how a deposit return scheme for 'on the go' could be designed for the UK

Commentary from SUEZ recycling and recovery UK on the report by Oakdene Hollins

suez

Why now?

Recycling rates in the UK are stagnant or slowing, markets for much of the materials collected for recycling are becoming more difficult to find after the introduction of the import restrictions under the Chinese Sword programme[1], litter of all sorts is increasingly being seen for the blight it is, and the longer term impacts of plastics leaking to land and oceans are becoming not only more visible but better understood.

SUEZ recycling and recovery UK believes that the time is right to move forward with a second generation of waste solutions, including new systems of harvesting valuable secondary resources from both municipal and business sectors in the UK. SUEZ believes that a deposit return scheme (DRS) for certain target materials, especially those consumed 'on the go', is essential to deliver high volumes of captured materials, improve the quality of the material streams, and help deliver the necessary cultural changes for consumers to understand resource value and the damage that litter is doing to the local and wider environment.

A deposit return scheme cannot, however, achieve all the change necessary and must be seen as a complementary process to a number of other policy, cultural and practical methods of secondary resource extraction and waste management. This is likely to include taxing some single-use plastic, higher targets for recycled content in packaging and more accessible and easier to use recycling services.

We recognise the desire by many to have more information and knowledge about how a DRS system might be constructed and how it might be integrated into existing and future methods of resource and waste management. We hope that this document will significantly add to the debate, provide some detailed numbers and proposals for what a UK-based DRS system should look like, and show how – by learning from internationally-established schemes and research – the optimum design can be constructed.

The report

SUEZ appointed consultants Oakdene Hollins to undertake a consolidation of available information and data from around the world (and data available in the UK) and to use that information to construct a model of how an 'on-the-go' deposit return scheme might operate. Once constructed, that model was used to assess the effectiveness of the various systems in order to determine which one is most applicable to the UK, to assess the impacts from harvesting rates to DRS charges, to identify key target materials and to understand the net impacts on resource value extracted and on revenue streams for local authorities should an 'on-the-go' system be adopted.

We specifically asked Oakdene Hollins to use their knowledge and experience, and a detailed evidence chain, to independently test our view. The report represents their analysis, outcomes and views of the data available. In undertaking the report, they robustly challenged some SUEZ views, requiring us to provide details and context to support our view of how the UK could best incorporate a deposit return scheme.

[1] China's General Administration of Customs announced the year-long 'National Sword 2017' campaign to cut the illegal smuggling of 'foreign waste' and other products including agricultural products, resource products, tax-related goods, drugs and guns.

A DRS system for the UK

A DRS system targeting 'on-the-go' PET bottles of a size less than 0.75 litres and metal cans can markedly increase the extraction rate of the target materials, significantly improve the quality of those materials collected and reduce the presence of these materials in litter. Further, targeting 'on-the-go' consumed items minimises the shift of materials and value from the current local authority collection systems, whilst also giving opportunities for local authorities to save money through reduced litter, to provide new services and revenue streams in the operation of redemption points and local logistics, and to benefit from the move to a more resource-sensitive consumption culture.

In calculating the impact of the deposit return scheme on the local authorities, we have estimated that the annual loss of income from material sales is likely to range between £113,000 and £192,000 per authority or £47 million to £80 million nationally. We should compare this to the estimated local authority spend on litter per year of £683 million (£1.63 million, on average, per local authority).

From the evidence presented on the reduction in litter through the introduction of a deposit return scheme for 'on-the-go' target materials, we would reasonably expect that much if not all of the loss of revenue from materials shifted away from household collections would be compensated for by a reduction in costs for litter management. The loss of revenue from materials sales per local authority requires an anticipated 7-12% saving per authority in the cost of litter services to be cost neutral.

A summary of the study and potential benefits is presented in the following tables.

Current practice	PET bottles	Aluminium cans
Total market size (billion containers)	8.8	9.7
'On-the-go' channel (billion containers)	1.3	2.9 to 4.4
Current recycling rate (%)	57	70
Capture rates in existing DRS (%)	65.4 to 82.3	64 to 97.2
Current average recycled content (%)	9.2	50
Current processing capacity in the UK	Lower than market size (340,000 tonnes capacity and 594,000 tonnes generated)	Higher than market size
Current material price (£/t)	60 to 130	800 to 1,060
Deposit return scheme		
Current material price (£/t)	60 to 130	800 to 1,060
Value of deposits in scheme (£millions)	256 to 589	460 to 486
Value of redeemed deposits (£millions)	211 to 385	382 to 448
Value of unredeemed deposits (£millions)	45 to 204	38 to 104
Required compensation for local authorities (£millions)	4 to 19.9	43 to 60.6
Potential increase in recycled content (%)	19.2 to 55.5	4.6 to 11.9
Potential increase in recycling rate (%)	8.5 to 25.3	4.6 to 11.9

DRS as part of a new system

At SUEZ, we strongly believe that a deposit return scheme cannot deliver all the necessary performance improvements required to capture and secure for future use the resources we consume on a daily basis. We have often said, and remain of the view, that a deposit return scheme should be part of a comprehensive and integrated system of resource and waste management.

The move from 12% recycling at the turn of the century to the current levels of around 45-53% (Scotland and England's recycling rate is 45% and Wales corrected back to a common statistical foundation of 53%) have been led through household and business collection systems that have proven to be effective and very cost efficient. However, the costs of the management of the waste produced, especially those from the householders, falls through taxation and the municipal waste management services on to all citizens, irrespective of their consumption habits. SUEZ believes that producers and consumers should proportionally shoulder their own burdens of responsibility. The adoption of schemes that reward people and business proportional to their activities in the waste hierarchy and that allow manufacturers and producers to shoulder the full cost of the burden of the products they place on the market should be the fundamental foundation of any new or revised systems.

Unduly disrupting current waste management practices should be avoided, as they have proven highly successful in delivering significant increases in recycling, in maintaining the standards of sanitary protection required by a developed society and doing so in a very cost-efficient manner. However, these traditional methods are showing signs of reaching their effective limits. Therefore, to continue the good progress made so far, we should be looking at schemes that recover more materials for recycling, that recover them in a manner that maximises quality and minimises contamination and does so through the most cost-effective methods possible.

Changing metrics

In moving towards a more resource-sensitive and conservatory culture, SUEZ believes that we should move away from using weight as the main measure of progress and success. Weight has been a useful metric to measure the diversion of waste from landfill, but it is blind to resource scarcity or importance to society (natural capital[2]), to resource value (markets and commodities) and to the carbon burden of its production and consumption (climate change). This change cannot and should not happen immediately, but should be phased in through a period where there is sufficient time to complete the necessary science and embed the cultural understanding fundamental to successful adoption. SUEZ believes a good target date for the completion of a move to a new system of measurement would be 2030.

[2] Natural capital can be defined as the world's stocks of natural assets which include geology, soil, air, water and all living things. It is from this natural capital that humans derive a wide range of services, often called ecosystem services, which make human life possible (https://www.gov.uk/government/publications/25-year-environment-plan).

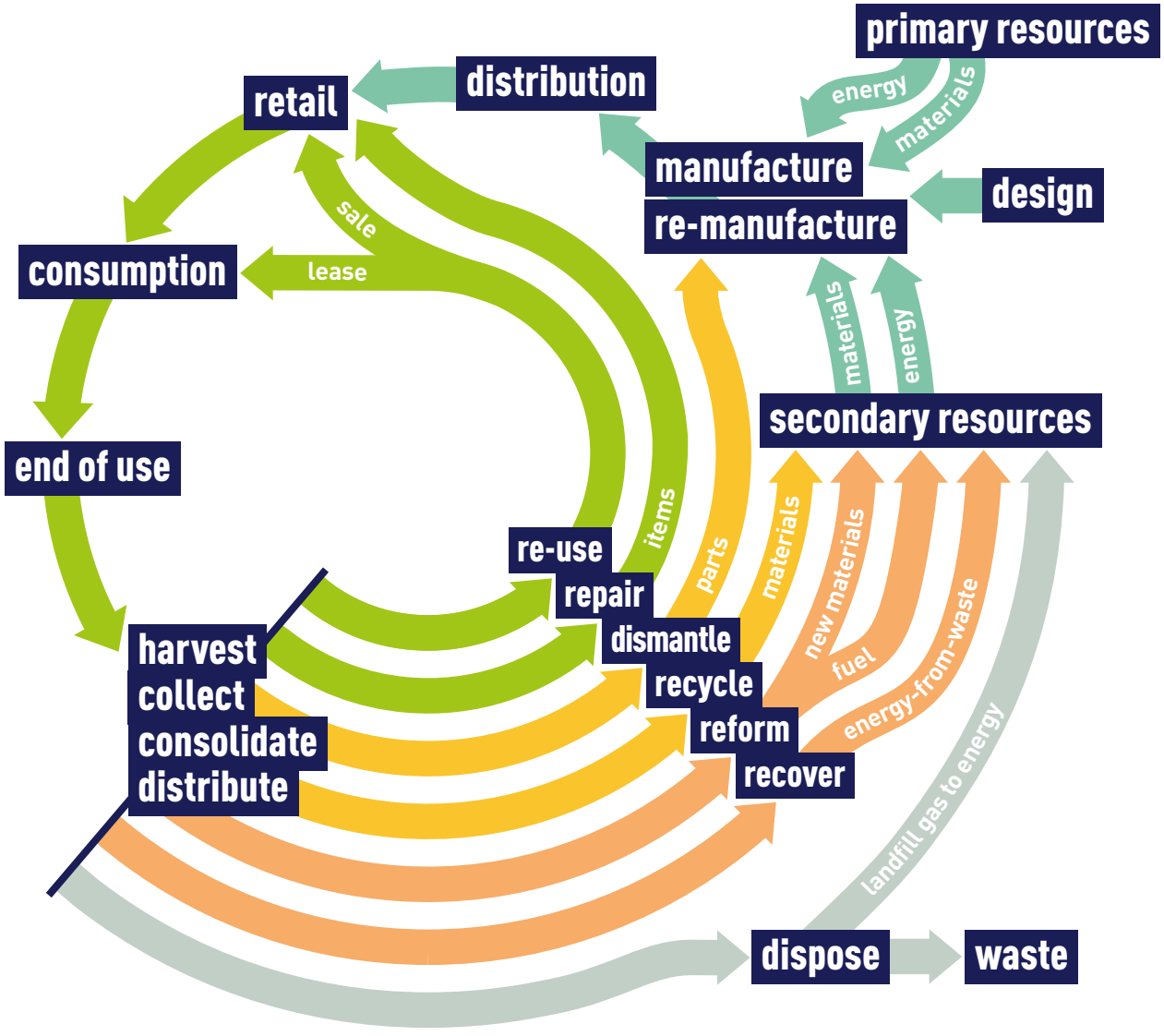
Collection and treatment systems

SUEZ considers that materials consumed in the household or business should, in many instances, continue to utilise the existing systems of collection and treatment. As one of the first recycling and resource management companies to adopt the circular economy as our guiding principle, we understand that changes to existing systems are necessary.

Our circular economy diagram illustrates how we feel the waste management industry should integrate with the cycle of production and consumption.

However, a focus in the value chain of removing unnecessary waste and redesigning those necessary items in a manner that allows their easy and cost-effective repair or re-use, efficient dismantling or collection for recycling, energy recovery or, for some instances, their safe and sanitary disposal, is essential.

the circular economy



For instance, the redesign of food packaging can allow the existing source-separated or co-mingled collections to harvest these materials and allow them to be more easily identified and sorted in recycling centres. This would improve not only the volume of recovered products, but also the quality of those material streams and therefore their value to the secondary resource market.

Some streams of waste from households and business do not easily fit into these traditional collection, consolidation and sorting systems. These 'niche' streams – such as small batteries, coffee pods or used nappies – have required or will require new methods of harvesting. Using combinations of take back (office, school, store, household waste recycling centre, bring bank etc), post back, survival bags and multiple modes of reverse logistics or specialist collection, these niche streams can be recovered from consumers in the most cost and environmentally-efficient methods and retain high degrees of convenience for consumers or others. The adoption of smart technology, digital-based communications and new techniques offers the potential to hugely increase the flexibility and efficiency of harvesting and ultimately resource extraction and conservation for these niche streams.

Producer responsibility

Fundamental to these necessary changes is the adoption of a comprehensive producer responsibility principle. A deposit return scheme is very visible and, as has been shown in the Oakdene Hollins report, a very effective method of harvesting target materials from the growing 'on-the-go' consumption channel, and of helping consumers and waste producers understand the intrinsic value of the materials they use and discard. In the field of litter, evidence strongly indicates that a deposit return scheme will reduce litter and recover more and higher quality materials for recycling and re-use.

Extending producer responsibility into those products consumed at home or in business will drive thinking from design to production and consumption, a further foundation of the changes required for a resource efficient society. For example, the application of extended producer responsibility (EPR) through a review of the packaging recovery note (PRN) system currently in place would seek to ensure that the funding available to harvest and recycle the packaging materials is sufficient to fund the system. This means that local authorities should be fully compensated for the net costs they incur in collecting, managing and treating the materials consumed in households that are subject to the PRN system.

Key to completing a comprehensive waste and resource system is the creation of the markets and commodity conditions favourable to increasing the percentage of secondary resources used in new products. Policy drivers can go some way to promoting this, but a well-constructed system of EPR can create the business conditions that drive the market to naturally increase the proportions of recycled component. This is a fundamental foundation to a long-term and stable resource-efficient value chain.

Quality data

Finally, absolutely fundamental to not only all these activities but to the minimisation and prevention of waste, is the generation of good quality data. For instance, SUEZ has many years of experience of collecting bin weight data from our commercial customers. This has enabled us to help our customers understand their pattern of waste generation and consumption. In turn, this has empowered prevention, not only in materials wasted, but also in the effort and cost of the management of the wastes themselves.

Moving the UK forward

Developing a system of complementary methods of waste management and of resource extraction, refinement and re-use over the complete value chain is essential to the next wave of recycling improvement in the UK. A DRS system, as described in the Oakdene Hollins report and working within a comprehensive and co-ordinated set of systems and solutions described here, will deliver huge improvements in reducing resource waste, minimise costs for all in delivering the new solutions and assign the costs and benefits to the appropriate parties. If all of the above were developed, the UK would move significantly forward in its ambitions to deploy an environmentally and economically-sustainable circular economy.

SUEZ recycling and recovery UK
SUEZ House, Grenfell Road
Maidenhead, Berkshire SL6 1ES

www.suez.co.uk

How a deposit return scheme for 'on the go' could be designed for the UK

An analysis for SUEZ prepared by Peter Lee, Tania Garcia, Olivia Bertham and David Fitzsimons

March 2018

How a deposit return scheme for 'on the go' could be designed for the UK

Value-driven consulting

Science-led research

Prepared by: Peter Lee, Tania Garcia, Olivia Bertham and David Fitzsimons

Final check by: Katie Baker

Approved by:

Date: 16 March 2018

Contact: peter.lee@oakdenehollins.com

Reference: SUEZ01 463 FINAL.docx

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Photo of litter after Woodstock festival in Poland, credited to iStock.com/ewg3D

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Foreword

Recycling and waste management performance in the UK has changed beyond all recognition in the last 10 to 15 years. Huge success has been achieved in driving up recycling and driving down waste to landfill. All of this has been done with limited policy intervention whilst providing a very effective and cost efficient system. However, in recent years municipal recycling performance has plateaued, and last year showed only limited growth, whilst at the same time funding for local authorities has reduced significantly. This is a real challenge for the UK recycling and resource management sector.

To deliver the second wave of change, we need to tackle waste production at source, at design and at consumer behaviour level, whilst significantly improving reuse and repair services and making the jump in resource recycling to deliver a more sustainable society. This needs new policies, methods and techniques.

One of these key new tools will be a deposit return scheme (DRS) delivered under the principles of extended producer responsibility and targeting key packaging used in the 'on-the-go' environment. Listening to our customers and many of our active partners in the value chain we believe the time is right to solidify our historic support for a DRS system in the UK with concrete information, facts and figures.

This report presents two key aspects: (1) an overview of how SUEZ thinks DRS should be integrated into the existing and future UK recycling and resource management systems; and (2) a factual and analytical report, undertaken at our request and with our support by consultants Oakdene Hollins. The brief for this report was to provide a basis of fact from which our own views, and other views, about DRS could be tested.

Our views on how we think DRS should be integrated into the UK are based on the SUEZ group's international experience of similar schemes, and our many years of working with local authorities, manufacturers, retailers and other stakeholders in the value chain. We think the evidence in the report reinforces our support for DRS in the UK, clearly showing the benefits to recycling performance and resource conservation, and managing the impacts on local authorities to a point where they will generally be no worse off and in many instances will have the opportunity to deliver new services with associated revenue streams as part of the proposed DRS.

We also believe that a DRS will only be truly effective if it is part of a suite of solutions and works in collaboration and in a complementary manner with existing and future services and systems. It cannot deliver anywhere near its potential if delivered in isolation.

We would like to thank everyone who contributed to this study and in particular the circular economy research consultancy Oakdene Hollins, whose data modelling and analysis informed both our choice of questions and our conclusions.

We hope you find this report interesting and welcome your responses to its findings.

David Palmer-Jones
Chief Executive Officer
SUEZ recycling and recovery UK

Contents

Glossary

CRI	Container Recycling Institute
DRS	deposit return scheme
EUR	Euro
GBP	Pounds Sterling
LARAC	Local Authority Recycling Advisory Committee
MRF	materials recovery facility
PET	polyethylene terephthalate
WRAP	Waste & Resources Action Programme

Units

Conventional SI units and prefixes used throughout: {k, kilo, 1,000} {M, mega, 1,000,000} {G, giga, 10^9} {kg, kilogramme, unit mass} {t, metric tonne, 1,000 kg}

1 Introduction

1.1 Background

Deposit return systems (DRSs) for single use drinks containers have been in operation for more than 40 years. Currently more than 350 million people use DRSs for drink containers in 38 countries/states around the world. The key drivers for the introduction of a DRS are:

- increasing recycling rates
- increasing the recycling quality and/or
- reducing litter.

There is a geographical split on whether recycling or littering is the key driver for the implementation of a DRS. Those operating in Europe typically focus on recycling, driven by recycling targets set in European law, whilst schemes in Australia and North America have traditionally focused on reducing litter.

Table 1 provides a summary of the performance of each country operating a DRS in Europe. This shows, with the exception of cans in Estonia, that all countries operating a DRS out-performed the UK in terms of return rates for the target materials. This also shows that the two key materials included in a DRS are PET (included in all schemes) and cans (included in all but the Netherlands scheme that targets PET only).

Table 1: DRS performance by European country compared with the UK return rates (2016)

Country	Total return rate (%)			
	Can	PET	Glass	Total
Denmark	89	89	89	89
Estonia	70	90	87	82.3
Finland	97	92	89	92.6
Germany	96	98		97
Iceland	94	87	86	90
Lithuania*	N/A	N/A	N/A	74
Netherlands		95		95
Norway	96.6	95.4		96
Sweden	93.8	82.7		88.25
UK (non-DRS)	**70**	**57**	**67.1**	

Source: Deposit systems for one-way beverage containers: global review 2016. CM Consulting.
**NB: The Lithuanian scheme was introduced in 2016 and hence only the headline 'total' figure was recorded.*

In terms of reducing litter, Figure 1 shows that the impact can be significant; the two Australian States that operate a DRS have between 49% and 78% lower levels of drinks containers in their litter stream. A key driver for the focus on litter is the high levels of drinks containers consumed outside the home and, in particular, 'on the go'.

Figure 1: Drinks containers in the litter stream in Australia (2015/16)

Source: Produced by Oakdene Hollins using data from 'CDL containers and plastic shopping bags in the litter stream. KESAB Environmental Solutions July 2016'

1.2 'On the go' consumption in the UK

The UK is in a position where it wishes to both increase recycling rates and reduce littering; 'on the go' consumption is a growing waste stream, for which a DRS is actively being considered. The House of Commons Audit Committee reports that[1]:

- Around 15% of the 13 billion plastic bottles used each year (i.e. 1.95 billion plastic bottles) are used outside the home and the UK has a particularly high 'on the go' consumption pattern. This is considered a significant factor in the stalling plastic bottle recycling rate which has remained at 57% for PET bottles for the last five years.
- 700,000 plastic bottles are littered every day; equating to 1.97% of the total 13 billion plastic bottles used each year.
- canfacts.co.uk reports[2] that 30% of drinks cans are consumed outside the home and so do not get recycled through existing schemes, and alupro provides an even higher estimate[3], stating that around 45% of the 9.7 billion drink cans sold in the UK are used outside the home. This equates to between 2.9 billion and 4.4 billion drinks cans being consumed outside the home annually in the UK. Currently 70% of aluminium cans are recycled in the UK which suggests that 'on the go' waste produced needs to be tackled if recycling is to increase.

[1] Plastic bottles: turning back the plastic tide. First report of session 2017-19. House of Commons Environmental Audit Committee. 19 December 2017.

[2] http://www.canfacts.org.uk/pages/pv.asp?p=canfacts8

[3] https://alupro.org.uk/industry/programmes/every-can-counts/

The 2017 Recoup survey of the 'on the go' collection infrastructure in the UK highlighted five key challenges for local authorities[4]:

1. There is inadequate 'on the go' collection infrastructure for both collection of recycling and residual waste material.
2. There are many examples of recycling 'on the go' units being removed due to increasing levels of both contamination of the waste streams collected and maintenance costs.
3. Key barriers to 'on the go' recycling are:
   a) High levels of contamination through poor waste segregation by consumers.
   b) Inadequate budget for consumer communications and education.
   c) Procurement, maintenance and collection costs.
4. The cost vs benefit equation does not add up: there are significant costs in providing 'on the go' collection services and high levels of contamination from the material collected, and many local authorities reported that the budget could be better spent on increasing quantities and reducing contamination in kerbside collections.
5. Investment is needed to prove the business case for 'on the go' collection schemes.

The growth trend in 'on the go' consumption in the UK follows that of the USA in the 1990s. The Container Recycling Institute (CRI) reports[5] that this growth in the USA had a major impact on the overall recycling rates for drinks containers, even at a time when kerbside collections were on the increase. For example, the recycling rates of PET plastic bottles reduced from 37.3% in 1995 to 24.8% in 2000 and just 23.5% in 2006. The CRI reports that the widespread adoption of bottled water contributed most to the dramatic growth in single-serve containers outside the home.

1.3 SUEZ support for DRS

SUEZ has long championed the value of deposit return as one part of extending the producer's responsibility for what is sold to customers. SUEZ works in many of the jusrisdictions where DRSs have been implemented and hence, with the issue becoming all the more pertinent in the wake of the UK Government's 25 year plan and increased social awareness concerning our throw-away culture, feels well positioned to make a significant contribution to the on-going debate on the merits of such a scheme.

- SUEZ supports DRS because they claim it is a proven win/win in terms of increasing recycling rates and reducing litter;
- SUEZ believes the funds raised through DRS should go to multiple sources but mainly back into the running of the scheme and supporting service providers;
- SUEZ thinks people should have the option to donate their deposit to charity; and
- SUEZ supports the manufacturers in agreeing DRS schemes should be run by manufacturers, since they are best placed to drive up the quality of the material being collected and hence increase the levels of closed loop recycling.

[4] Local authority disposal 'on the go' survey. December 2017

[5] CRI. Wasting and recycling trends: Conclusions from CRI's 2008 beverage market data analysis.

2 Key elements of the modelling process

This research paper, produced by Oakdene Hollins and supported by SUEZ, aims to address the first piece of the puzzle in creating a DRS tailor-made to address the challenges in the UK 'on the go' consumption of drinks. The research sought to test SUEZ' position on DRS through system modelling. The two key elements of the scheme are:

- Recycled containers recovered through the DRS: Determination of the potential improvement in the quantity (Section 2) and quality (Section 3) of the materials being recovered.
- Scheme funding mechanisms: how would the scheme be funded? (Section 4).

2.1 Assumptions used in the modelling process

We simplified the many questions about the design of a DRS to model the impact of our proposals. Our model is based on:

- **Sales channel: 'on the go'**. The problematic waste stream in terms of recycling rates and litter.
- **Product category: soft drinks including water** but not milk and not beer/cider since they are typically not consumed 'on the go'.
- **Packaging material: PET and metal cans** - the two main packaging materials included in existing European schemes (Table 1). Within the modelling process we have assumed that all metal cans are aluminium, although it is acknowledged that in reality a small portion of cans would be steel. Glass is the third most popular packaging material included within DRS but again it is not as common in the 'on the go' channel. HDPE, the second most common polymer used for drinks containers after PET, is used predominantly for milk and hence is excluded from the modelling process.
- **Unit size:** three scenarios with threshold limits of **<0.5 litre**, **<0.75 litre** and **<1 litre**. This takes into consideration the reports by Britvic[6] that 0.5 litre is the most common size used in the UK 'on the go' channel, and 1 litre in the 'at home' or grocery channel. Please note: it is not possible to fully distinguish between the different sales channels and hence a DRS will inevitably result in a level of cannibalisation of material[7] in the household kerbside recycling scheme. By targeting 'on the go' items, the degree of cannibalisation of the household kerbside schemes would be minimised.
- **The level of cannibalisation of the existing kerbside scheme** will be between **17% and 25%**. This estimate is taken from two studies undertaken in Australia:
  - A study in New South Wales suggested that the introduction of a DRS would result in the kerbside recycling containing 17% less material.[8]
  - A review of the scheme in Victoria estimated that there would be a reduction of 25% of material in the kerbside-only scheme.[9]
- **Range of container return rates: taken from existing DRS** in operation. The schemes operating in the Canadian provinces were considered the most representative since they have a greater focus on 'on the go' consumption than the schemes operating in Europe.

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[6] Britvic soft drinks report 2009

[7] material recovered through the DRS that had previously been recovered through the kerbside scheme

[8] Mike Ritchie and Associates, 2012, The Impacts (Cost/Benefits) of the Introduction of a Container Deposit/Refund System (CDS) on Kerbside Recycling and Councils, for New South Wales LGSA

[9] EPA Victoria 2003. Policy Background Paper. Container Deposit Legislation – financial impacts

Table 2 shows the range of capture rates in the Canadian provinces schemes, and these are used within the modelling process to represent the upper and lower capture rates that can be expected in the UK scheme.

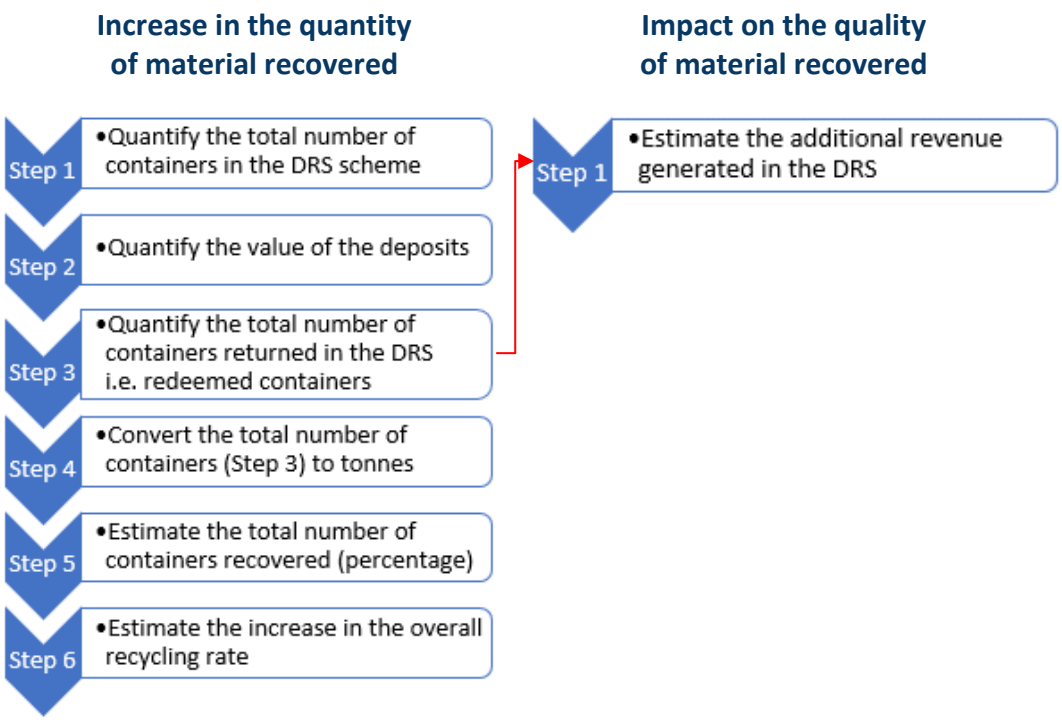
Table 2: Current UK recycling rates (kerbside only) versus Canadian DRS-based recycling rates

Material / container type	Current UK recycling rate (%)	Range of capture rates in the Canadian provinces (%)
Aluminium cans	70	64 to 97.2
PET	57	65.4 to 82.3

Source: Reloop. Deposit systems for one-way beverage containers, global overview, 2016

- **Deposit set at 10p per container**. This is in line with the minimum deposit used in the modelling exercises undertaken by Zero Waste Scotland[10], which used a range of 10p to 20p per container. Annex A shows the scatterplot of the capture rate versus the value of the deposit across all the existing DRSs. This shows that the DRSs targeting litter (North America and Australia) have the lowest deposits (below 8p per container), whereas the European schemes, targeting recycling, have higher deposits of around 10p. In the case of the Netherlands and Germany, with deposits of over 20p, the intention was to introduce a price differential between single use and refillable containers. Therefore 10p was considered appropriate for a scheme targeting both litter and recycling.
- **UK level implementation**. This is considered important to reduce the potential risk of fraud associated with transboundary movements of materials or money.

2.2 The modelling process



[10] Zero Waste Scotland. Review of feasibility study for a deposit return system for drinks containers. Spring 2015.

2.3 The results of the modelling - summary

Table 3 summarises the findings from the modelling exercises.

Table 3: Summary of results

Description		Packaging material	
		PET bottles	**Aluminium cans**
Current practice	Total market size (containers)	8.8 billion	9.7 billion
	'On the go' channel (containers)	1.3 billion	2.9 to 4.4 billion
	Current recycling rate (%)	57	70
	Capture rates in existing DRS (%)	65.4 to 82.3	64 to 97.2
	Current average recycled content (%)	9.2	50
	Current processing capacity in the UK	Lower than market size (340,000 tonnes capacity and 594,000 tonnes generated)	Higher than market size
	Current material price (£/t)	60 to 130	800 to 1,060
DRS	Value of deposits in scheme (£millions)	256 to 589	460 to 486
	Value of redeemed deposits (£millions)	211 to 385	382 to 448
	Value of unredeemed deposits (£millions)	45 to 204	38 to 104
	Required compensation for LAs (£millions)	4 to 19.9	43 to 60.6
	Potential increase in recycled content (%)	19.2 to 55.5	4.6 to 11.9
	Potential increase in recycling rate (%)	8.5 to 25.3	4.6 to 11.9

3 Modelling the increase in the quantity of material recovered through the DRS

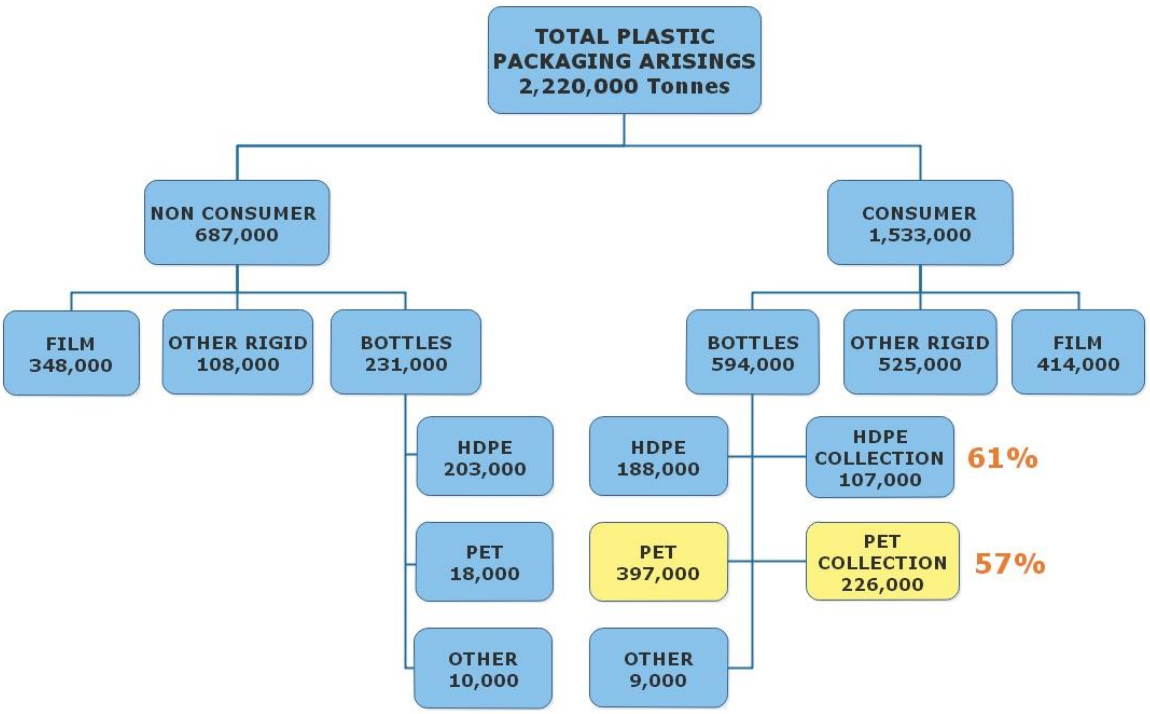
3.1 PET bottles

We set out to model the PET bottles within the context of all PET packaging placed on the market, the types of PET bottles falling into the target set for modelling, and the scale of potential recovery and their DRS end resource value.

3.1.1 Background

Figure 2 provides an overview of the total plastic packaging arisings in the UK and shows that consumer-based PET bottles account for 397,000 tonnes of the overall 2,220,000 tonnes, equating to 17.9% of total arisings. The collection of 226,000 tonnes of PET bottles leaves 171,000 tonnes that are not currently recovered for recycling.

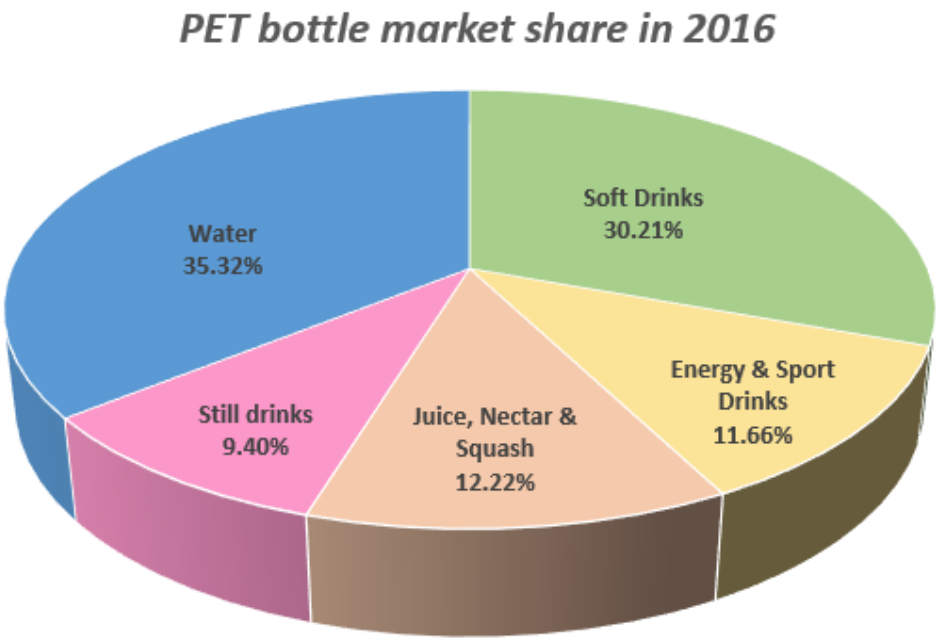
Figure 2: Plastic packaging in the UK (2014)



Source: Produced by Oakdene Hollins using data from WRAP's Plastics market situation report, 2016

Figure 3 shows the breakdown of the PET bottles market by product category. This shows that this market is dominated by soft drinks and water and hence, from a product category perspective, almost all PET containers would be included in the DRS. Please note: Beer and cider account for less than 0.5% and hence are omitted from the chart.

Figure 3: PET bottles market share in 2016 by number of containers



Source: Global Data 2017

3.1.2 Modelling the number of containers that would be in the DRS

Global Data reports that there were 8,810 million PET bottle containers in the UK market in 2016. Breaking this down by the size of the containers, through the three scenarios (<0.5 litre, <0.75 litre and <1 litre), Table 4 shows the number of containers that would be in the scheme based on our modelling assumptions. This shows that the difference between the <0.5 litre scenario and <0.75 litre scenario is considerable, in terms of the number of containers that would be in the scheme (i.e. 29.1% of containers compared to 62.8%). The difference for <0.75 litre and <1 litre is less pronounced, increasing from 62.8% to 67.0%.

Table 4: Potential sales volumes (containers) at different PET container size (volume) thresholds (2016)

Threshold for containers in the scheme	In scheme		Outside of scheme	
	Containers (millions)	% of total	Containers (millions)	% of total
Scenario 1 <0.5 litre	2,566	29.1	6,244	70.9
Scenario 2 <0.75 litre	5,537	62.8	3,273	37.2
Scenario 3 <1 litre	5,899	67.0	2,911	33.0

Source: Adapted by Oakdene Hollins using data from Global Data

Table 5 provides a breakdown of the key product categories by size that would be included in each of the scenarios.

Table 5: The significant product categories and pack sizes included within each PET scenario

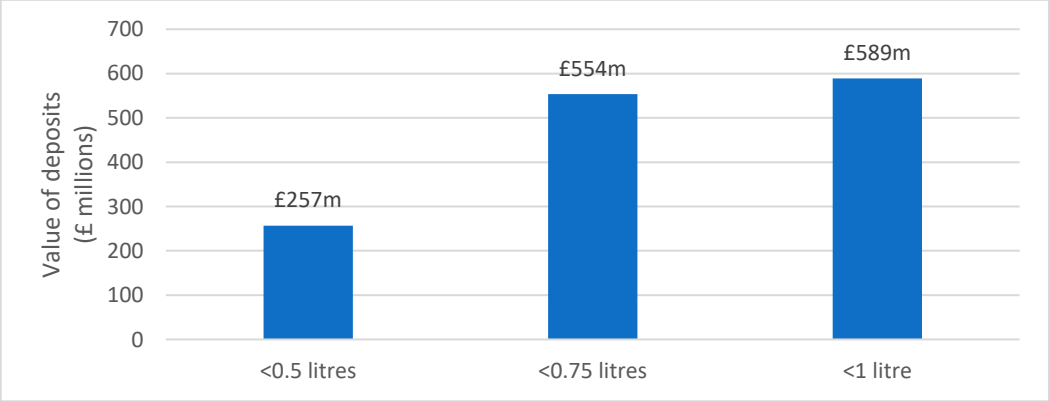
Scenario	Product category	Pack size	Sales (million units)
<0.50 litre	Energy drinks	38cl	599
	Packaged water	33cl	162
	Still drinks	33cl	116
	Carbonates	33cl	111
	Juice	30cl	93
	Juice	33cl	39
<0.75 litre	Energy drinks	50cl	149
	Carbonates	60cl	144
	Still drinks	50cl	123
	Enhanced water	60cl	79
<1 litre	Packaged water	75cl	139
	Juice	90cl	96
	Squash	75cl	78
>1 litre	Carbonates	200cl	666
	Packaged water	200cl	388
	Packaged water	150cl	311
	Carbonates	175cl	259
	Carbonates	100cl	187
	Squash	100cl	185
	Flavoured water	100cl	173
	Squash	150cl	95
	Carbonates	125cl	64
	Energy drinks	100cl	49
	Flavoured water	150cl	47

Source: Adapted by Oakdene Hollins using data from Global Data

3.1.3 Quantification of the value of deposits

Taking the estimate of the number of containers in the scheme from Table 4, we calculated the projected overall value of the deposits based on a 10p per unit deposit. The results are shown in Figure 4.

Figure 4: Projected value of deposits in £millions in the 3 scenarios



To model the estimated number of containers that would be returned through the scheme, we used a minimum capture rate of 65.4% and a maximum of 82.3% based on the schemes in operation in Canada shown in Table 2 and multiplied this with number of containers in the scheme shown in Table 4. The Canadian schemes were chosen since they focus on both litter and recycling, and hence are representative of the UK situation. Table 6 shows the estimated number of containers that would be returned within the DRS scheme targeted in this way.

Table 6: Estimates of the total number of returned containers

Threshold	Total number of containers in scheme (millions)	Total number of returned containers (million containers)	
		65.4% capture rate	82.3% capture rate
Scenario 1 <0.5 litres	2,566	1,678	2,112
Scenario 2 <0.75 litres	5,537	3,621	4,557
Scenario 3 <1 litre	5,889	3,851	4,847

3.1.4 Quantification of the tonnes of PET captured within the DRS

Using the conversion factor of 22,000 containers per tonne (source: Recoup) in our modelling, the number of containers estimated in Table 6 was converted to tonnes and reproduced in Table 7.

Table 7: Estimates of the total weight of returned containers (tonnes)

Threshold	Total number of containers in scheme (millions)	Total weight of returned containers (tonnes)	
		65.4% capture rate	82.3% capture rate
Scenario 1 <0.5 litres	2,566	76,270	96,000
Scenario 2 <0.75 litres	5,537	164,590	207,140
Scenario 3 <1 litre	5,889	175,050	220,318

3.1.5 The impact on the overall recycling rate

There will inevitably be a level of cannibalisation[11] and for this study it was assumed that the material in the kerbside scheme would reduce by between 17% and 25% (see Section 2), i.e. the kerbside recycling rate would reduce from 57% to between 32% and 40%. Adding this to the percentage of the total number of containers (8,810 million as shown in Section 3.1.2) that are returned through the DRS (see Table 6), gives the overall (kerbside + DRS) recycling rates shown in Table 8.

Table 8: Estimates of the overall recycling rates (%)

Threshold	Estimated overall recycling rates (kerbside + DRS) (%)	
	65.4% capture rate	82.3% capture rate
Scenario 1 <0.5 litres	51 – 59	56 – 64
Scenario 2 <0.75 litres	73 – 81	84 – 92
Scenario 3 <1 litre	76 – 84	87 – 95

[11] material recovered through the DRS that had previously been recovered through the kerbside scheme

Most noticeably, Table 8 shows that:

- Scenario 1 would result in a minimal increase in overall recycling - the minimum estimate of 51% being below the current recycling rate of 57%. This estimate of 51% is made up of 32% in the kerbside scheme and 19% in the DRS.
- Scenarios 2 and 3 would result in a significant increase in the overall recycling rate of between 16% (73% less the current recycling rate of 57%) and 38% (95% less 57%).

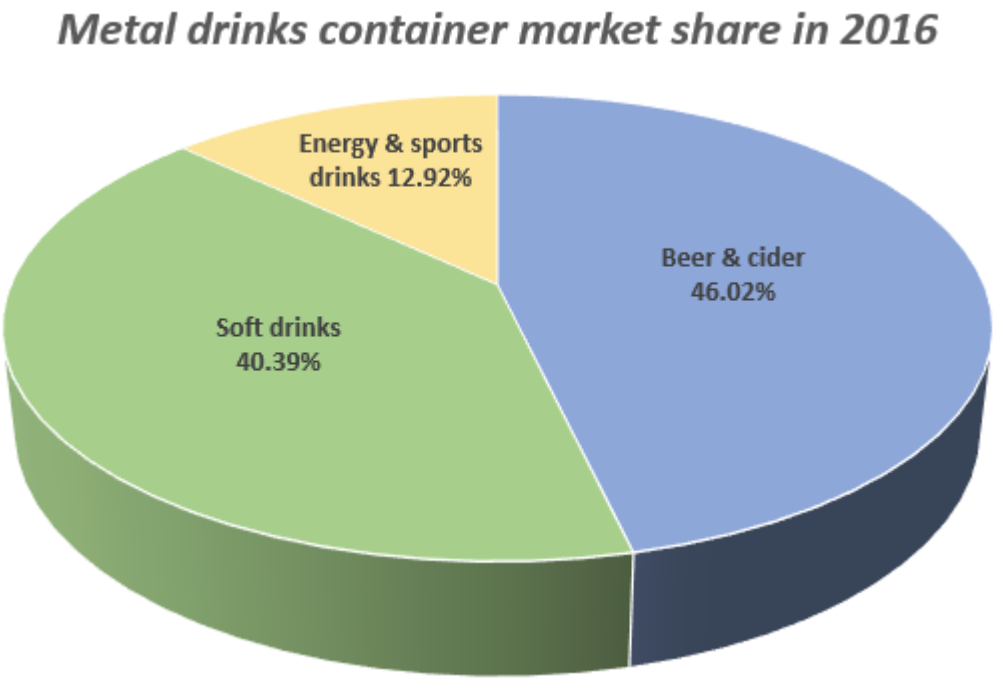
Please note: In the event that the DRS is implemented, the local authority targets would need to be adjusted to accommodate this change - or new, more resource-focused, metrics developed.

3.2 Aluminium cans

For aluminium cans we have used market data and data from other DRS schemes to model the likely outcome of implementing a DRS in the UK.

Global Data estimates metal drinks sales in the UK at 9 billion containers in 2016. Figure 5 provides a summary of the drinks market for metal containers in the UK. This shows that beer & cider accounts for 4.1 billion containers or 46% of the total market and soft drinks 3.6 billion containers or 40.4%. Since a relatively small portion of beer will be consumed 'on the go', this is omitted from the modelling exercise. Therefore, from a product category perspective, Figure 5 shows that around 53% of metal cans would potentially be included in the DRS.

Figure 5: Metal drinks container market share by product category in the UK in 2016



Source: Global Data 2017.
Please note: Ice / RTD drinks, juice & nectar, still drinks and water are omitted from the chart since together they account for less than 0.7% of the total market.

3.2.1 Modelling the number of containers that would be in the DRS

All aluminium drinks cans contain less than 0.75 litres and hence the modelling of the impact based on the three scenarios used in the PET case (Table 4) is less meaningful. This is demonstrated in Table 9 where 95% of the total containers are below 0.5 litres and 100% below 0.75 litres. For the modelling exercise it is assumed that 100% of products will be included in the scheme.

Table 9: Breakdown of the units in the scheme based on the three scenarios

Scenario	In scheme		Outside of scheme (0.5 litre and above)	
	Containers (millions)	% of total	Containers (millions)	% of total
< 0.5 Litre	4,600	95	255	5
< 0.75 Litre	4,855	100	0.11	0

Table 10: The main product categories / pack sizes included in each aluminium can scenario

Scenario	Product category	Pack size	Containers (millions)
<0.50 L	Carbonates	33cl	3,387
	Energy drinks	25cl	869
	Carbonates	15cl	194
	Energy drinks	33.5cl	26
< 0.75L	Energy drinks	50cl	252

Source: Global Data 2017

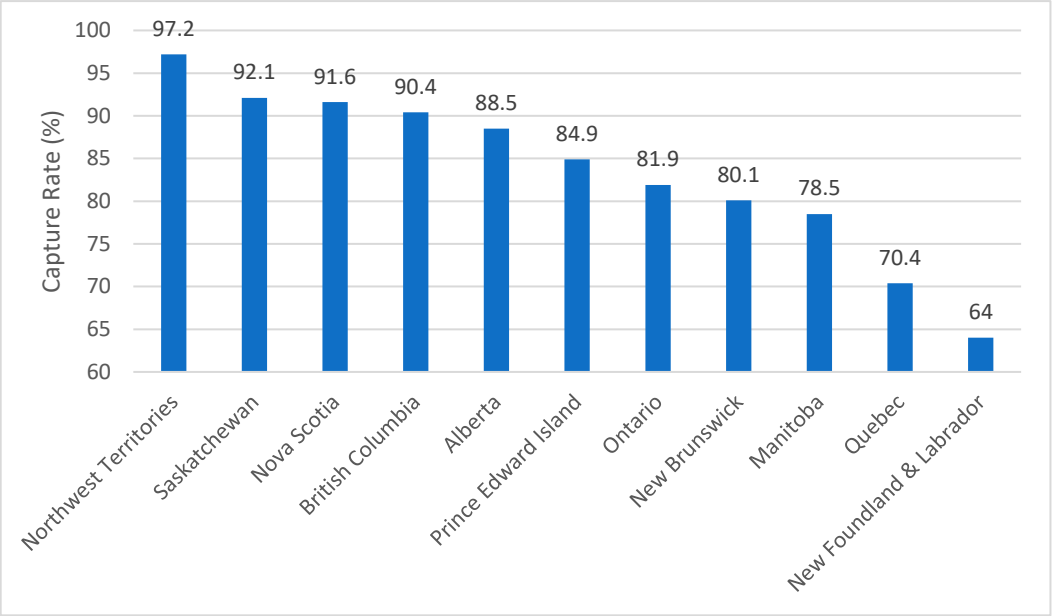
3.2.2 Quantification of the value of deposits

The total value of the deposits would be £460 million in the <0.5 litre scenario (i.e. 4,600 million containers with a deposit of 10p per container), and £485.5 million (i.e. 4,855 million containers x 10p deposit per container) in the <0.75 litre and <1 litre scenarios.

To calculate the number of containers that would be returned, the Canadian results are again used. Table 2 showed that, for aluminium cans, the minimum capture rate for DRSs (64%) in the Canadian schemes falls below that of the current recycling rate in the UK (70%), which would call into question the whole purpose of introducing a DRS for aluminium cans in the UK.

Figure 6 shows the detailed breakdown of the 11 Canadian DRSs for which data are provided, and this shows that, although the overall range is between 64% and 97.2% (i.e. a range of 33.2%), the middle eight schemes have capture rates that fall between 78.5% and 92.1% (13.6% range). Within the modelling exercises undertaken in this paper, the range of these eight DRSs was used.

Figure 6: Capture rate (%) of aluminium cans in the DRSs operating in Canadian provinces[12]



3.2.3 Estimated increase in overall recycling rate

Table 11 shows the additional material that would be captured assuming that the DRS will increase the recycling rate of material in the scheme from the current UK average of 70% to between 78.5% and 92.1%. The modelling suggests that increasing the recycling rate to 78.5% would result in the recycling of a further 412,000 containers and an increase in the overall recycling rate by 4.6%, i.e. an increase to 74.6%. If the recycling rate increased to 92.1%, then an additional 1.07 million containers would be recovered, equating to an increase in the current recycling rate of 11.9% to 81.9%.

Table 11: Calculation of the additional cans that will be captured through a DRS

Product category	Total units (millions)	Recycling rate (%)		
		70	78.5	92.1
Carbonated soft drinks	3,633.07	2,543.15	2,851.96	3,346.06
Energy & sport drinks	1,162.32	813.62	912.42	1,070.50
Iced/RTD drinks	11.88	8.32	9.33	10.95
Juice & nectar	17.04	11.93	13.37	15.69
Still drinks	18.77	13.14	14.74	17.29
Water	12.06	8.44	9.47	11.11
Total	**4,855.14**	**3,398.60**	**3,811.29**	**4,471.58**
Increase in units recycled (millions)		**412.69**		**1,072.99**
Increase in total recycling rate for aluminium cans (%)		**4.59**		**11.93**

[12] Adapted by Oakdene Hollins using data from Deposit systems for one-way beverage containers: global review 2016. CM Consulting

4 Modelling the impact on the quality of material recovered in the DRS

4.1 Background

4.1.1 'On the go' consumption

The material recovered through 'on the go' consumption is typically of lowest quality due to high levels of contamination. Recoup's *Local authority disposal 'on-the-go'* survey (December 2017) reports that *"there are many examples of 'on-the-go' recycling collection provision being withdrawn due to high costs and contamination levels"*. Evidence in the report *Plastic bottles: turning back the plastic tide* provides a strong consensus of opinion regarding the lack of material quality.

4.1.2 MRF processed materials

Table 12 highlights the variability in quality across materials recovery facilities (MRFs) showing that contamination rates can be significant, e.g. as high as 20.1% for clear PET and 8.1% for aluminium - albeit that the mean contamination can be seen to be much lower (2.5%) for aluminium than the 7.5% shown for PET clear. Defra's *Proposals to promote high quality recycling of dry recyclates* Quality Action Plan (February 2013) reports that in a market where there can be a wide variation in quality, and if it cannot be immediately identified at the point of purchase, there can be a bias towards customers only being willing to pay a lower price, as they would rather not risk overpaying. At the same time sellers may not be willing to produce higher quality material if they are not certain that it will fetch a higher price.

Table 12: Percentage MRF non target and non-recyclable material based on quality (2013)

Material	Percentage MRF non target and non-recyclable material		
	Min %	Mean %	Max %
PET Clear	0.5	7.5	20.1
PET Coloured	3.0	8.1	13.2
Aluminium	0	2.5	8.1

Source: Proposals to promote high quality recycling of dry recyclate' Quality Action Plan February 2013

4.1.3 The redemption points in an 'on the go' DRS

Reverse vending machines (RVMs) represent the most common method of returning containers in modern 'on the go' DRS schemes. In such schemes, operating in Australia and North America, the RVMs are located in public areas (public transport facilities, educational establishments, parks, shopping centres, etc.) in line with the point of consumption rather than the point of sale. This caters for the consumer demand for convenience and is geared to the processing of single containers.

Modern RVMs operate using a barcode system to ensure that only containers that have the appropriate barcode are accepted by the machines and hence receive the deposit. This not only provides a level of fraud-proofing but also presents a quality control point.

In Spring 2015, Zero Waste Scotland reported[13] on the pilot RVM systems the Scottish Government committed to in 2011 aimed at increasing:

- the recycling of single use containers (for plastics, glass and aluminium containers) and
- the quality of this material, to support the development of 'home-grown' closed-loop re-processing infrastructure in Scotland.

The material that was collected by the schemes was typically of very high quality, and contamination was low, as the machines reject incorrect materials that people try to recycle (unlike a conventional recycling bin, where users may leave the wrong item by mistake, causing problems for waste management or reprocessing further down the line). In theory this higher quality of material should save money (reducing recycling management fees) or even generate revenue (where material can be sold directly).

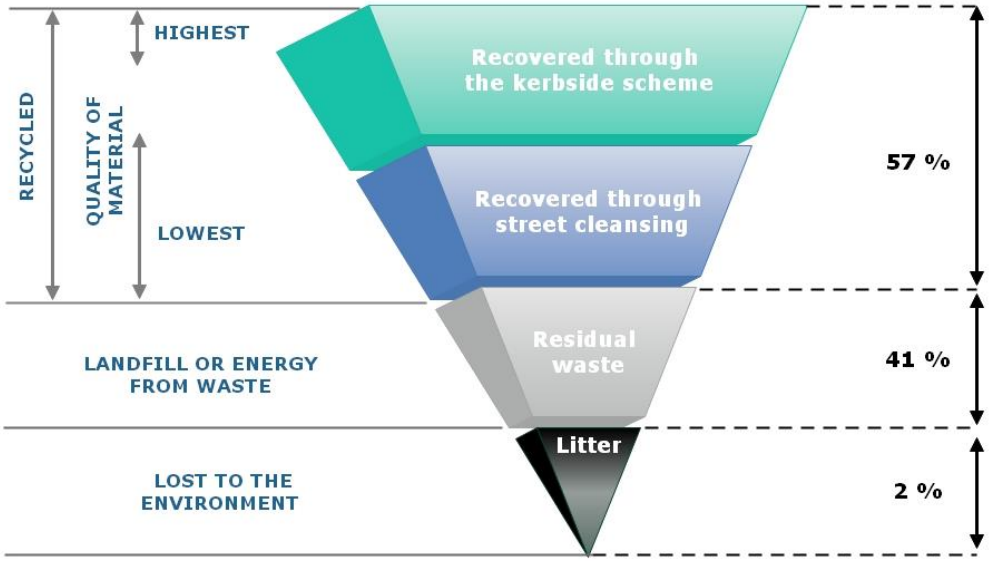
4.1.4 The quality hierarchy

Based on the above observations, a quality hierarchy was developed, shown in Figure 7, overleaf. The challenge of the DRS is to provide a financial incentive to move the material from litter, residual waste and that which is recovered through street cleansing up the hierarchy to high quality material captured and recovered through the DRS.

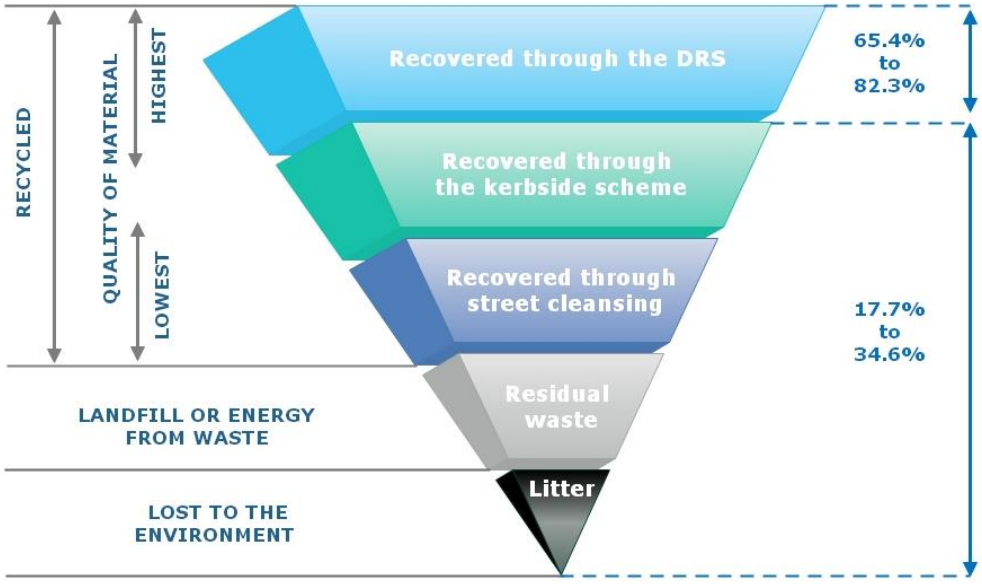
Currently, the Landfill Tax is a major policy driver to motivate the diversion or 'push' of material from landfill (residual waste) into more environmentally beneficial routes, such as kerbside recycling. Additionally, the funds generated through the Landfill Tax can be used to support recycling schemes. However, the success of the Landfill Tax in diverting waste from landfill means that the revenue from the tax is declining. Therefore, the DRS provides an alternatively funded delivery mechanism. The DRSs operated in Australia represent an interesting case, since they operate without a landfill tax, and hence could be considered a potential vision of the future for the UK.

[13] https://www.zerowastescotland.org.uk/sites/default/files/Recycle and reward pilots Overview Report.pdf

Figure 7: The quality hierarchy for UK PET bottles: Current scenario



The quality hierarchy for UK PET bottles: Future scenario



Source: Produced by Oakdene Hollins using data from: Plastic bottles: turning back the plastic tide. First report of session 2017-19. House of Commons Environmental Audit Committee. 19 December 2017

4.2 PET bottles: Modelling of the potential additional revenue

4.2.1 Background: the German example

A 2012 study by PwC reports[14] that, in terms of PET bottles in the German scheme:

- In deposit systems, all collected materials are recycled with 'clear' PET commanding EUR460-530 per tonne.
- In the kerbside systems, the quality of the collected material is of worse quality with 'clear' PET commanding EUR275-320 per tonne.

Applying these findings to the UK case, Table 13 shows the estimated additional revenue that would be generated through the DRS due to the increased quality of the material. The calculation converts the PwC estimates into GBP using the 2012 average exchange rate of £0.81 per Euro and assumes 22,000 containers per tonne.

Table 13: Estimates of the additional revenue generated in the DRS for PET bottles using German 2012 data

Threshold (litres)	Total number of returned containers (million)	Revenue (£millions)		
		DRS revenue @ £372.60 - £429.30 per tonne	Kerbside revenue @ £223 - £259.20 per tonne	Difference (DRS v kerbside)
<0.5	1,678	28.4 – 32.7	17.0 – 19.8	8.6 – 15.7
	2,112	35.8 – 41.2	21.4 – 24.9	10.9 – 19.8
<0.75	3,621	61.3 – 70.7	36.7 – 42.7	18.7 – 34.0
	4,557	77.2 – 88.9	46.2 – 53.7	23.5 – 42.7
<1	3,851	65.2 – 75.1	39.0 – 45.4	19.9 – 36.1
	4,847	82.1 – 94.6	49.1 – 57.1	25.0 – 45.5

4.2.2 UK estimate

WRAP reports[15] that the maximum price for clear PET bottles in the UK was £175 per tonne, with an average price of £155 per tonne in 2017. Table 14 provides the estimate of the potential additional revenue that would be generated through the DRS.

Table 14: Estimated extra revenue generated in the DRS for PET bottles, using UK 2017 data

Threshold (litres)	Total number of returned containers (million)	Revenue (£millions)		
		DRS revenue @ £155 - £175 per tonne	Kerbside revenue @ £60 - £130 per tonne	Difference (DRS v kerbside)
<0.5	1,678	11.8 – 13.3	4.6 – 9.9	1.9 – 8.8
	2,112	14.9 – 16.8	5.8 – 12.5	2.4 – 11.0
<0.75	3,621	25.5 – 28.8	9.9 – 21.4	4.1 – 18.9
	4,557	32.1 – 36.2	12.4 – 26.9	5.2 – 23.8
<1	3,851	27.1 – 30.6	10.5 – 22.8	4.4 – 20.1
	4,847	34.1 – 38.6	13.2 – 28.6	5.5 – 25.3

[14] Refillables for sustainability: key facts and figures from the independent PwC study on different types of beverage packaging. Brussels 2012.

[15] http://www.wrap.org.uk/content/plastic

Please note: The DRS pricing is average and maximum price, and the kerbside is minimum and maximum. It would therefore be prudent to assume that the minimum price in the DRS would be very similar to the maximum price in the kerbside scheme, i.e. £130 per tonne, and hence, the minimum 'difference' would be zero in all cases.

4.3 Corporate aspiration to increase recycled content of PET containers

A major driver for an increase in the quality of the recycled material collected is the commitments made by the brand owners to address the issues around recycled content of PET containers. For example:

Coca-Cola Great Britain reports[16]:

"*We're committed to doubling the amount of recycled materials in our plastic bottles to 50% by 2020 across our entire portfolio of the 20 different brands we sell."*

Diageo says:[17]

"Our aim is to increase the use of post-consumer recycled plastic materials in PET and other plastic formats in line with our ambition to increase recycled content in all packaging by 45% by 2020 (from the 2009 baseline). This is challenging because availability of appropriate recycled materials is limited in many countries. In addition, we need to balance the need to use recycled materials with the need to maintain the quality of our packaging.

"We also aim to increase the supply of recycled PET by promoting consumer recycling, improving recycling technology and engaging with governments to improve recycling infrastructure. Our aim is to move to a more circular approach, encouraging consumers of our brands to recycle the packaging we produce."

Danone states:[18]

"Evian bottles are recyclable and globally contain on average across the range 25% recycled plastic (rPET). Evian has announced that it will make all of its plastic bottles from 100% recycled plastic by 2025, a move that will see the natural spring water brand adopt a 'circular approach' to its plastic usage, where plastic is kept within the economy and out of nature. Working in close relationship with the Ellen MacArthur Foundation to define this roadmap, Evian will move from a linear model to a circular one, where all bottles will be made from recycled plastic without the need for any virgin plastics. This will enable plastic to evolve from potential waste to become a valuable resource.

"Evian plans to achieve this through pioneering partnerships to redesign its packaging, accelerate recycling initiatives and remove plastic waste from nature."

This is not a new phenomenon since the British Soft Drinks association (BSDA)[19] reported in its *UK Soft Drinks Responsibility* report in March 2012:

[16] How much recycled material does Coca-Cola Great Britain use in its packaging? Coca-Cola

[17] https://www.diageo.com/pr1346/aws/media/2565/diageo-plastics-guideline-may-2017.pdf

[18] http://ethicalmarketingnews.com/evian-transforms-approach-plastic-become-100-circular-brand-2025

[19] http://www.britishsoftdrinks.com/write/mediauploads/publications/bsda_responsibility_report_2012.pdf

"…demand for recycled PET plastic exceeds supply, so soft drinks companies are sponsoring campaigns to encourage the public to recycle, including the installation of facilities for collecting bottles for recycling on-the-go."

WRAP's 2016 market situation report shows the impact the current practice of collecting mixed dry recyclate (high levels of lower quality, relatively high contamination material) has on the high value, higher quality recyclate markets. For example, only 95,000 tonnes of the 226,000 tonnes of recovered PET is clear PET of a quality suitable for the 'bottle-to-bottle' (36,700 tonnes) or sheet PET markets (59,300 tonnes). This results in only 9.2% of the original material finding its way back for bottle-to-bottle recycling.

This compares to a 50% recycled content for aluminium cans in the UK and an average for glass containers (all colours) in the UK of 38.5% (green glass 68.1%, amber 30.3% and clear / flint 31.9%).[20] This clearly shows the significance that the estimated additional, higher quality material shown in Table 7 (of between 76,000 tonnes and 220,000 tonnes) could have on closed-loop recycling / recycled content. For example, if all the additional material were to be used in bottle-to-bottle recycling then theoretically the recycled content of the PET containers could be increased from 9.2% currently to between 28.4% and 64.7% helping to meet producer demand.

4.4 Metal cans: Modelling of the potential additional revenue

4.4.1 Calculation

Unlike the PET example, detailed above, aluminium reprocessing is less sensitive to contamination: for example[21], 81% of aluminium cans can be recovered from waste incinerator bottom ash as ingots. Therefore, it is assumed that the additional revenue results only from the additional material being recovered.

Table 15 shows the financial impact of the increase in recycling and shows that an increase in recycling to 78.5% would result in additional revenue of between £5.5 million and £7.3 million, while an increase to 92.1% would increase revenue by between £14.4 million and £19.1 million.

Please note: this does not take into consideration the current costs associated with managing this material, and this could be significant for materials currently sent to landfill or contained within street cleaning activities.

Table 15: Financial impact of the increase in aluminium can recycling

Impact	Recycling rate (%)	
	78.5	92.1
Increase in recycling (tonnes)	6,942	18,049
Increase in revenue @ £800 per tonne (£)	5,553,398	14,438,836
Increase in revenue @ £1060 per tonne (£)	7,358,253	19,131,458

Packaging prices have been taken from Letsrecycle and represent the lowest and highest prices in 2017.

[20] British Glass. Recycled content. September 2017.

[21] https://www.ncbi.nlm.nih.gov/pubmed/23831779

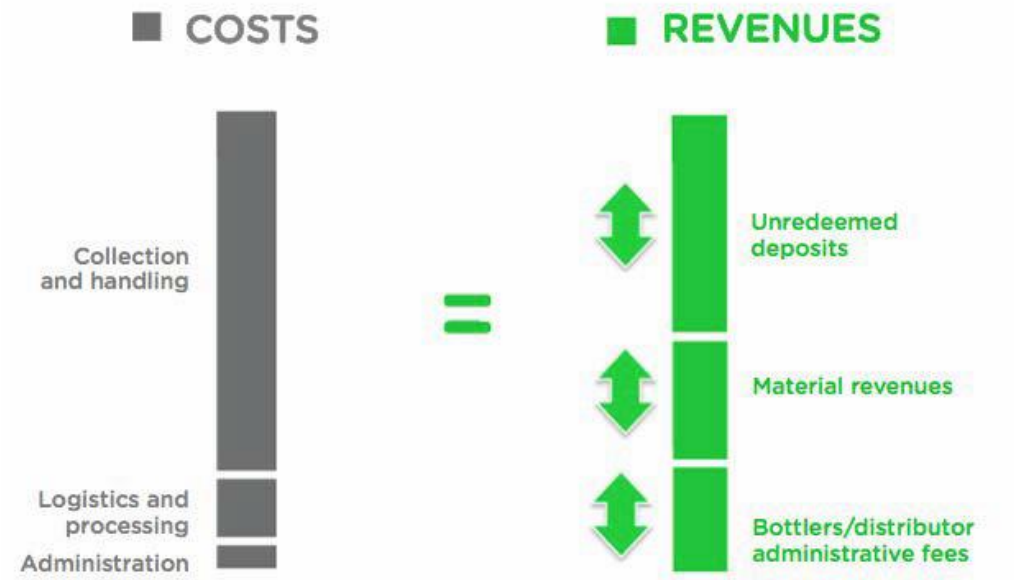
5 Funding the DRS

Figure 8 shows the conventional breakdown of costs versus revenue in a DRS. This shows that the most significant costs are the collection and handling of returned containers. Much debate in the consultation for the proposed Scottish and English DRSs have centred on the impact it would have on local authority revenues. This section considers the funding models and includes estimates of the potential revenue impacts for local authorities.

From a revenue perspective, Figure 8 shows that unredeemed deposits represent the most significant revenue stream, followed by material revenue (discussed in Section 4). Additional funding, if required, can be generated through bottler / distributor administrative fees. New Brunswick directs half the unredeemed deposits into the province's environmental trust fund where it is used for environmental conservation, education, protection, and other provincial environmental initiatives aimed at reducing waste; in the Yukon money is directed into a recycling fund.[22]

This section provides an estimate of the value of unredeemed deposits and compares this with the revenue impacts for local authorities.

Figure 8: Costs versus revenue in a DRS



Source: Reloop: Petcore – Europe conference 2018: strategy for PET in the circular economy

[22] Deposit systems for one-way beverage containers: global review 2016. CM Consulting

5.1 Estimated value of unredeemed deposits

Table 16 provides an estimate of the value of unredeemed deposits within the PET scheme; Table 17 provides the same assessment for aluminium cans based on the calculations made in the previous sections.

Table 16: Estimates of the value of unredeemed deposits for a DRS on PET containers

Threshold	Total value of deposits (£million)	Value of unredeemed deposits (£million)	
		65.4% capture rate	82.3% capture rate
<0.5 litres	256.6	88.78	45.42
<0.75 litres	553.7	191.58	98.00
<1 litre	588.9	203.76	104.24

Table 17: Estimates of the value of unredeemed deposits for a DRS on aluminium cans

Impact	Capture rate (%)	
	78.5	92.1
Value of unredeemed deposits (£millions)	104.4	38.4

5.2 Options for using unredeemed deposits

Table 18 provides a summary of the options for using the unredeemed deposits. The most common option is to use the funds to support the management and operation of the scheme.

Table 18: Options for using unredeemed deposits

Option	Where it is currently used
Payment to service providers	This is the most common approach used in most schemes around the world. Typically, it is managed through the scheme administrators in the form of: handling fees (paid to the retailers in many DRS); container recycling fees (paid to the collectors or recyclers in British Columbia and Hawaii); and transport fees (paid to the retailers for transporting the collected containers to waste packaging management centres in Croatia).
Taken as Government revenue	New York, Saskatchewan, Yukon
Funding for recycling and other environmental protection projects	Croatia, Israel
Funding for local community projects and charities	Denmark. As in many of the DRSs, the unredeemed deposits are firstly used in the conventional way to support the management and operation of the scheme. However, any surplus revenue is donated to charity or community projects.

Much attention is currently being placed on the DRS in California where the success of the scheme in reaching a recycling rate of 85% in 2013 resulted in insufficient funds (unredeemed deposits) remaining in the scheme to reimburse recyclers.[23] This has resulted in 2.5 million fewer containers per day being recycled, due to the closure of 560 recycling centres and the recycling rate dropping to 77% in mid-2017. This is not a situation we should let happen in the UK, and is why SUEZ proposes that a top-up fund may be required from manufacturers/retailers.

5.3 Modelling the impacts of revenue flows for local authorities

This paper reviews the potential revenue losses that the current kerbside collection schemes operated by local authorities could incur (due to reductions in volumes of recyclates that would have generated income) since they could be the biggest potential 'losers' from running a DRS in tandem with a kerbside scheme. It is noted that the DRS could provide new revenue streams for local authorities, like operating redemption points or the operation of local consolidation points. Additionally, studies in Scotland[24] in 2015 and for England[25] in 2017 state that the loss of revenue is compensated by savings in such activities as:

- reduction in residual waste requiring treatment
- reduction in material recovery facility and collection costs and
- reduction in street cleansing costs.

On balance, the two reports estimate a £4.6 million annual saving to the local authorities in Scotland and £56 million to those in England from the introduction of a DRS scheme.

However, in response to the 2015 report, LARAC, in its call for evidence to review the feasibility study for DRS for drinks containers in Scotland, stated that *"LARAC believes that as currently outlined the system proposed has not fully investigated cost implications for local authorities and therefore is in danger of introducing unintended consequences"*. The City of Edinburgh Council also stated that *"such systems do operate successfully in other countries but in at least some of these they are operating in an environment which may not have the same extent of kerbside recycling as is in place in Scotland"*.

5.3.1 PET scenario-testing

For the modelling exercise we wished to determine:

- The maximum loss in material revenue that the local authorities would incur should all DRS containers be removed from the kerbside scheme.
- How significant the revenue loss would be when compared with the overall value of the DRS deposits (%).

The scenario-testing exercise modelled the percentage of unclaimed DRS containers that would need to remain in the kerbside recycling scheme to compensate for the anticipated loss of material. Six scenarios were tested based on the size threshold (<0.5 litre, <0.75 litre and <1 litre) and on the minimum and maximum material prices shown on the *Letsrecycle* website for 2017. For example, for PET the 'clear or blue PET bottles' category was selected

[23] https://www.prnewswire.com/news-releases/on-30th-anniversary-of-california-bottle-bill-recycling-rates-sharply-decline-300514193.html

[24] Eunomia: A Scottish deposit refund system. Final report for Zero Waste Scotland 7th May 2015.

[25] Eunomia: Impacts of a deposit refund system for one-way beverage packaging on Local Authority waste services. Final report 11th October 2017. Keep Britain Tidy et al.

and the two figures for December 2017 were used; namely, a minimum of £60 and a maximum £130 per tonne. The assumption made for this analysis was:

- One tonne of PET containers equates to 22,000 units *(Source: Recoup)*.

Table 19 shows that if all the containers within the DRS are removed from the kerbside scheme, the loss of income to all UK local authorities would be between £4 million and £19.9 million - dependent on the realised material prices (£60 to £130 per tonne) and the scenario. These losses equate to between 1.5% to 3.4% of total deposits in the DRS (Figure 4). This apparently low figure is due to the high value of deposits that would be generated per tonne, i.e. one tonne of PET containers (22,000 units) with a deposit of 10p each equates to £2,200 per tonne (excluding the cost of sorting and reclaiming the deposit), whereas the price in the kerbside scheme in this scenario is between £60 and £130 per tonne.

Table 19: PET scenario testing – the impact of the DRS on local authority revenue

Scenario	Material revenue (£ per tonne)	Potential loss of material revenue in the kerbside recycling scheme (£ millions)	Percentage of DRS deposits that would need to be paid to LAs to cover lost revenue (%)
Scenario 1 <0.5 litre	60	4.0	1.6
	130	8.6	3.4
Scenario 2 <0.75 litre	60	8.6	1.6
	130	18.7	3.4
Scenario 3 <1 litre	60	9.2	1.6
	130	19.9	3.4

Table 20 shows the comparison of unredeemed deposits against the level of local authority revenue loss. It can be seen that the local authority losses are significantly lower than the value of unredeemed deposits.

Table 20: Unredeemed deposits vs required LA compensation (PET)

Description	Value
Value of unredeemed deposits (£millions)	45 to 204
LAs potential lost revenue (£millions)	4 to 8.6

Please note: Additional funds would be required from the unredeemed deposits and other revenue sources (Figure 8) to cover the costs incurred by other scheme operators involved in the collection and recovery of the containers and for the management of the scheme. These costs were not calculated in this paper so it is not possible to categorically state that the scheme would be economically viable.

5.3.2 Aluminium cans scenario-testing

Table 21 shows the same analysis for aluminium cans and, due to the higher value of the material (£800-1,060 per tonne), the revenue losses and breakeven points are more significant. The losses if all DRS containers were removed from the kerbside scheme would be between £43 million and £60.6 million equating to 9.1% and 12.2% of the total value of deposits in the DRS (Section 3.2.2).

Base assumptions:

- The aluminium can prices have been taken from *Letsrecycle* and represent the lowest and highest prices in 2017.
- The scenarios have been modelled based on 100% of the drinks cans being aluminium.
- One tonne of aluminium cans equates to 59,450 containers.

Table 21: Aluminium cans scenario testing – the impact of the DRS on local authority revenue

Scenario	Material revenue (£ per tonne)	Potential loss of material revenue in the kerbside recycling scheme (£ millions)	Percentage of DRS deposits that would need to be paid to LAs to cover lost revenue (%)
Scenario 1 <0.5 litre	800	43.3	9.1
	1,060	57.4	12.2
Scenario 2 <0.75 litre	800	45.7	9.1
	1,060	60.6	12.2
Scenario 3 <1 litre	800	45.7	9.1
	1,060	60.6	12.2

Table 22 shows the comparison of unredeemed deposits against local authority revenue losses. The figures are much closer than for PET (Table 20), and hence the viability of the scheme cannot be judged based on this measure alone, i.e. a full cost benefit analysis would be required taking into consideration such factors as:

- Reduction in the costs associated with the reduction in residual waste requiring treatment.
- Reduction in the costs due to the reduction in material recovery facility and collection costs.
- Reduction in street cleansing costs.

Table 22: Unredeemed deposits vs required LA compensation (aluminium cans)

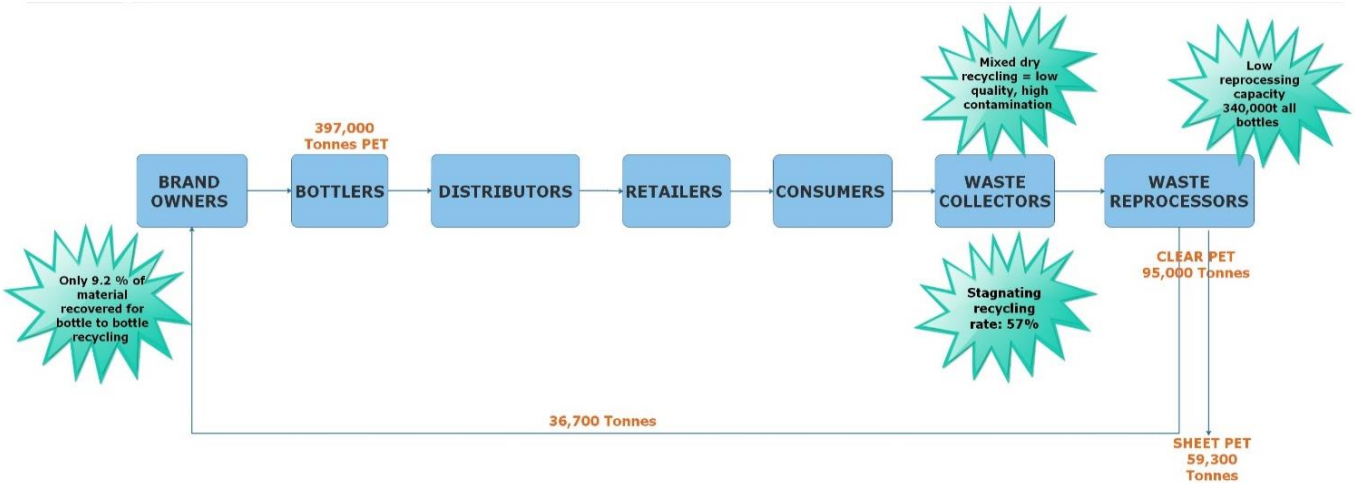
Description	Value
Value of unredeemed deposits (£millions)	38 to 104
LAs potential lost revenue (£millions)	43 to 61

6 Observations and discussions

1. The case for introducing a DRS for PET consumed 'on the go' is compelling from the perspective of litter reduction, recycling and – potentially – bottle-to-bottle recycled content. The appetite for change is clearly evident. Figure 9 provides a summary of the key issues in the current system that would be addressed through the implementation of a DRS.

   Please note: The low reprocessing capacity, not discussed in this paper, will be affected due to greater availability of higher quality material and the increased demand for material from the brand owners / manufacturers because of their commitments to increase the percentage recycled content of their products.

Figure 9: A process flow diagram for PET bottles in the UK

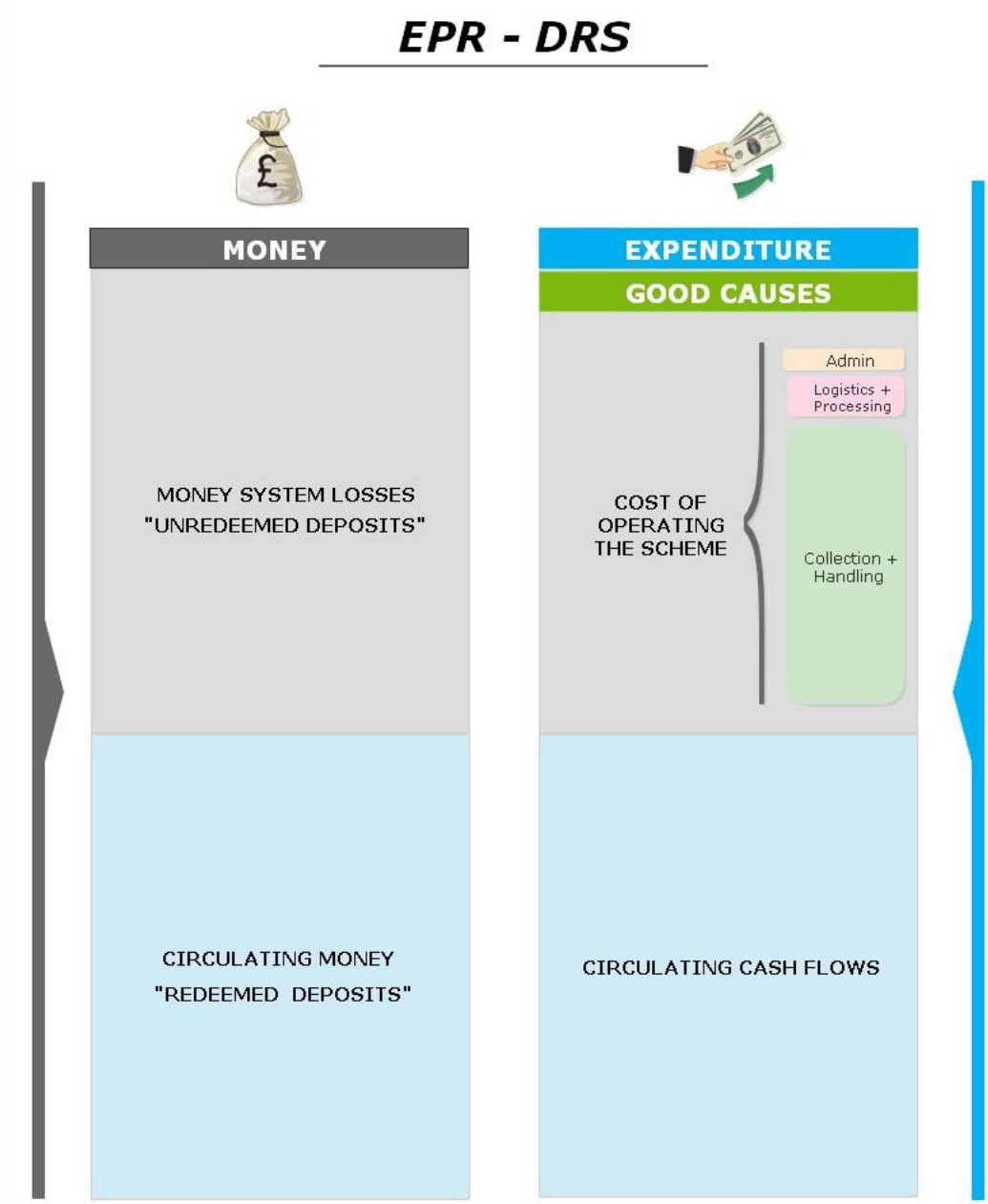


2. The case for introducing a DRS for cans is less compelling due to the current higher recycling rates driven primarily by the higher value of the material and existing demand from the brand owners / manufacturers. This results in the benefits of a DRS being less pronounced.

3. Introducing a PET-only DRS, similar to that in the Netherlands, is a means of tackling this issue, but market distortions would be a critical factor; i.e. would this result in a switch from PET to other materials by manufacturers and, if so, is this a good thing?

4. Should the UK follow the Danish DRS, whereby any surplus revenue that remains after the service providers have been reimbursed is used to support local community projects or charities? Figure 10 shows how this system would operate. A key question is: should the consumer have more control over the end fate of the deposit, e.g. a means of selecting their desired use of the deposit on the return of the container (such as options on the reverse vending machines)?

Figure 10: The proposed flow of money versus expenditure



5. Should local authorities be reimbursed for the loss of material revenue they receive through the kerbside recycling schemes, or is this likely to be more than offset by reduced operating costs, as suggested in the consultation documents produced for Scotland and England? Alternatively, should they be reimbursed as a service provider for processing material carrying unredeemed deposits that remain in their kerbside collection schemes? Further work is clearly required to provide a level of guarantee that local authorities will not be victims of the scheme.

6. In many of the existing DRSs the systems are operated by a not-for-profit entity made up of industrial partners. The commitments made by brand owners to increase the recycled content (%) in their products provides a demand pull. Should the scheme be managed by brand owners and other industrial stakeholders through a not-for-profit

entity driven by these commitments? How would this impact on other existing closed loop markets such as sheet PET?

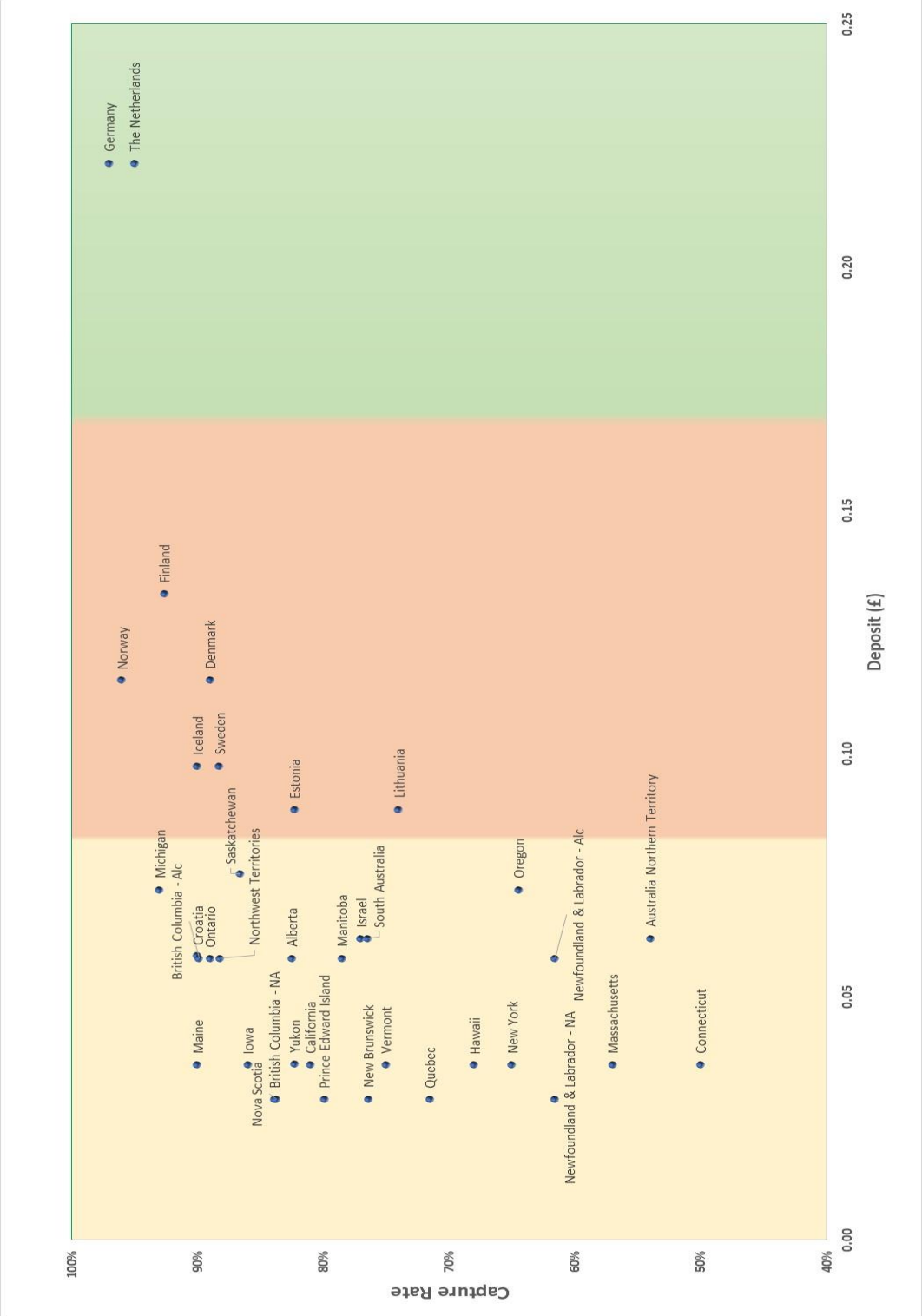
Please note: The Every Can Counts *voluntary initiative is a partnership between drinks can manufacturers and the recycling industry, and encourages recycling outside the home. Initially targeting recycling in the workplace, in 2010 it was extended to 'on the go' consumption, in particular music festivals and tourist locations.*[26] *The scheme is managed by the Aluminium Packaging Recycling Organisation (alupro). Organisations or individuals returning cans receive between 40p and 50p per kilogram of empty cans returned to designated recycling centres. Partners are:*

- *alupro*
- *Metal Packaging Europe*
- *Can-Pack UK*
- *Novelis*
- *Red Bull*
- *AG Barr*
- *UK Canmakers*
- *Metal Packaging Manufacturers Association.*

7. Futureproofing: the growth in 'on the go' consumption does not look like abating any time soon, which places more and more emphasis on the introduction of recovery schemes that are alternative / supplementary to household kerbside schemes. Additionally, the Landfill Tax is currently a significant revenue generator, helping to subsidise existing schemes and other local authority activities, but as more material is diverted from landfill this revenue stream will inevitably reduce. A DRS provides an alternative funding mechanism which could future-proof the recycling of drinks containers and (potentially) other products. Could the DRS deposit ultimately replace the Landfill Tax as the new key driver?

[26] https://www.everycancounts.co.uk/who-we-are/

Annex A : Scatterplot of capture rate versus deposit value for current DRSs



Source: adapted by Oakdene Hollins using data from Deposit systems for one-way beverage containers: global review 2016. CM Consulting

About the authors

Olivia Bertham MPhil MSc, Senior Consultant

Olivia has been an environmental and corporate responsibility consultant for over 15 years. Since joining us in 2015, she has researched and consulted on projects with the common theme of the circular economy. For large corporates and trade associations she has advised on secondary raw materials – recycling, markets, technologies, challenges and the communication of environmental benefits.

David Fitzsimons MBA CEnv CMInstWM, Managing Director

A founder Director of Oakdene Hollins, David's strength is in the application of economic instruments to environmental policy objectives and in analysis of market opportunities for environmental technologies. He has peer reviewed LCA papers on waste management options for paper, glass, plastics, wood, aggregates, steel and aluminium, and co-written major papers on resource efficiency, CO_2 reduction and energy from residual wastes.

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.

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.

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Oakdene Hollins is a research and consulting business that advises clients on the circular economy and product stewardship. From offices in the UK and Brussels we provide market research and science-based evidence for Government and business clients.
The company manages a European knowledge centre on remanufacturing and has established a new European Council for Remanufacturing based in Brussels (see www.remancouncil.eu).
Oakdene Hollins manages the award of the European Ecolabel within the UK to companies applying to sell their products within the European single market (see www.eu-ecolabel.uk).

For more information about Oakdene Hollins please visit www.oakdenehollins.com

Registered office
3rd Floor, Ardenham Court
Oxford Road, Aylesbury
Buckinghamshire HP19 8HT

Brussels office
4th Floor
Square de Meeus
1000 Brussels

Oakdene Hollins Ltd
Ardenham Court
Oxford Road
Aylesbury
Buckinghamshire
HP19 8HT

+44(0)1296 423915
admin@oakdenehollins.com
www.oakdenehollins.com

Registered in England&Wales
no: 2937129

www.remancouncil.eu
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