultations that promise to change how manufacturers produce packaging, and how citizens, local authorities and waste managers deal with used material. The government is consulting on implementing a deposit return scheme for drink containers, overhauling the producer responsibility system for packaging, harmonising recycling systems across local authorities and taxing virgin plastic.

These proposals promise to improve a system regarded as inefficient at best and broken at worst. But the scale of the changes means they must be carefully planned to make sure they work for all groups concerned; they must make it easy for people, leave local authorities no worse off and benefit the domestic recycling industry by providing high quality material and greater employment opportunities.

The changes must also work for all the different materials we use. The focus has been overwhelmingly centred on plastic, but here we examine how reform can work for another widely used material: aluminium.

To achieve a near 100 per cent recycling rate for aluminium packaging, we recommend harvesting it in the waste management process as early as possible. It becomes increasingly more expensive and energy intensive to generate high quality material the more it becomes mixed with other materials.

We recommend the following four step approach, in order of significance:

1

Create an 'all-in' deposit return scheme (DRS)

DRSs in Europe have shown it is possible to recycle nearly all drink containers on the market, but they must be carefully designed to work with the wider recycling system. This will be

especially important in the UK, as kerbside collection schemes are well established and there is high on the go consumption. We set out a number of principles for a workable UK system. This includes ensuring containers of all sizes and composition are included to maximise the flow of high quality material into the recycling process and prevent consumer confusion.

The UK should not just cut and paste another country's system, but there are important lessons from abroad, with case studies that show how consumer engagement has led to rapid success in Lithuania, how producers are supportive of the system in Norway and how the scheme works with consumption on the move in Estonia.

A well run DRS could collect 95 per cent of cans for high quality recycling, compared to 72 per cent today, around a quarter of which is material currently harvested after incineration.

2

Improve kerbside services

Drink cans account for around two thirds of aluminium packaging. Once they are dealt with through a DRS, careful consideration is needed to ensure other types of aluminium packaging are recycled at the kerbside. There is considerable scope to improve both the current haphazard system and the government's proposals for harmonisation. We recommend being more prescriptive about source separation and residual waste restriction, similar to Welsh guidance. The government should also expand the core set of materials for collection to include other forms of aluminium packaging.

Packaging streams like aerosols, foil and trays are recycled at a rate of only about 13 per cent today. Ensuring they are universally collected could increase aerosol recycling to 50 per cent and the other formats to a third, contributing 11 per cent to the overall aluminium packaging recycling rate.

3

Ensure best practice at sorting plants

Although extracting material from the mixed waste stream is less ideal than separation at source, as the quality and quantity of material is lower, recent research has shown that it is increasingly possible to do when items have been missed by previous steps. However, this requires investment in new machinery, such as eddy current separators and sorting robots, so that, where they are still present, aluminium items can be salvaged from mixed waste.

Best practice sorting for material that would normally go to landfill or incineration could contribute an additional 11 per cent to the overall aluminium packaging recycling rate.

4

Recover the remainder from incinerator bottom ash

If the previous steps are taken, the amount of aluminium ending up in incineration will fall considerably. Material will have been harvested earlier in the process, which is important as some aluminium is oxidised and lost through incineration, and material that is collected after this stage cannot currently be recycled back into packaging. In 2017, 26 per cent of the UK's aluminium recycling rate came from material recovered after incineration. In our scenario, recovery at this stage would account for just seven per cent of the total.

Harvesting remaining material after incineration would bring the total aluminium packaging recycling rate to 97 per cent.

Introduction

“The current producer responsibility regime for packaging is not fit for purpose.”

At the end of 2018, Defra published its long awaited strategy on resources and waste, promising to focus on known problems, cut confusion over household recycling and tackle packaging waste.¹

The government is now consulting on its promises to introduce a deposit return scheme and to embed the concept of extended producer responsibility in resources policy. This move invokes the ‘polluter pays’ principle, aiming to ensure that producers pay the full costs of disposing the material they place on the market. If done well, this will mean products and packaging are designed with resource efficiency – including material reduction and recyclability – in mind.

This dramatic overhaul follows widespread recognition that the current producer responsibility regime for packaging is not fit for purpose. The Packaging Recovery Note (PRN) system, created more than 20 years ago, has seen producers meet recycling targets at minimal cost. But it has also resulted in perverse outcomes, including an over reliance on waste exports that allow the perpetuation of inconsistent collections and make high levels of recycling difficult to achieve.

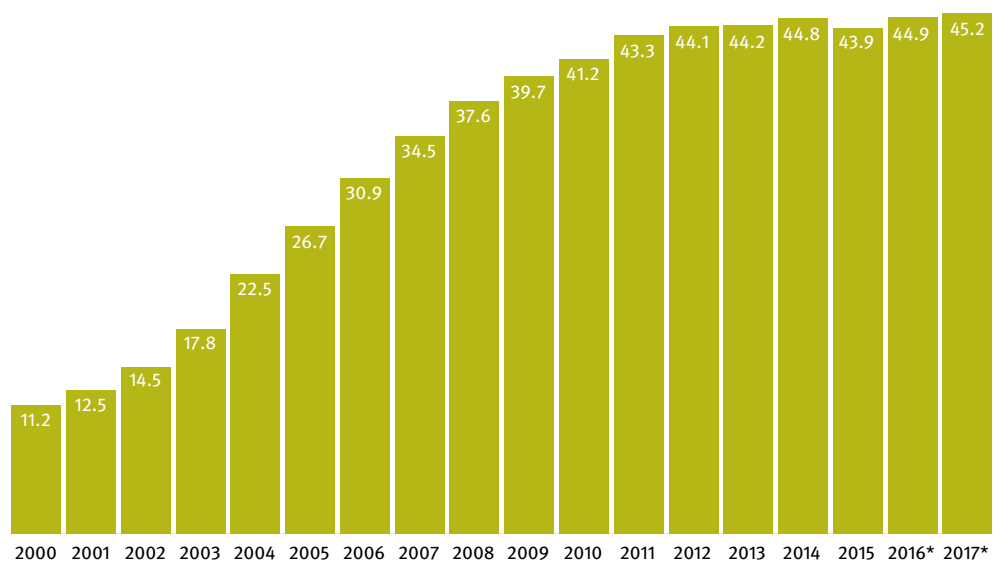
The new system should minimise the environmental impact of packaging and maximise recycling rates. While much of the current debate has focused on reducing plastic packaging pollution, it is important that policy adequately addresses all materials used in a holistic way.

As an indication of what can be achieved through ambitious policy, here we examine the changes necessary to achieve nearly 100 per cent recycling of aluminium packaging.

Recycling in England

Local authority recycling rates have stalled since 2013 at around 45 per cent, after rising from just 11 per cent at the beginning of the century.

Recycling rates in England (%)²



* 2016 was the first year metal recovered from incinerator bottom ash was included in the recycling rate. Without it, the recycling rate would have been 44.2 per cent in 2016 and 44.4 per cent in 2017.

“The proportion of aluminium packaging exported for recycling has been increasing in recent years.”

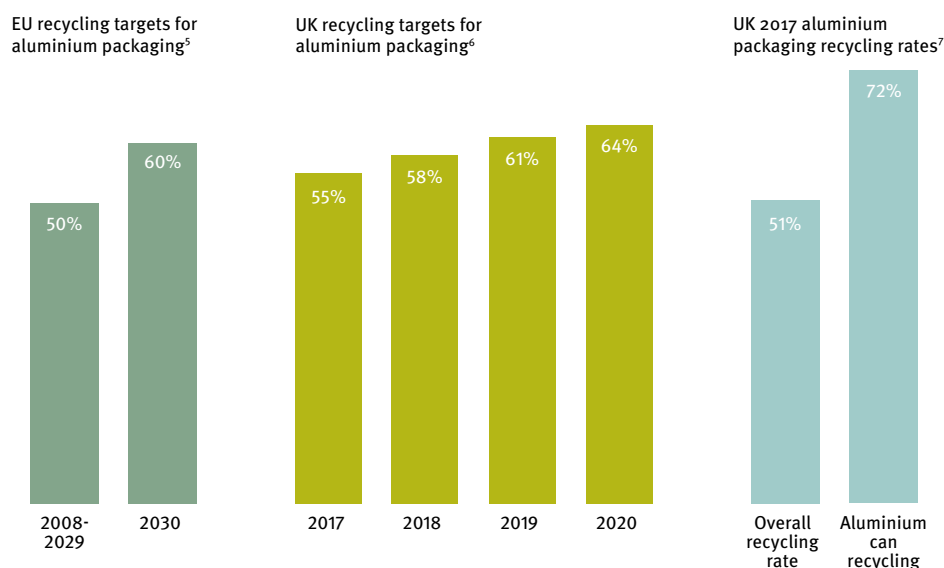
There are multiple, interlinked reasons why rates have plateaued, including: a lack of investment and consistency in local authority services; minimal on the go recycling facilities; and misplaced incentives for producers through the PRN system, and for waste managers through the Landfill Tax, which has not successfully promoted reuse, reduction or recycling.

Aluminium packaging in focus

Despite household recycling rates levelling off, the UK continues to exceed recycling targets for packaging, particularly those set by the EU Packaging Waste Directive. The UK’s own targets for packaging are higher than those mandated by the EU. Although many criticisms of the system exist, packaging recycling targets have been exceeded at low cost to businesses.

It should be noted, though, that many commentators, including the National Audit Office, have questioned the robustness of reported data. Criticising Defra in an analysis of the packaging recycling system, it said: “the department’s estimates of packaging recycling rates are not sufficiently robust”. The current system does not account for undetected fraud and error, given the “financial incentive for companies to over-claim, and a particular risk that some of the material exported overseas is not fully recycled”. The approach to estimating packaging put on the UK market was further criticised as involving a “complex methodology and a number of assumptions”.³ In the case of aluminium, it is also believed that recycling is sometimes carried out by reprocessors that are outside the PRN system.⁴

UK recycling rates vs targets



Unlike other material streams, notably plastic, the majority of aluminium packaging is still recycled in the UK. Novelis Recycling’s plant in Warrington has the capacity to recycle all of the aluminium drink cans sold in the UK.⁸ However, the proportion of aluminium packaging exported for recycling has been increasing in recent years and, in 2017, nearly half was exported for recycling. Unlike other material streams like plastic and paper, almost all of this went to other European countries.⁹

In 2017, Alupro reported an overall UK recycling rate for aluminium packaging of 51 per cent. For cans alone, which make up two thirds of the total, it has estimated that the recycling rate is 72 per cent. The remaining types of aluminium packaging, including foil, aerosols, trays and containers, are not as widely recycled, with a recycling rate in the region of only 13 per cent. At present, more than a quarter of the overall recycling rate comes from material recovered from incinerator bottom ash.

“Recycled aluminium requires 95 per cent less energy to produce than new aluminium.”

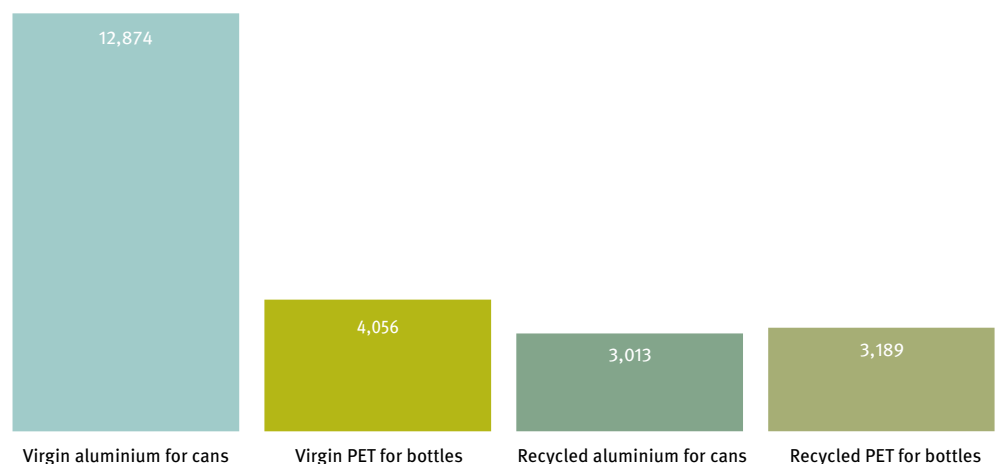
Why high recycling matters for aluminium

Aluminium can be recycled with little loss of quality, regardless of how often it is reprocessed. This is important, given the environmental impacts associated with primary aluminium production: it is an energy intensive process that results in environmental degradation and hazardous waste.¹⁰ In 2015, this included about 150 million tonnes of bauxite tailings, also known as ‘red mud’ from mines that are mainly located in tropical and sub-tropical areas, including Africa, South America and Australia. This highly alkaline and potentially fatal toxic waste is normally landfilled.¹¹

Recycled aluminium avoids these impacts. It requires 95 per cent less energy to produce than new aluminium, which is an important benefit, as aluminium production is responsible for around one per cent of total global greenhouse emissions.¹² While the carbon footprint of producing a tonne of the metal varies widely (from around 3tCO₂e per tonne using hydropower to 20tCO₂e per tonne using coal fired power), the carbon footprint of recycled aluminium is always much lower at below 1t CO₂e.^{13,14}

This is relevant when it comes to the carbon impact of using aluminium for packaging, compared to other materials. Full lifecycle analyses have well documented shortcomings because of the number of variables that must be taken into account and the number of assumptions that must be made. But a simple comparison of government figures for calculating the carbon impact of using virgin versus recycled content for both aluminium packaging and PET plastic packaging demonstrates the carbon benefits of recycled aluminium.

Carbon emissions associated with a tonne of material (kgCO₂e)¹⁵



Aluminium packaging often weighs less than its plastic counterpart. A lightweight 330 millilitre aluminium drink can, for instance, can weigh less than ten grammes, whereas a lightweight 500 millilitre PET bottle will weigh around 20 grammes.¹⁶ Most importantly, high recycled content is much easier to achieve for aluminium cans. This is not only because the recycling process itself is simpler, because cans are sold without labels, different coloured caps or sleeves, but also because the material does not degrade as plastic does. PET suffers from polymer shortening during the recycling process, which makes continual bottle to bottle recycling impractical (although there are now companies developing solutions to enable closed loop recycling by rebuilding polymer chains). Process losses are also substantial when recycling PET, with final yields totalling only around 70 per cent of what goes into the recycling process.¹⁷

“Aluminium contributes a quarter of the revenue derived from local authority sales of recyclables.”

According to industry, around 75 per cent of the aluminium ever produced is still in use today.¹⁸ Improving this figure further by increasing recycling will help to avoid the waste and greenhouse emissions associated with primary production.

It would also bring considerable economic benefits, given the inherent value of the material, especially compared to other commonly recycled household items. According to Alupro, aluminium is less than one per cent of the household waste stream, but it contributes a quarter of the revenue derived from local authority sales of recyclables.¹⁹

Prices per tonne of recyclable material, December 2018²⁰



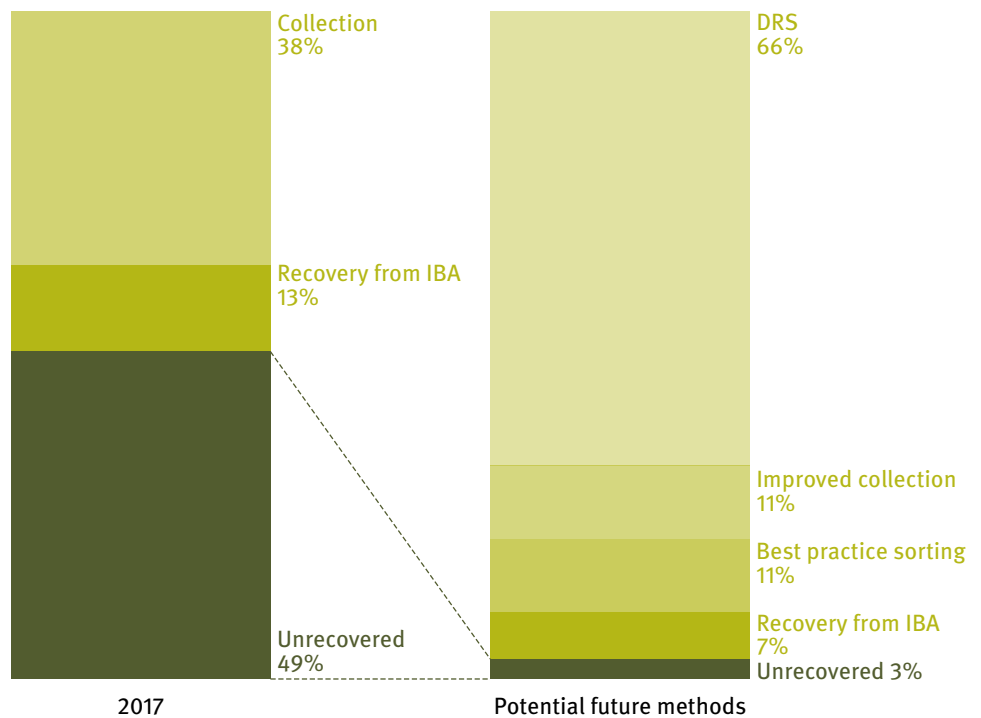
How to achieve nearly 100 per cent aluminium recycling

“The quality of material collected for recycling, and therefore its value, is higher the less it is mixed.”

As a general rule, the quality of material collected for recycling, and therefore its value, is higher the less it is mixed, as it avoids the energy, environmental impacts and costs involved in separating material streams and maintaining quality. The best way to achieve this is by keeping recyclable items separate at source as it becomes increasingly more expensive and energy intensive to generate high quality material the later it is harvested in the waste management process.²¹

There are just a few steps needed to shift the system towards nearly 100 per cent aluminium packaging recycling. We discuss them below, starting with those that will result in the highest quality material and contribute most to a higher recycling rate.

How to achieve nearly 100% aluminium packaging recycling



“In 2018, drink cans made up 68 per cent of aluminium packaging used in the UK.”

1 A deposit return scheme



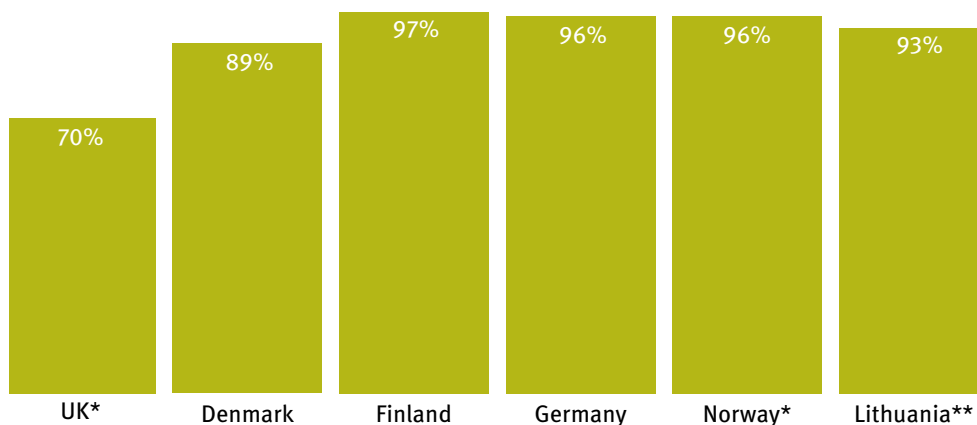
The idea behind extended producer responsibility is to give producers more incentives to increase recycling of the materials they put on the market. Although the government is consulting separately on its promise to implement a deposit return scheme (DRS), the scheme should be viewed as a vital part of producer responsibility reforms, as it will allow beverage manufacturers to fulfil their responsibilities.

A DRS will see a small deposit added when someone buys a product which is then returned when the packaging is collected for recycling. This normally applies to beverage containers and is often held up as the best way to improve plastic bottle recycling rates. But it can also contribute to significant increases in drink can recycling. This is significant in the case of aluminium, as Alupro's projections suggest that, in 2018, drink cans made up 68 per cent of aluminium packaging used in the UK.²²

DRSs are already in place in many European countries, North America and Australia. Many of the well designed schemes in Europe achieve much higher recycling rates for aluminium and other materials than the UK.

“Bringing the UK’s return rate more in line with other European countries would significantly boost overall aluminium recycling.”

Aluminium can recycling rate by country, 2016²³



* The figures for the UK and Norway include material recovered from incinerator bottom ash, as is common in calculating municipal recycling rates for Europe’s Green Dot packaging system. This is not normally the case for material collected from DRSs in other countries.

** Lithuania’s figure is from 2017 as it only began a DRS in 2016.

Bringing the UK’s return rate more in line with other European countries would significantly boost overall aluminium recycling, as well as improving material quality.²⁴ Twenty six per cent of the UK’s current aluminium recycling comes from material recovered after incineration. A DRS would be able to harvest this material earlier in the process through separate collection.²⁵

Integrating an effective DRS system

Not all countries operating DRSs achieve return rates approaching 100 per cent. Some include contributions from municipal collections and, in rare instances, material recovered after incineration. To achieve a return rate of 95 per cent, a DRS must be carefully designed to work with the wider recycling system. This will be especially important in the UK, as kerbside collection schemes are well established and there is high on the go consumption.

We propose the following guiding principles:

- **Producer fees should vary by material type and recyclability**
Producers should pay for the recycling of their own products, so highly recyclable material does not subsidise costs associated with less recyclable containers. Further modulation of fees would encourage design for recyclability.
- **The system should be countrywide**
A single system across Britain would be easier for consumers to understand. It would minimise unnecessary burdens on businesses and prevent cross border fraud.
- **The system should not leave local authorities worse off**
Local authority collection of non-beverage packaging and other waste and recycling must be adequately financed.
- **All drink containers of all sizes should be included**
An intuitive system for a consumer should handle all drink containers of all sizes.

“The UK lacks a consistent recycling system outside the home.”

- **Information must be adequately monitored**
Reverse vending machines where people can return containers will automatically register container information, but fraud avoidance should be designed in throughout the system, including in relation to information about material placed on the market.
- **Packaging not covered by the DRS must be adequately covered by other policies**
Wider extended producer responsibility reforms must guard against perverse outcomes, including encouraging a switch to less recyclable material.
- **The return process should be simple and convenient for consumers**
Given the high rate of consumption on the go, return to retailers, including on the high street, is likely to be most convenient for consumers. This should be supplemented by collection in public areas with high footfall.
- **Unredeemed deposits should fund improvements to recycling**
Sending unclaimed deposit money to the Treasury, as is being consulted on, would provide the government with a perverse incentive to keep recycling rates low.

For a more in depth analysis of these principles, see the annex on page 21.

Making a DRS work for on the go consumption

Exact figures for consumption outside the home are difficult to obtain, but are considered to be much higher in general in the UK than elsewhere in the EU.²⁶ For aluminium packaging, some say that 30 per cent arises outside the home, though it may be as high as 45 per cent.²⁷

This is problematic as the UK lacks a consistent recycling system outside the home, both in workplaces and public spaces. According to RECOUP, only 42 per cent of local authorities provide on the go recycling bins in public spaces.²⁸ Even where they exist, the quality of captured material is notoriously low due to cross contamination, and often cannot be recycled at all.²⁹ And recycling from businesses is often lower than it is for households.³⁰ All this means that a considerable amount of used packaging is unnecessarily sent to landfill or incineration.

Aluminium cans make up the majority of aluminium packaging consumed outside the home. A DRS where collection happens at high street retailers should give consumers easy access to recycling services when they are out and about (see the example of Estonia on page 13). In addition, street bins should also be accompanied by tubes or slots to collect deposit bearing containers. This is done in some Scandinavian countries to allow people to leave containers for others to collect the deposit. This will allay concerns that DRSs might result in ‘bin mining’, where people look through bins to find containers.³¹ Reverse vending machines should also be installed in areas with high footfall, where people are likely to be eating and drinking on the move, such as rail stations, tourist attractions and city parks. This is already being trialled in places like Edinburgh Zoo.³²

“The value of the high quality aluminium more than covers the costs of collecting it.”

Lessons from abroad: three case studies

Given the UK’s unique circumstances, with high on the go consumption and established kerbside recycling, policy makers will not be able to copy and paste a system from elsewhere. However, other countries’ experiences can still offer valuable lessons for the UK.

Public engagement in Lithuania

Lithuania introduced a DRS for single use beverage containers in 2016 to prevent litter and improve separate collection of recycling.³³ Great effort went into engaging the public to achieve this.

Before the DRS was introduced, public engagement in the recycling system was low, resulting in contamination problems.³⁴ As in the UK, the majority of the population and some producers were in support of introducing a DRS, but the established producer responsibility organisation argued that the existing system would be damaged and that the focus should instead be on increasing on street recycling containers.^{35,36}

The scheme was designed to make it as easy as possible for consumers to return packaging to retailers. Nearly all stores in rural areas and those with over 300 square metres of retail space take part, with others able to opt in. Crucially, the DRS operator is responsible for educating the public about waste and recycling issues in general, as well as the DRS specifically.

This focus on engaging the public has worked: a survey after the second year found that 97 per cent of people thought it was either ‘necessary’ or ‘very necessary’, while 93 per cent thought it also contributed to the separation of other waste.³⁷ Most importantly, initial targets were easily surpassed. In 2017, the target was 70 per cent collection, but the overall return rate was 92 per cent, including 93 per cent of metal drink containers.³⁸

Producer buy-in in Norway

Norway’s 20 year old DRS is often held up as the most efficient in the world and central to this success has been the support of producers, who set the system up to avoid heavy environmental taxes on non-recycled packaging.

All beverage packaging sold, including cartons and flexible pouches, is subject to a basic tax (currently 11p per container), as well as an environmental tax (currently 53p for cans and 32p for bottles). The second tax decreases on a sliding scale when return rates hit 25 per cent, disappearing completely when 95 per cent of containers are returned.³⁹

Kjell Olav Maldum, CEO of Infinitum, the private company that administers the system, believes producer involvement has been the key to the scheme’s success: “In all other countries, the politicians have said that they want a system and then the producers have got together to prove that it is not a good idea. But, in Norway, we have had support from producers and retailers since the start and, therefore, we have been working in collaboration, and also with the Green Dot system for collecting municipal waste. So, we have been able to create a very efficient system with a very high return rate.”⁴⁰

Aluminium producers are effectively profiting from the system because the value of the high quality aluminium more than covers the costs of collecting it through the scheme. This is possible because there is no cross subsidy by material. Maldum says that this concept, the essence of extended producer responsibility, is vital: “The producers who are putting the material on the market should cover the costs of dealing with it... normally that will reflect the environmental impact of the different packaging type. So, if you have a material that’s very efficient to recycle, to transport and sort, as with aluminium, then it will be lower cost for the producer.”⁴¹

“Small shops offering to take back containers benefit from increased footfall and sales.”

On the go returns in Estonia

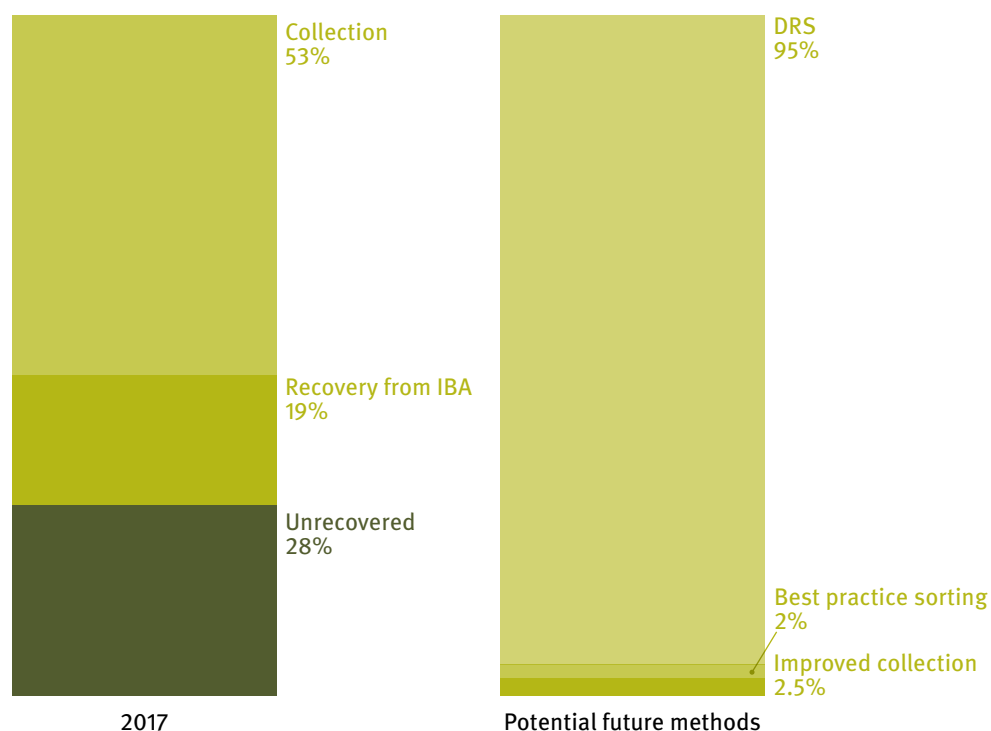
In Estonia, only large and medium sized retailers are required to take back deposit bearing containers. Those with less than 20 square metres of retail space are exempt, while those with between 20 and 200 square metres can apply for exemptions.⁴² In practice, though, that rarely happens, as small shops have found that offering take back attracts customers to their stores.

Rauno Raal, CEO of the Estonian deposit system between 2008 and 2018, explains that, during his decade long tenure, there were only four or five cases where this happened. The reason businesses do not apply for exemption, he says, is because they realise they would lose revenue to competitors or larger stores if they do not offer a return service to people who have a container to discard. The small shops offering to take back containers benefit from increased footfall and sales. Reverse vending machines give people receipts for their containers, which they can exchange for cash or put towards more groceries. Raal suggests that the vast majority – perhaps 90 per cent – put the money towards further in store purchases.⁴³

Having visited Estonia and other countries where small stores offer take back, the operator of an independent ‘Family Shopper’ franchise in Scotland decided to trial a return system for bottles ahead of the introduction of a DRS there. The six month trial saw a seven per cent increase in footfall and a 20 per cent increase in sales.⁴⁴

The DRS will only have an impact on aluminium drink cans, capturing almost all material placed on the market. The charts below show how the steps we propose will affect the recycling rate of cans alone. The following sections outline the additional steps that will have a bigger impact on other types of aluminium packaging.

The impact of a DRS on aluminium drink can recycling



2 Improved kerbside recycling services



“Kerbside sorting along the lines promoted by the Welsh Collections Blueprint maintains material quality and value by keeping it separate at source.”

A DRS will remove most aluminium cans from the kerbside collection system, leaving an estimated 32 per cent of other aluminium packaging unaddressed. The government has promised “comprehensive and frequent waste collection systems” for householders and business, and has proposed a core set of materials that local authorities should collect from the kerbside.

There is considerable scope for improvement, to both the current service and the government’s proposals. Disappointingly, the only aluminium packaging streams specifically mentioned in the government’s proposed core list of materials that all local authorities should collect are tins and cans.⁴⁵ Aluminium food tins make up less than two per cent of aluminium packaging, and most drink cans will be diverted to a DRS. The proposed core list should be amended to include aerosols, trays and foil, currently recycled at a rate of around 13 per cent. Most local authorities already collect these packaging types, either through kerbside collection or recycling banks, showing a clear case for these other items to be included as standard in harmonised collections.

The government should also be much more prescriptive in its guidance on how recycling should be collected to maintain material quality and reduce collection costs. Segregated collection systems are the best way to do this. The government has recognised this, consulting on whether it should produce statutory guidance to help councils in decision making on separate collection. Its consultation says it “would expect local authorities to collect dry materials separately where this helps to increase quality”, but leaves it to local authorities to make the final decision and it seems unlikely it will mandate separate collection wherever possible. While separate collections can be difficult to achieve from some housing, such services are suitable under most circumstances, and the government should ensure they are used. This is important as, once materials are mixed together, they cannot always be easily separated again. Aluminium formats like foil, for instance, might not be picked up during the sorting process at material recovery facilities. This is because other material, like paper, can block them from the sensors.

Kerbside sorting along the lines promoted by the Welsh Collections Blueprint maintains material quality and value by keeping it separate at source.⁴⁶ As well as avoiding the costs of dealing with contamination, this makes separate collections more economical overall. An independent review in 2016 confirmed that this type of system represents the best value for money. The model sees weekly separate collection of dry recyclables, sorted at the kerbside, paired with weekly separate collection of food waste in the same multi-compartment vehicles allowing single pass collection of both. Residual waste destined for landfill or incineration is restricted by volume, through limits placed on bin sizes and frequency, with fortnightly collection at most.

This final point is important in light of the consultation launched by the Department for Environment, Food and Rural Affairs (Defra). The department is considering implementing statutory guidance for residual waste to be collected at least once every other week. The review of the Welsh Collections Blueprint, though, found that there was “consistent evidence” to suggest restricting frequency and volume of residual waste services reduces service costs. It also highlights “emerging evidence” that collections even less frequent than fortnightly – once every three or four weeks – would further reduce costs.⁴⁷ This is, in large part, because councils have lower disposal costs, and the approach also encourages householders to separate material more effectively for recycling.

Cost of annual collection services per household in Wales⁴⁸



“Keeping recycling materials completely separate could result in cumulative savings across England of £658 million, compared to business as usual.”

WRAP’s analysis of kerbside collection indicates that a system along the lines of the Welsh Collections Blueprint would be financially beneficial in England, too. It found that keeping recycling materials completely separate could result in cumulative savings across England of £658 million, compared to business as usual.⁴⁹ This is mainly down to the greater revenue received for high quality, source segregated recyclables.

Research from Eunomia shows that, although a DRS will mean some of the higher value material is diverted away from kerbside collections, the accompanying reduction in residual waste and savings from collections efficiencies – with less material overall to collect and sort – could result in savings of £35 million for local authorities across England.⁵⁰ Nonetheless, there are concerns about the impact of diverting high value items like PET bottles and aluminium cans to a DRS. More research is needed to better understand the impact, and how best to adjust services for continued savings, in both England and Wales.

A more harmonised collection approach should be complemented by national information campaigns about services. Such awareness raising national campaigns – which will complement proposals for more consistent labelling on packaging itself – should ensure that people put out appropriate material for recycling, including aluminium foil, trays, closures and aerosols. The government’s extended producer responsibility reform proposals suggest that communications about recycling should be funded by industry, and producers of packaging not covered by the DRS must cover all the costs associated with recycling the material they sell.⁵¹

Improved kerbside services could contribute a further 11 per cent to the overall aluminium packaging recycling rate. This would happen if a further 2.5 per cent of cans were recycled through the kerbside system, as well as 50 per cent of aerosols and a third of the remaining aluminium streams, apart from laminates and composites. Laminates and composites are the only aluminium packaging streams that cannot be widely recycled. These account for ten per cent of the total, and are the only formats that cannot be targeted by the first three steps to higher recycling that we are proposing. To address this, higher producer fees should be paid by laminate producers to reflect the higher cost of treatment, and to encourage recyclable alternatives.

3 Best practice at sorting plants



The UK's main plant for recycling aluminium cans, Novelis, has already invested in equipment to sort material from the UK's haphazard collection systems.⁵² But having to sort materials after collection requires greater energy inputs and incurs charges, not least to transport and dispose of unrecyclable contamination. In 2012, the Resource Association conservatively estimated that this costs the UK reprocessing industry (including aluminium recyclers) £51 million a year.⁵³

With a well run DRS and better kerbside collection services, the cost of contamination would go down and revenue from high quality material streams would go up. But the UK's recycling sorting infrastructure would also need to change. The materials recovery facilities (MRFs), currently used to sort as much as possible from mixed recycling streams, would no longer be needed to sort co-mingled household recyclables, as materials would be separately collected.

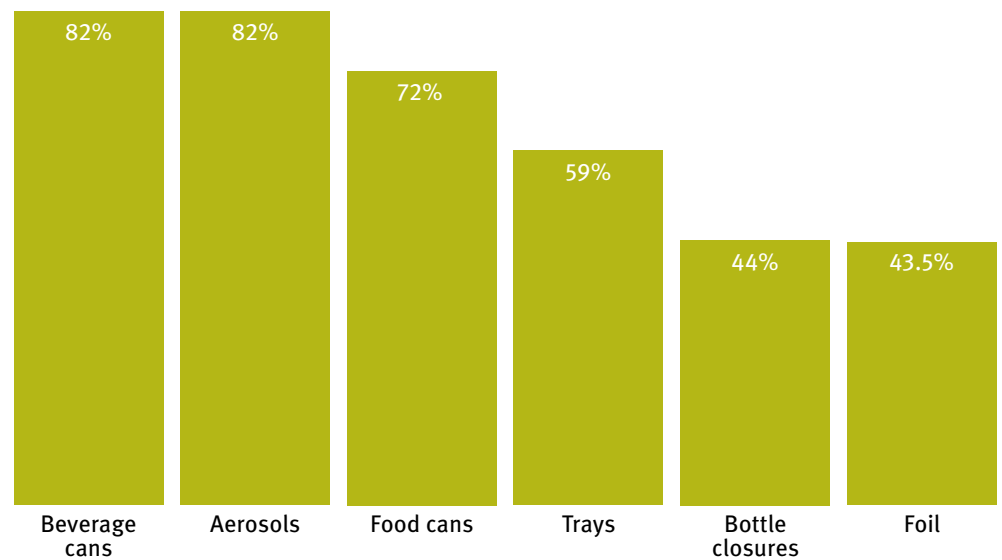
A new purpose for materials recovery facilities

This does not mean MRFs would be obsolete, as the service they offer could evolve and be reconfigured to deal with different material streams. Many UK facilities prioritise sorting cans over other aluminium streams because of their inherent value. But new configurations would allow the capture of different aluminium packaging and other recyclables that also have value. Some MRFs could act as refineries for relatively pure material, while others could focus on pulling out recyclable material from mixed waste.⁵⁴

Before investing in technology, operators would need to consider factors including how much material needs processing, and the composition and size of material to be sorted.⁵⁵ Further research is needed to produce guidance on how best to reconfigure MRFs, depending on what sort of material they could sort once a new DRS and better kerbside services have changed material flows.

Recent research has shown it is increasingly possible to sort material ever later in the waste management process, though this requires appropriate investment to be made and the quantity and quality of material will not be as high as if it were kept separate. A project by HTP for the European Aluminium Association (EAA) determined that, by adding additional sorting steps to MRFs, much material can be salvaged from mixed waste destined for landfill or incineration. The project, which took place in a Bucharest municipal waste sorting facility, saw the addition of two extra eddy current separators and robots to target aluminium streams, including those that are harder to target than cans. The graph below shows the results.

Best practice sorting of different aluminium packaging formats at a facility in Bucharest⁵⁶



If these results were replicated in the UK, we estimate it would add another 11 per cent to the UK's aluminium packaging recycling rate.

“Recycling before incineration is still preferable to maintain material quality and achieve high yields.”

4 Recovery from incinerator bottom ash



Unlike other recyclable materials that go through the incineration process, metals survive to some extent in a useable form. Currently, 26 per cent of the UK’s aluminium recycling rate comes from material recovered after incineration. Aluminium recovered from incinerator bottom ash (IBA) can be recycled into new products, although currently not back into new packaging. This is largely because it is mixed with alloys from applications other than packaging.⁵⁷ Although it is thought that, in future, it might be possible to recycle this material back into packaging, recycling before incineration is still preferable to maintain material quality and achieve high yields. Some material will inevitably be oxidised and lost through incineration so, in a system aiming to maximise recycling, this is a process of last resort.

The measures already outlined in this report would mean less aluminium entering the incineration process. This is in line with the waste hierarchy, which calls for incineration to be minimised and recyclable material to be kept separate. Nevertheless, incineration has taken over from landfill as the main treatment method for residual waste from English local authorities, accounting for 71 per cent of the total in 2016-17.⁵⁸ This will increase in coming years, as more facilities are already under construction or have planning permission and funding.⁵⁹ Given the current situation, any aluminium that goes through this process should be recovered and reused.

Data on how much material from different aluminium packaging types can be recovered from bottom ash is still being determined. Research for the EAA suggests that between 50 and 80 per cent of the material that goes through incineration can later be recovered, depending on the proportion of foils included. Because of their thinness, foils have relatively low material yields after incineration, at only around 40 per cent of material, compared to cans and aerosols, which the EAA says are 85 to 90 per cent recoverable.⁶⁰

Assuming this level of material yield is achievable and that reclaiming IBA is the final step in the recycling hierarchy, this source would boost the overall recycling a further seven per cent, bringing the total rate up to 97 per cent.⁶¹

Conclusion

“The government’s promised reforms are a unique opportunity to address the system’s shortcomings.”

It is widely accepted that England’s current recycling system is still losing valuable resources, with inefficiencies, unnecessary costs and lost revenue for companies and taxpayers alike. The government’s promised reforms are a unique opportunity to address the system’s shortcomings.

But these changes must be well conceived to make the most of the opportunity. As we have shown, for aluminium, the greatest value recovery comes from harvesting material as early as possible, before it is mixed with other recycling or, worse, thrown out with residual waste.

The biggest wins will come simply from motivating people to bring back recyclable beverage containers through a well designed deposit return system and by ensuring more consistent kerbside collections of remaining aluminium packaging and other items. Better sorting, followed by recovery from incinerator bottom ash as a final step, could bring the recycling rate to nearly 100 per cent.

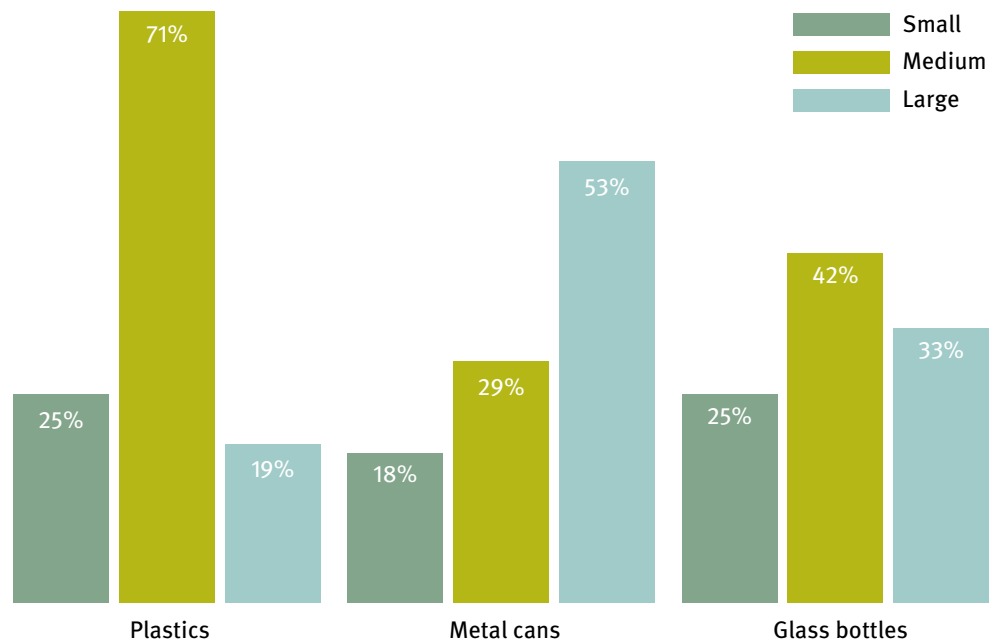
The UK has been lagging behind other countries in recovering valuable materials. Aluminium is the most valuable packaging material of all in the waste stream. Taking the four steps we outline here would create a world class aluminium packaging recovery system and help to set a precedent for better resource recovery overall in a more circular UK economy.

Annex: Guiding principles for a DRS

Principle	Explanation
<p>Producer fees should vary by material type and recyclability</p>	<p>There should be no cross subsidy of materials to ensure producers cover the costs of their own products and that highly recyclable packaging does not subsidise the costs associated with less recyclable material. Producer fees should vary to cover the costs of managing each material, in line with the overarching idea behind extended producer responsibility.</p> <p>Further ecomodulation should encourage design for recyclability. In the case of plastic, for instance, coloured PET bottles or those covered in sleeves, should incur larger fees than clear, sleeveless counterparts, which are easier to recycle.</p> <p>Higher fees for products with international barcodes will help prevent fraud. This is because barcodes specific to the UK system will allow reverse vending machines to automatically recognise and record the return of containers that have had a domestic deposit paid for them.</p>
<p>The system should be countrywide</p>	<p>Scotland is pushing ahead of England, and consulted on its preferred DRS model in June 2018. Defra’s resource strategy’s revelation that the English system will not be instituted until 2023 is cause for concern, as it increases the risk of different systems developing. This would subject producers to the unnecessary bureaucratic and financial burdens of operating in two parallel systems on one small island. It would also increase the risk of consumer confusion, which has been so detrimental to quality collected in the current kerbside recycling systems.</p> <p>Significantly, it could also lead to fraud or ‘waste migration’ across borders, especially if the level of deposit is higher in one system than the other. This has proven to be a problem in some European countries, such as Estonia, where consumers pay a lower deposit than in neighbouring countries like Finland. That means people can pay a relatively low deposit in Estonia (€0.10) and then travel across the border to Finland and, in some instances, get more money back than they originally paid (as deposits there range from €0.10 to €0.40).⁶² This is problematic for both countries: Estonia does not capture material through its system and Finland pays out more money to consumers than it should.⁶³</p>
<p>The system should not leave local authorities worse off</p>	<p>Most European DRSs were introduced before the widespread adoption of kerbside recycling services. Although many now operate in harmony with municipal services, UK councils worry that a DRS could leave them worse off. The Local Authority Recycling Advisory Committee (LARAC), for instance, has said: “seeking to capture drinks containers, for which comprehensive kerbside recycling schemes are already in place, may undermine the integrity of the services that local authorities have developed”.⁶⁴</p> <p>These concerns must be viewed in light of changes that will come from full cost recovery extended producer responsibility. Reforms should mean that, for packaging in the waste stream, the proportion of the bill picked up by local authorities will go from 90 per cent to zero per cent.</p> <p>Eunomia has found that a DRS could result in savings for the services councils currently run across England of £35 million, through greater collection round efficiencies and reduced litter and landfill charges.⁶⁵</p>

Principle	Explanation
All drink containers at all sizes should be included	<p>The government’s resources and waste strategy promises to help consumers take more considered action through easy to use systems. An intuitive system for a consumer should involve all drink containers at all sizes. This contrasts with some industry and local authority views, which argue DRSs should only cover small containers consumed on the go, which they say are more likely to be littered, and which the government is also consulting on.</p> <p>However, CPRE has shown littered containers come in all sizes.⁶⁶</p>

Containers collected through CPRE’s 2018 Green Clean



An arbitrary cut off at 750 millilitres, which the government is consulting on, could also incentivise producers to begin creating 755 millilitre containers, for instance, to avoid fees. This would represent a perverse outcome. It would also limit the amount of high quality, separately collected material available for reprocessing in the UK.

It would make sense, though, to vary the deposit by container size, with higher deposits paid on bigger packaging that uses more material. As well as reflecting to consumers the inherent value of material, this will also help to prevent market shifts where producers convert to larger format containers.

Information must be adequately monitored	<p>If reverse vending machines are used, they can automatically register information about container return rates. But fraud avoidance needs to be designed into the system, including at the start. If information about what is placed on the market is provided by producers themselves, as in the current producer responsibility system, this must be more robustly monitored and enforced to avoid continued concerns around misreporting. This will necessitate more robust auditing than in the current system, with the Environment Agency or enforcement body resourced to audit figures on a regular basis. In Norway, for instance, producers report figures that can be checked on a monthly basis, a frequency that allows for anomalies in sales figures to be easily identified.⁶⁷</p>
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Principle	Explanation
<p>Material not covered by the DRS must be adequately covered by other policies</p>	<p>If any packaging formats do not fall within a DRS – whether because of size or material used – there could be an incentive to switch to materials that are outside the system to avoid charges. Depending on how the system is designed, this could include cartons or laminated pouches, which are lower in value and harder to recycle than many other packaging formats, or glass containers, which are heavier and lead to much higher transport emissions.</p> <p>One of the five potential models Scotland consulted on, for instance, included only plastic and metal containers, which would exclude glass on the grounds that it is a bulky material that would complicate the system. This would be a mistake, as the consultation document itself recognised that “excluding glass... risks distorting the market if producers chose to move over to packaging in glass to avoid being included in the deposit scheme”. It also suggested the move would lose a material stream of value to spirit bottlers and could result in harm to people and animals if bottles are littered and broken instead of being recycled.⁶⁸</p> <p>While including glass, cartons and pouches with other materials in the DRS is the best way a UK system could avoid these negative impacts, the Norwegian model (see page 12) shows that supporting economic instruments can discourage switching to materials outside a DRS because lower recycling rates achieved by other systems would mean non-deposit packaging was subject to higher charges. This is because all containers face a high environmental tax if they cannot achieve a 95 per cent recycling rate. Even if a DRS in the UK covers all drink containers, this sort of approach will help to encourage the recycling of other packaging besides beverage containers.</p>
<p>The return process should be simple and convenient for consumers</p>	<p>Returning to retailers is likely to be a convenient option that allows consumers to bring containers from home or to return drink cans that have been used on the go.</p> <p>This means that as many high street retailers should be in the system as possible. The system should allow for smaller retailers to opt out rather than opt in to ensure as many as possible are taking part from the start of the project. This approach in Estonia has seen very few smaller stores opt out, as they realise that doing so would mean they lose out on custom to larger stores offering the service (see page 13).</p> <p>Retailers should be paid an appropriate handling fee to cover costs and encourage the use of compacting reverse vending machines (RVMs), which improve the transport logistics and environmental footprint of a DRS. Where RVMs are not feasible, though, manual collection should be allowed to encourage maximum participation in the system. This could potentially extend beyond grocery and convenience stores, with collection points at retailers including charity shops. This already happens in Canberra, allowing people to donate deposits to charity.⁶⁹</p> <p>RVMs or take back points should also be available in areas with high footfall, and where people are likely to be eating and drinking on the move, such as rail stations, tourist attractions and city parks.</p>

Principle	Explanation
<p>Unredeemed deposits should fund improvements to recycling</p>	<p>Currently, the government’s consultation is seeking views on two options: whether unredeemed deposits should part fund the DRS system, as happens in many international examples, or whether they should instead be passed to the Treasury. The former option would keep producer fees down and could be reinvested in the system to make it as efficient as possible.</p> <p>The second option, by contrast, would provide a perverse incentive for the government to keep return rates down. That is because the state would benefit from increased income when people do not bring their beverage containers back.</p> <p>This sort of approach has proved problematic elsewhere. In Connecticut, for instance, the government has been accused of treating the bottle deposit as a ‘cash cow’, with unredeemed deposits earning the state more than \$35 million in 2016-17. The change that allows the state to keep unclaimed deposits was introduced in 2008, and return rates in Connecticut are now falling. In the year to September 2016, they fell to below 50 per cent.⁷⁰</p>

Endnotes

- ¹ HM Government, 2018, *Our waste, our resources: a strategy for England*
- ² Data compiled from Defra, 2016, *Statistics on waste managed by local authorities in England in 2015/16*; Defra, 2016, *Digest of Waste and Resource Statistics – 2016 Edition (revised)*; and Defra, 2018, *Statistics on waste managed by local authorities in England in 2017/18*
- ³ NAO, 2018, *The packaging recycling obligations*
- ⁴ Alupro commissioned a study in 2015 which found at least 10,000 tonnes of aluminium packaging material was handled by unaccredited reprocessors and exporters, which is included in its calculation of aluminium recycling rates. See: Alupro, 2016, 'Study reveals "real" aluminium packaging recycling rate'
- ⁵ EUR-lex website, accessed January 2019, 'Summaries of EU legislation: packaging and packaging waste'
- ⁶ HM Treasury, *Spring Budget 2017*
- ⁷ Alupro, 2017, 'Aluminium packaging: achieving an 85% recycling rate within 2 years'
- ⁸ Letsrecycle, 29 May 2013, 'Novelis completes 1.7m Warrington plant upgrade'
- ⁹ National Packaging Waste Database, 29 March 2018, 'Monthly packaging waste exported and accepted for reprocessing: Quarter 1, 2, 3 & 4'. The database shows that 46,287 tonnes of aluminium were exported in 2017, compared to 47,860 tonnes recycled domestically. A freedom of information request from Alupro to the Environment Agency demonstrated that, in addition to the 51 per cent recycled in the UK, 41 per cent of the total was recycled in Europe. See: Alupro, 2017, op cit
- ¹⁰ M Niero and S Irving Olsen, 2016, 'Circular economy: to be or not to be in a closed product loop? A life cycle assessment of aluminium cans with inclusion of alloying elements', in *Resources, conservation and recycling*, Volume 114
- ¹¹ European Commission's European Innovation Partnership on Raw Materials, 2014, 'BRAVO – Bauxite residue and aluminium valorisation operations'. According to the project document, in 2010, for instance, "approximately 1,000,000 m³ of red mud from an alumina plant near Kolontár in Hungary was accidentally released into the surrounding countryside in the Ajka alumina plant accident, killing ten people and contaminating a large area".
- ¹² International Aluminium Institute, 2009, 'Global aluminium recycling: a cornerstone of sustainable development'
- ¹³ Carbon Trust, 2011, *Aluminium – international carbon flows*
- ¹⁴ M Gautam, B Pandey and M Agrawal, 2018, 'Carbon footprint of aluminium production: emissions and mitigation', in *Environmental carbon footprints: industrial case studies*
- ¹⁵ BEIS, 2018, 'GHG conversion factors for company reporting'. Unlike PET, the figures for cans do not include emissions from forming.
- ¹⁶ The weights of individual containers vary considerably. As of 2014, Coke's lightest aluminium can was below 10g; see Coca-Cola Enterprises, 2014, *Corporate responsibility and sustainability report 2013/14*. According to Ball Beverage Packaging Europe, its typical 330ml can weighs 11.78g but 'sleek' cans weigh less. A lightweighted Irn Bru bottle, by comparison, weighs 19.7g, though typical bottles will weigh well over 20g; see British Soft Drinks Association 'Soft drinks road map case studies: A G Barr: Packaging', available at: www.britishsoftdrinks.com/Soft-Drinks-Road-Map-Case-Studies/ag-barr-packaging
- ¹⁷ See, for instance, Susan Mair's presentation, 6 February 2019, 'Annual European survey on PET recycle industry'. According to the annual survey conducted by trade association Petcore, 1.7 million tonnes of PET were input into the recycling process in Europe in 2017. From that material, 1.2 million tonnes of recycled PET (rPET) resulted, representing a process yield of 70.6 per cent.
- ¹⁸ The Aluminium Association website, accessed January 2019, 'Facts at a glance'
- ¹⁹ Alupro, 2017, op cit
- ²⁰ Prices taken from letsrecycle.com

- ²¹ See, for instance, WRAP, 2016, *The case for greater consistency in household recycling: supporting evidence and analysis*. WRAP's detailed analysis quantifies the financial implications of different types of kerbside collection schemes. The data clearly shows that a system where all materials are kept separate at source "provide the greatest opportunity to increase income from the sale of secondary material".
- ²² Figures on aluminium packaging split provided by Rick Hindley, executive director of Alupro
- ²³ CM Consulting, 2017, *Deposit systems for one-way beverage containers: global review 2016*
- ²⁴ If the UK matched the 95 per cent recycling rate just for cans that other countries have shown is achievable, the overall UK aluminium packaging recycling rate would reach 66 per cent, even without the recycling of any other type of aluminium packaging. Green Alliance calculation, based on Alupro estimates of material put on the market and the market share of different types of aluminium packaging. A full methodology is available from our website.
- ²⁵ According to Alupro, 26 per cent of the UK's current aluminium packaging recycling rate is derived from material recovered from incinerator bottom ash. The exact proportion of these that are cans is not known.
- ²⁶ The UK's overarching 'food-to-go' market was valued at £17.4 billion in 2017, and expected to rise to £23.5 billion by 2022. See IGD press release, 9 August 2017, 'Food-to-go on the move to £23.5bn by 2022, IGD forecasts'
- ²⁷ Defra's Voluntary & Economics Incentives Working Group, February 2018, *Voluntary & Economics Incentives Working Group report: voluntary and economic incentives to reduce littering of drinks containers and promote recycling*
- ²⁸ RECOUP, December 2017, 'Local authority disposal "on the go" survey'
- ²⁹ Defra's Voluntary & Economic Incentives Working Group reported: "A number of LARAC members mentioned that they had a nil return for the percentage of litter bin waste that is recycled." See: Voluntary & Economics Incentives Working Group, 2018, op cit
- ³⁰ HM Government, 2018, op cit. The strategy notes: "it frequently costs businesses more to separate packaging or food waste for recycling".
- ³¹ Voluntary & Economics Incentives Working Group, 2018, op cit
- ³² Edinburgh Zoo press release, 11 April 2018, 'Cabinet secretary launches plastic bottle reward scheme at Edinburgh Zoo'
- ³³ ACR+, January 2019, 'Deposit-refund systems in Europe for one-way beverage packaging'
- ³⁴ European Commission, 2011, 'Country factsheet for Lithuania'. According to the document, "State of the public awareness in relation to the issues of waste management is estimated to be on a low level. There is a high level of impurities in the source separated waste indicating lower readiness of the public to participate in the separation of the certain waste stream."
- ³⁵ According to a YouGov poll commissioned by the Marine Conservation Society in 2017, 73 per cent of the British public are in favour of a DRS. See Marine Conservation Society, 2017, 'Public support for deposit return systems across the UK'
- ³⁶ ACR+, 2019, op cit
- ³⁷ Ibid
- ³⁸ Ibid
- ³⁹ Infinitum website, accessed January 2019, 'The environmental tax system'
- ⁴⁰ Personal conversation with Kjell Olav Maldum, Infinitum CEO, 03 January 2019
- ⁴¹ Ibid
- ⁴² CM Consulting, 2017, op cit
- ⁴³ Personal conversation with Rauno Raal, 31 January 2019
- ⁴⁴ Better retailing, 9 January 2019, 'Bottle return trial success for independent store'

- ⁴⁵ Defra, February 2019, *Consultation on consistency in household and business recycling collections in England*. The proposed set of 'core' materials to be collected by all local authorities includes: glass bottles and containers; paper and card; plastic bottles; plastic pots tubs and trays; and steel and aluminium tins and cans. The consultation also suggests food and drink cartons, plastic bags and film, and black plastic could be added to the list.
- ⁴⁶ Welsh Government, 2011, *Municipal sector plan part 1: collections blueprint*.
- ⁴⁷ Eunomia, 2016, *Review of the Welsh government collections blueprint*
- ⁴⁸ Ibid
- ⁴⁹ WRAP, 2016, op cit
- ⁵⁰ Eunomia, 11 October 2017, *Impact of a deposit refund system for one-way beverage packaging on local authority waste services*
- ⁵¹ Defra, February 2019, *Consultation on reforming the UK packaging producer responsibility system*
- ⁵² Letsrecycle, 2013, op cit. In fact, in 2013, Novelis carried out a £1.7 million upgrade in anticipation of having to fill its capacity with more domestically sourced material, after a sister plant in Germany started taking more of the well sorted cans from Northern European DRSs.
- ⁵³ Resource Association, 2012, 'Costs of contamination report 2012'
- ⁵⁴ Personal conversation with Adam Read, external affairs director at SUEZ recycling and recovery UK, 8 February 2019
- ⁵⁵ See, for example, *Waste advantage magazine*, 3 January 2017, 'Modern separation equipment increases ferrous and nonferrous recovery rates for MSW/MRF facilities'. The article notes that eddy current separators, the traditional method for sorting aluminium by alternating magnetic fields to create currents to repel material, are evolving. It says that high frequency rotors can help separate nonferrous fines of less than an inch, a traditionally difficult stream to target, and describes an 'eccentric magnetic rotor' to concentrate eddy current forces, which can protect equipment and prevent wear and tear from ferrous material. It also notes that 'metal loss monitor' systems can scan residues to identify valuable metal that has escaped the process, and indicate when the separation system needs to be adjusted to improve material capture rates.
- ⁵⁶ Nils Wollseifen presentation at the annual packaging group Seminar 2018, Krakow, Poland, 19-21 September 2018, 'Elaboration of an aluminium sorting model for public use'
- ⁵⁷ Alupro, 2017, op cit
- ⁵⁸ Defra, December 2017, 'Statistics on waste managed by local authorities in England in 2016/17'
- ⁵⁹ See Eunomia, 2017, *Residual waste infrastructure review, Issue 12*, which suggests that an additional 5,700 kilotonnes per annum (ktpa) residual waste treatment capacity is either under construction or committed. This is in addition to the 15,800ktpa that was already operational in 2017.
- ⁶⁰ See, for instance, European Aluminium Association and Alufoil, 2014, 'Fact sheet: More aluminium packaging recovered from incinerator bottom ashes than expected'
- ⁶¹ This assumes the proportion of incineration will increase, in line with the facilities that are under construction or are committed. A full methodology is available on our website.
- ⁶² ACR+, 2019, op cit
- ⁶³ Regions 4 Recycling, 2014, 'Good practices factsheet: Tallinn – system of deposit packaging'
- ⁶⁴ LARAC press release, 28 March 2018, 'LARAC responds to DRS announcement'
- ⁶⁵ Eunomia, 2017, op cit
- ⁶⁶ CPRE press release, 19 November 2018, 'Buy-drink-return: how deposits on cans and bottles will untangle recycling confusion'. In September 2018, a CPRE initiative collected 11,212 containers through 35 litter picks. The containers were categorised as follows: for plastic, 'small' containers were those less than 500ml, 'medium' were 500ml; and 'large' were above 500ml (including nine per cent that were more than 1.5l); for metal, 'small' containers were those below 330ml; 'medium' were 330 ml; and 'large'

were more than 330ml; for glass, 'small' containers were less than 330ml, 'medium' were between 400 and 750ml and 'large' were more than 750ml.

⁶⁷ Personal conversation with Kjell Olav Maldum, 2019, op cit

⁶⁸ Scottish Government, July 2018, *A deposit return scheme for Scotland*

⁶⁹ CityNews, 8 June 2018, 'Charity shops take a role in container deposit refunds'

⁷⁰ WNPR, 24 January 2017, 'Has Connecticut's "Bottle Bill" changed from environmental law to cash cow?'

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