Have we got the bottle? Implementing a deposit refund scheme in the UK

Report prepared for the Campaign to Protect Rural England

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We aim to:

- Influence land use in town and country for people and nature
- Protect and enhance beauty, tranquillity and local distinctiveness
- Increase and harness public and political support for the countryside

CPRE's Stop the Drop campaign is working to stop the blight of litter and fly-tipping on our countryside, cities, waterways, towns and villages.

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Foreword

I am proud that CPRE has committed its limited resources to commissioning this research into deposit refund schemes. The findings throw rational and informed light on an issue that is nonsensically contentious in the UK. What sensible nation would not want to capture and recycle its precious and finite resources? What discerning people would not want to enjoy a litter-free environment?

CPRE has published this research to reignite the debate, so that an effective mechanism which delivers environmental and social benefits in many other countries can be given its proper consideration in the UK. I believe the time is right. We must have this debate now and harness the new will that is so evident - from people, politicians and policy-makers alike - to rethink how we live and reassess how we manage our resources.

It's a debate we must have, if we are serious about creating a future that is sustainable, responsible and litter-free. I'm sure we've got the bottle to do it.



Bill Bryson President

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EXECUTIVE SUMMARY

In April 2008, CPRE launched its *Stop the Drop* campaign against litter and flytipping, with the twin aims of getting existing litter picked up and preventing further litter being dropped. As part of the campaign it worked with Policy Exchange in 2009 to publish *Litterbugs: How to deal with the problem of littering*¹, which detailed a suite of proposals for addressing litter.

One of the key recommendations of that report was for the introduction of a national deposit scheme, linked into broader waste and recycling policies, in light of the research findings that deposit refund schemes (DRSs) significantly reduce litter and help to promote virtuous cycles of behaviour.

This report was subsequently commissioned by CPRE to investigate, in more depth, the environmental and financial implications of its recommended introduction of a UK-wide DRS for beverage containers. The report is particularly timely given the devolved administrations' active commitment to achieving zero waste economies and the publication in May 2010 of the Coalition's Programme for Government, which states:

'We will work towards a "zero waste" economy, encourage councils to pay people to recycle, and work to reduce littering.'²

As highlighted in more detail within the main report, DRSs offer the opportunity for the UK Government collectively to increase recycling and consequently increase the amount of waste diverted from landfill and other residual waste treatment options, as well as reduce litter. Individuals are able to return their empty containers and recoup their deposit whilst 'on the go' or as part of their household shopping, with the system therefore encouraging them to dispose of their waste responsibly.

A DRS can arise as a consequence of a decision to implement a mandatory scheme, or as a response, from industry, to high recycling targets. Defra has previously argued (albeit, we suggest, on limited evidence) that there are alternative schemes which can achieve the same outcomes as DRSs at a lower cost. The evidence in support of this view is thin, with only Belgium achieving recycling rates approaching the levels achieved in DRSs (and then, not for PET bottles). Belgium has a producer responsibility scheme in place which is fully funded by obligated industry. It also sets targets well above those prevailing in the UK at present, and also has near-universal implementation of so-called pay as you throw schemes at the household level, a policy which the Coalition Government has clearly set itself against. Finally, it is not clear how levels of beverage container litter compare between, for example, Belgium and those countries where DRSs generate high return rates.

This research has set out to explore the potential costs and benefits of the set up and operation of a DRS in the UK. The modelling indicates that the introduction of a UK-wide DRS is:

a) Likely to cost around £84 million to set up if well designed;

- Policy Exchange and CPRE (2009) Litterbugs: How to deal with the problem of littering, London: Policy Exchange, 2009.
- 2 HM Government (2010) The Coalition: Our Programme for Government, available at http://www.cabinetoffice.gov.uk/media /409088/pfg_coalition.pdf

- b) Likely to cost around £700 million per year to run (net of revenues);
- c) Unlikely to introduce very significant costs to producers. Even at 90% return rates, in our modelling, the unclaimed deposits fund around 70% of system costs;
- d) Likely to generate savings to local authorities (and hence, reduce the burden of taxation) of around £160 million;
- e) Likely to deliver strong environmental benefits in terms of:
 - i. reduced greenhouse gas (GHG) emissions and air pollutants, mainly from increased recycling, in the region of £69m; and
 - ii. additional benefits associated with the reduction in the disamenity associated with litter, potentially in the region of £1.2billion.
 The benefits associated with litter reduction are particularly large and generate the overwhelming majority of the environmental gain.

Therefore, the case for the introduction of a DRS appears sound, based upon our analysis of the potential impacts. With this in mind, a number of key recommendations have been developed for UK policy makers. These are presented below.

Recommendation 1: The UK Government should introduce a deposit refund system

Even if other systems could meet the recycling rates achieved by DRSs, there is scant evidence that they can achieve the same benefits in respect of litter reduction. The environmental benefits associated with litter reduction are dominant in this analysis. Therefore, it is clear the Government must consider a DRS from the perspective of achieving high return rates for recyclable beverage containers, and significantly addressing beverage container litter.

The research carried out in this report suggests a DRS can:

- Increase recycling rates of beverage containers through rewarding returns;
- Reduce litter by generating an incentive to 'not throw away';
- Generate environmental gains, both in terms of reduced litter and reduced GHG emissions.

In addition, a DRS is a significant mechanism which can be used to deal with beverage containers (and other packaging) which will reduce the costs to central government, local authorities and taxpayers of dealing with packaging. This is a particularly relevant factor in the current economic climate.

DRSs are not always mandatory. They can arise from the setting of high targets for producers to meet, with DRSs becoming the means to meet those targets. There are, however, difficulties to be overcome in setting litter reduction targets, hence our recommendation in favour of a DRS. Even so, in order to ensure that the DRS is established with convenient infrastructure for returns, it makes sense to set targets for recycling of beverage containers.



3 Although in this case, it seems likely that consumers would 'internalise' lost deposits in the price of the beverage, more so than where the deposit can easily be recouped. This might, in turn, depress demand for the beverage itself.

Recommendation 2: High targets should be set for the recycling of all beverage containers, irrespective of material type

Targets are a pre-requisite for a well-functioning DRS since, in their absence, schemes may be designed which are inconvenient, deliver low recycling rates, and lead to high levels of unclaimed deposits, which can become a source of revenue.³ We also note that these targets should apply even to materials and container types which are not so easily included as part of a DRS, to prevent producers switching between container types which are, and are not, subject to targets.

Our study has suggested rates of deposit expected to generate return rates in the order of 90%. We suggest, therefore, a target rate of 85%, in the first instance, is set for the targeted beverage containers. Sanctions should be considered in the event of non-compliance.

In principle, were a DRS to be introduced, whether of a mandatory nature, or in response to the existence of targets, we would recommend the following:

Recommendation 3: A central system should be established to administrate the deposit refund system

We would recommend one central system, potentially owned by various stakeholders, such as industry groups, NGOs and retailers, which would operate to meet the recycling targets specified by the Government and administrate the DRS (See Recommendations 1 and 2). This is a similar system to the Scandinavian approach. The exact nature of the central system would probably reflect the way in which the DRS emerges (mandatory, or more voluntary in nature), with discussions to be had about the amount of outsourcing of various functions that would need to be undertaken.

Recommendation 4: PET bottles, glass bottles and aluminium and steel cans should be covered by a UK-wide deposit refund system

We recommend that the following beverage containers should be covered within a UK-wide DRS:

- PET bottles
- Glass bottles
- Aluminium and steel cans

The option to include other plastic bottles should also be considered. The decision to include beverage cartons, in light of technological developments being made, should also be considered prior to full implementation of the scheme. In any case, as suggested above, such containers should also be made the subject of high recycling targets.

In order to meet the targets mentioned above (see Recommendation 2), we would suggest that the level of the deposit (ultimately to be determined by the central system) should be in the region of:

- 15p for containers ≤500ml; and
- 30p for containers >500ml.

These are the average values used in our modelling - it is recognised that schemes may differentiate these by material.



Recommendation 5: In order to deal effectively with imported beverage containers, the deposit refund scheme should operate in parallel with kerbside recycling services <u>and/or</u> the deposit refund scheme should be designed to accept containers with European Article Number codes from France and Ireland.

A large volume of containers crosses the border with France, and to some extent the Republic of Ireland, as a result of private trade in alcoholic beverages. Neither country has a deposit system.

We have examined both 'parallel' and 'complementary' systems in this report, with a parallel scheme running alongside existing kerbside collections and a complementary scheme replacing the provision for recycling certain materials at the kerbside. We have noted in the main report that a parallel DRS may increase unclaimed deposits, but that we expect matters to converge, with some extraction of deposit-bearing containers from the kerbside recycling system. Given the minimal effect on financial flows other than the unclaimed deposits, we think it would make sense to still operate the kerbside recycling service. This enables those consumers who import beverage containers which bear no deposit to still recycle their containers.

An alternative approach would be to design the system to accept containers with European Article Number (EAN) codes from France and the Republic of Ireland. This would allow reverse vending machines to accept containers which bear no deposit. Clearly, in these cases, no deposit would be redeemed, but it seems important for the system to accept containers from abroad, to ensure consumer confidence is not lost (and especially if the existence of the DRS leads some local authorities to cease collecting the targeted beverages over the medium- to long-term).

Recommendation 6: A timescale of introducing a deposit refund scheme by 2015 should be considered

Whether in setting recycling targets, or in the context of introducing a mandatory scheme, the UK Government should consider the time scales for the implementation of a DRS. Four to five years appears to be an appropriate time to allow for infrastructure development and communication with all stakeholders. In addition, this would allow for some transitional issues to be considered. For example, local authorities' collection schemes will be affected by the implementation of a DRS. In order to realise the financial benefits to authorities from the DRS's operation, time to consider contractual positions and service design would appear appropriate.



Recommendation 7: Further research into the disamenity of litter should be commissioned by the Coalition Government.

The Coalition Government has set its sights on reducing litter, yet there is no UKbased study, to our knowledge, that allows us to estimate the negative effects the disamenity - of litter. The costs of litter and street cleaning are now a major part of local authorities' waste management budgets. They also appear to be costs which are spent in seeking to address an environmental issue which is consistently cited by residents as being a priority. There is a need for more research to be undertaken regarding the environmental benefits associated with reductions in litter, in order to strengthen the evidence base for estimating the impacts upon litter of a DRS in the UK. Indeed, given the Coalition Government's determination to address litter, it would seem appropriate to consider the economic benefits which might be derived from the clean-up of litter, if only to understand the level of resource which should be committed to addressing the matter.



INTRODUCTION

Some readers will be old enough to remember that in the 1970's, in the UK, one often paid a deposit on bottles of fizzy drinks and beer. When the drink was finished, one could return empty bottles to the store, or even have them collected from the front door as part of the milkman service, in order to retrieve the deposit. The system led to high return rates for glass bottles, which were typically washed for refilling. The bottles were designed for re-use many times over.

Over time, the system has been replaced by one where single-use, non-refillable packaging has become the norm. Some DRSs remain in the UK, but they are the exception rather than the rule, and target the smaller market of refillable glass bottles (eg. the A. G. Barr scheme in Scotland), rather than the growing market of disposable containers.⁴ However, even with the broad shift to single-use, non-refillable packaging, many European countries, several states in the USA and a number of Canadian provinces, among others, are using DRSs. The emphasis now is less often on the re-use of the containers under the scheme, but rather DRSs are used to achieve high return rates for recycling, and to reduce litter.⁵

- 4 http://www.agbarr.co.uk/agbarr/newsite/ ces_general.nsf/wpg/corporate_ responsibility-courtauld_commitment_2
- 5 Some EU Member States are seeing 98.5% of aluminium cans returned by consumers for recycling.



Existing Research

The theoretical literature is supportive of DRSs as an efficient policy instrument to drive up recycling rates. The current literature suffers, however, from the fact that it does not address all the transaction costs implied by a DRS.

Within the UK, DRSs have periodically been reviewed on behalf of the Department for Environment, Food and Rural Affairs (Defra), but our review suggests they have never been examined in enough detail. Furthermore, given that a mechanism to recover packaging materials already exists - the Producer Responsibility (Packaging Waste) Regulations - policy makers may be somewhat reluctant to consider changes to the existing arrangements, notwithstanding the persistence of some shortcomings within the existing system.

Despite the absence of any studies that clearly set out to identify the costs and benefits of DRSs and alternatives, pronouncements from the previous Labour Government leant on conclusions from a study undertaken by ERM in 2008, which did very little by way of an objective comparison of alternatives.⁶ The Defra Packaging Strategy cross references the 2008 study, stating:

'The study concluded that deposit systems are likely to increase recycling but that other measures may achieve the same goals more cheaply.'

High return rates derived from DRSs would lead us to agree with the first part of the statement, in that a well-designed deposit system will increase recycling. However, we were unable to find any evidence in the ERM study of a measured comparison between DRSs and other alternatives which would support either the contention that other measures would achieve the same performance, or that they could do so more cheaply. Indeed, to have undertaken such a comparison within the research would have fallen outside the scope of that particular study.

6 ERM (2008) *Review of Packaging Deposits System for the UK*, Final Report produced for Defra, December 2008.



Aims and Objectives

- 7 Eunomia (2009), International Review of Waste Management Policy: Annexes to Main Report, Report for the Department of the Environment, Heritage and Local Government, Ireland, p.316-321
- 8 We note that this research was undertaken by the consultants on the understanding that the results may not be favourable. The aim was always to be as objective as possible, despite the orientation of CPRE. CPRE was also aware that the results might not be favourable, and nonetheless still committed the financial resources to this research.
- 9 The closest any study comes to doing this adequately is a study by BDA Group in Australia. The study most often cited by opponents of deposit schemes is one by BIO Intelligence Service, which includes no serious attempt to model the change in the cost of kerbside collection logistics.
- 10 Few systems cover, for example, cartons such as tetrapak. One of the reasons for this relates to the shape of the containers. Advances in reverse vending machine technology are expected to make it possible to include tetrapaks in future schemes.
- 11 CRR (2009) *Policy Study: Refillables Evaluation of Market Opportunity in the UK*, Centre for Remanufacturing and Reuse, August 2009, available at:

http://www.remanufacturing.org.uk/pdf /story/1p317.pdf?session=RemanSession: 42F9475818a2d30D7AXwp1883067 Given the support for DRSs in the theoretical literature, and the lack of studies that have looked seriously at the potential costs and benefits of such schemes in the UK, it would be tempting to seek to understand the costs and benefits using secondary sources that have examined existing DRSs. However, the available information is not rich in this data. This was one of the conclusions of a recent review of secondary literature carried out for the Irish Government.⁷ Those studies that do purport to shed some light on the costs and benefits of such schemes tend to make opaque assumptions and methodological errors that compromise the analysis. Furthermore, the debates around the use of DRSs are generally characterised by somewhat dogmatic positions, with evidence either selectively cited in support of their use or to dismiss the rationale for their deployment.

The aim of this report, therefore, is to investigate the costs and benefits of a UKwide DRS and advance the debate on the benefits and disadvantages of DRSs.⁸ Through bottom-up modelling, we sought to answer the following question:

'How do the benefits of introducing a UK-wide DRS for certain beverage container packaging compare with the costs of implementation and operation?'

Significantly, this study uses logistics modelling to understand how the costs of household waste collections change when a DRS is put in place. To our knowledge, no study has carried out this work in a satisfactory manner. It is, however, crucial for understanding the true costs (net of savings) of introducing a DRS.⁹

Furthermore, most existing studies only assume one scenario, where the existing kerbside collection systems remain in place. The European Commission has recently tendered research seeking to examine the introduction of an EU-wide DRS for metal beverage cans. In the tender they specifically ask for an analysis of the costs and benefits when the existing systems remain, but also when they no longer accept cans (ie. all must go through the DRS route).

This study, therefore, examines the costs and benefits associated with introducing a DRS in the UK under two scenarios. First, it models a *complementary* system, which means beverage containers are no longer collected at the kerbside. And secondly, it looks at a *parallel* system, where the household kerbside systems for beverage containers target the same range of materials that are covered by the DRS.

In order to maximise the potential impact of introducing a DRS we have modelled a system that covers the following beverage container materials:

- Plastic bottles made from PET (Polyethylene Terepthalate);
- · Metal cans, both steel and aluminium; and
- Glass.

The modelled system targets non-refillable containers, because the market for refillables in the UK is much smaller than for non-refillables and there will typically already be systems of collection for re-use of refillables, eg. glass milk bottles.¹¹

In addition, the report looks in considerable detail at the potential environmental benefits associated with the increase in material collection, above existing systems, as well as the potential savings derived from removing litter from the environment. It also seeks to understand the associated negative effects, often referred to as the disamenity, of the presence of litter, though the literature here is somewhat lacking (and highlights a clear need for further research).

Evidently, the modelling has been developed using a range of different approaches and assumptions. We have sought to be as transparent as possible in identifying these. In order to address the potential range in values for some assumptions, we also carried out Monte Carlo analysis to test the robustness of the results (see page 25 for further details).

Approach

In order to examine the potential costs and benefits associated with the introduction of a DRS in the UK, the following key steps were employed:

- 1) Review of existing DRSs worldwide;
- Formulation of high-level design for a DRS to be modelled for the UK, including the scope of materials;
- 3) Establishment of baseline tonnages of waste collected at the kerbside, through bring sites, as commercial waste, via on-the-go recycling and from street sweepings, as well as the total number of units placed on the market;
- 4) Determination of tonnages that would be diverted from each of these waste flows into the DRS in:
 - A) a complementary system; and
 - B) a parallel system.
- Establishment of the costs and revenues for both the complementary and parallel systems;
- Determination of the change in costs for local authorities and commercial waste businesses resulting from the introduction of a DRS;
- 7) Determination of key environmental impacts (benefits and disbenefits) associated with parallel and complementary systems in relation to the baseline tonnages, including the disamenity associated with litter;
- 8) Estimation of the impact of the scheme on the flows of revenues through the Packaging Recovery Note/Packaging Export Recovery Note (PRN/PERN) systems; and
- 9) Pulling all figures together to produce a cost benefit analysis for the introduction of a DRS in the UK.



THE DEPOSIT REFUND SYSTEM MODEL

The various stakeholders involved in operating a DRS are:

- A government body authorising the system and associated finances, and setting recycling targets for the various materials;
- A central organisation owned and run (within the constraints set by the authorising body) by, for example, non-governmental organisations (NGOs), industry bodies, producers, breweries and retailers;
- The manufacturers of containers, producers and importers of beverages and industries that 'fill' the containers;
- Any retailers which sell beverages in the UK;
- All consumers who purchase beverages in the UK; and
- Businesses and organisations involved with the collection, sorting and reprocessing of waste containers.

Within the DRS, various stakeholders are involved in the material flows of beverages (pre - and post-consumption) and in the processing of deposit payments, other finances and sales or container return data. An overview of the key elements, material and finance flows in the UK's DRS model developed for this study is given in Figure E-1. The system developed for this study is based on similar principles to the systems which exist in the Nordic countries (Dansk Retursystem, Norsk Resirk, Returpack and Palpa) and in a number of provinces within Canada (ENCORP Atlantic Ltd, ENCORP Pacific Inc), although the details reflect the UK's structure of retailing.

Figure E-1: Deposit Refund System Model



The operation of the system is, briefly, as follows:

- As beverages are produced and sold to wholesalers, or directly to retailers, producers send sales data to a central system along with a payment matching the total value of the deposits on all items sold. The cost of the deposits is then paid back to the producers, by wholesalers or retailers, upon sale. The same happens when wholesalers sell items to retailers. Producers also pay an administration fee to cover the remaining costs of the system. This is set each year to reflect market prices of recyclate, amongst other factors.
- When the consumer purchases a beverage they pay the deposit to the retailer (as this is included within the price of the item), so the retailers are also reimbursed the total value of deposits.
- As consumers return empty containers to stores or other take-back centres, the deposit is paid to them by the retailer. This puts the retailer out of pocket, so the retailer then sends the returns data to the central system, which then reimburses the retailer for those returned containers for which a deposit has been paid out to the consumer. Thus the circle of deposit payments is closed. As the return rate for containers is not 100%, the unclaimed deposits result in a net gain to the system, which can be used to fund its operation.
- In addition to the deposit, the central system pays a handling fee to the retailer for each returned container, the intention being to compensate the retailer for loss of space (storage requirements) and time (in processing the deposit and taking back the containers). Handling fees are reviewed and adjusted each year.
- Returned empty containers are collected in a number of ways. Automated systems of collection use reverse vending machines or automated counting machines. Manual collection is also possible. In this instance the retailer accepts the container over the counter, and stores it in bags or crates within the store or at their transport outlet.
- Where the containers are collected via an automated machine, the sorted (and predominantly compacted) material can be transported directly to a recycler, with material revenues being paid back into the central system. Material revenues will also be paid on those containers that are collected manually, though this material will first have to be transported to a dedicated centre for counting, sorting and compacting, before it can be hauled on to a recycling facility. These costs are met by the central system.
- The central system is the focal point for the flow of information regarding container sales and finance for the whole DRS. A significant one-off cost will be required initially to set up the DRS, including all the necessary administrative support, which we have modeled as being met by 'one-off' producer and retailer joining fees. There will also be on-going costs associated with administering the system, which are covered as part of the producer administration fee paid on each unit placed on the market. The overall administration fee payable by the producers/importers is calculated as the balance of income from material revenues and unclaimed deposits against the costs of collection, transport, processing, administration and handling fees. In other words, the administration fee guarantees the DRS is cost neutral overall.

12 This differs to the typical systems employed in countries such as Sweden and Canada, where collections occur at a small number of redemption centres rather than at every retail outlet. We believe that in order to maximize return rates and to remove the need for consumers to travel individually to redemption centres, a denser network of collection points would be more appropriate for the UK, and would eliminate additional environmental impacts which might arise from making 'dedicated journeys' to redemption centres. Thus we have modeled the system based on a higher number of collection points via both automated and manual methods of collection, similar to systems used in Norway and Denmark.

KEY FINDINGS



The operating costs and financial impacts of the DRS are considered first, followed by the environmental considerations. Note that the costs and benefits are presented relative to a future baseline where the landfill tax has reached £80 per tonne, and where it is assumed that comprehensive kerbside collection systems for the materials identified within this study have been rolled out across the UK. This seems likely to be the case under the Packaging Strategy, given the desire of the Strategy to collect and recycle high levels of packaging waste from all sources, particularly from households.

System Finances

The majority of this section focuses on the complementary DRS as the central modelling scenario. We focus on the complementary system first, because this determines, in effect, the costs of running a 'discrete' DRS. In first understanding the costs and benefits associated with running this system, it is then easier to understand the key differences between this system and the parallel system and how, in reality, the costs associated with the two systems are likely to converge, depending on the return rates achieved (this convergence is discussed in more detail below).

Figure E-2 summarises the costs of operating the complementary DRS and the net balance of transactions for the main stakeholders.

The following points note some key aspects of the financial cost calculations and results:

- Based on existing examples of deposit values for beverage containers across Europe, the USA, Canada, Australia and Israel, we calculated that a deposit of 15p and 30p would be required for beverage containers of ≤500ml and >500ml respectively in order to achieve a return rate in the region of 90% for the glass bottles, PET bottles and aluminium and steel cans included in the DRS. We recognise that in several existing systems the value of the deposit does vary depending upon the material in question. We use an average figure in this study to simplify the modelling.
- A significant driver of the overall costs relates to how empty containers are returned. Containers returned in either a manual or automated fashion will incur varying labour and logistics costs. This is mainly related to the fact the automated machines crush materials to make them denser, which is more efficient in logistics terms. The number of potential return locations is important, as is the type of collection (manual or automatic) an outlet would be likely to employ. Hence an understanding of the UK retail landscape was required to form the basis of the modelling. Based on a 90% return rate, 24 billion containers from over 350,000 retail outlets across the UK would need to be collected as part of the DRS.¹³

13 This includes an estimate of private cross border trade from France and the Republic of Ireland.

Figure E-2: Overview of Complementary Deposit Refund System Costs 90% overall return rate, £millions 2010 Real Terms



- Handling costs for the retailers are estimated to be around £576 million per annum. We have modelled that these costs would be compensated through the central system, via a per unit administration fee of 4p for retailers with Reverse Vending Machines (RVMs), and 1p for those without. Collection and counting costs, financed by the central system, are likely to be around £337 million per year.
- On-going administration costs of around £15 million per annum for the system were also factored into the modelling. These costs were crosschecked and validated, as far as possible, with operators of the Finnish system, Palpa.
- At an overall 90% return rate, a minority of consumers would forfeit a total of £491 million of unclaimed deposits. In our model, this revenue offsets the amount required from producers to recover the overall operating costs of the DRS (of around £700 million). This highlights the desirability of setting targets alongside the introduction of a DRS, since without these it may be tempting for producers to 'underperform' and use unclaimed deposits to offset their own contributions to the overall cost.¹⁴ This, in turn, is likely to ensure that the network of return points is sufficiently dense, so that it does not discriminate against individuals without affordable transport, and that, in instances where people may not, through illness, be able to return empties, their carers and support network would be within easy reach of a return point in order to claim the deposit on their behalf.
- 14 This may be less likely than it first appears, for the simple reason that the more difficult it is for consumers to return beverage containers, the more the deposit will be perceived by consumers as a straightforward price increase, with likely greater impacts on demand for beverages. If the system makes returns easy, then this is less likely to be the case.

- Even with the income from selling recyclate and the revenue from unclaimed deposits, the central system cannot cover all costs. There is a shortfall of around £212 million per annum. This cost could be financed by the producers through the implementation of a (on average) 0.7p administration fee on each container placed on the market. The demand for beverage containers is not highly elastic. As such, the administrative fee is likely to be reflected in the price of beverages. It is not expected that the small administrative fee would affect sales in anything other than a marginal way.
- One-off costs associated with the set-up of a DRS in the UK were also constructed. Based on the modelling, a total cost of £32 million would be required to set up the central DRS, plus an additional £1.25 million for producers to change their labelling, and an additional £51 million for retailers to adapt their store areas to accommodate the new system requirements. Nordic experience shows that once the system has 'bedded in', retailers are actually likely to achieve net revenue from the handling fee paid by the central system, and so upfront costs will be recovered in the medium term.

The impacts on related financial transactions are described below:

- Under this system, the overall responsibility for dealing with beverage packaging is shifted specifically onto the producers and the individual consumers, rather than the costs being borne by the population as a whole (the latter being the case under the existing system, where the majority of the collection of beverage containers, and of litter, is funded by Council Tax/revenue support grant).
- As noted in the literature, and as modelled here, the introduction of a DRS should lead to an increase in recycling rates for those containers included in the system (with a 90% return rate contributing to an overall recovery rate for these materials of 95% compared to a baseline recovery rate of 68%). This would also imply that industry would be more likely to achieve targets as set under the existing packaging policy.
- If targets increase as planned, a reduction in the costs of acquiring PRNs would be expected, since the additional recycling would increase the supply of PRNs, relative to demand. As such, some savings to obligated producers/companies would be expected to occur.

It could be argued that the introduction of a DRS could even enable the existing PRN policy, and the associated running and administrative costs, to be abandoned, given the likely higher return rates that would be achieved through the DRS. The avoided costs are potentially significant for a large number of companies, given the current annual costs associated with demonstrating compliance and paying for this to be discharged by compliance schemes.



Importantly, as part of the cost benefit analysis, we also included the savings that would be achieved in other waste management routes, particularly at the kerbside. The removal of containers from the kerbside collection system, and a slight reduction in containers at bring sites, Household Waste Recycling Centres (HWRCs), in street sweepings and from on-the-go recycling would generate a saving of around £159 million per year for local authorities in avoided costs of collection and treatment/disposal of waste. This is a saving of around £7 per household per annum. This saving has not been properly modelled in any previous study of deposit refunds (globally).

In exploring the potential difference between running a complementary or parallel DRS, a key difference in the assumptions used was the return rate achieved by the systems. We assumed that the overall return rate of beverage containers would be 90% for the complementary system but would fall to 80% for the parallel system if higher targets were not enforced. The rationale for this was that some individuals may prefer to continue using the doorstep recycling service where the kerbside system still targeted the same materials for recycling, with more individuals continuing to put their containers out in the kerbside collection rather than claiming deposits on them. The cost and revenue streams for a parallel DRS are given in Figure E-3.

Given the lower amount of material being collected in the parallel DRS, the overall logistics costs were calculated as $\pounds15$ million lower, and the material revenues generated were also lower by $\pounds22$ million. In addition, given that there will be an increase in the number of containers collected at the kerbside in the parallel system, there is a resultant decrease in the overall savings available to local authorities of $\pounds15$ million in comparison to the complementary system.





The lower return rate modelled for the parallel system compared to the complementary system proved extremely significant in the distribution of costs across the two systems. Around £450 million in additional revenue is generated in the parallel system from the 10% additional unclaimed deposits. If the same return rates had been modelled for both systems, the difference in the financial flows of all other aspects of the systems would have been relatively small. The key impact in terms of overall costs is that associated with the return rate itself and the subsequent implications for unclaimed deposits. This affects the distribution of the cost of the DRS across the producers and the consumers (in the form of unclaimed deposits). Note that Figure E-3 shows a net positive balance for the central system and no administrative fee for producers (the system is funded from unclaimed deposits). Were this situation to arise, this additional revenue could be used to fund environmental projects run by NGOs, local authorities or community groups, as is the case in some Nordic countries.

It is important to note that, in reality, given the size of the deposits, it may well be that the return rate in the parallel system is comparable to that of the complementary system, be it due to individuals or the local authority itself extracting containers from the kerbside collections in order to redeem the deposit. Consequently, the systems might not be so different in outcome depending on how these actors respond, and the costs and benefits of the two systems would be expected to converge.

Moreover, given that DRS costs to producers are lower with lower return rates, as mentioned above, it would appear essential to introduce target recycling rates for these materials to encourage higher return rates from the system, and reduce the incentive for poor system design. This would also result in the convergence of the complementary and parallel systems, in terms of return rate. The effect of this is to lower the revenue generated from unclaimed deposits, thus leading to slightly higher administrative fees, but with the ultimate outcome that greater environmental benefits are delivered.

Given that the operational costs (not including unredeemed deposits) are similar between the parallel and complementary systems, and that they are likely to converge in any case, it seems sensible to allow householders to continue to use existing kerbside collection systems if they so desire (ie. the parallel DRS).



Environmental Consequences

The environmental impacts associated with the introduction of a DRS are presented in Figure E-4. The impacts considered include the following elements:

- the positive impacts associated with increased recycling, reduced disposal of beverage containers and a reduction in litter;¹⁵ and
- 2) the negative impacts associated with the potential increased transportation required by consumers in returning containers to collection points, and in the collection and transport of containers from the retail outlet to the counting centres and beyond.

As part of the analysis of the environmental impacts listed above, two main factors were considered: greenhouse gas (GHG) emissions and air quality impacts. The calculation of GHG-related impacts was based on the latest guidance from the Department of Energy and Climate Change (DECC) on the valuation of carbon in policy appraisal. For air quality impacts, the approach applied external damage costs to emissions of a range of air pollutants, allowing impacts to be quantified in monetary terms.¹⁶

Figure E-4: Annual Monetised Environmental Impacts (Complementary System) £millions 2010 Real Terms



- 15 By a reduction in disposal we mean the reduction in beverage containers going to landfill or for thermal treatment. In this modelling we have assumed that 25% of the UK's waste is managed though thermal facilities in the future, and have calculated the avoided costs associated with diverting material away from landfill and thermal treatment accordingly.
- 16 Damage costs for air pollutants were based on UK-specific damage costs for non-GHGs taken from the UK Government's Interdepartmental Group on Costs & Benefits (IGCB) Guidance on Air Quality Damage Costs, and the Clean Air for Europe (CAFÉ) programme.

Tangible benefits accrue from the reduction in GHG emissions and air pollutants as a result of increased recycling and reduced disposal (net = \pounds 94M). Costs also occur from the net additional emissions from vehicles used to collect and process empty containers. It should be noted, however, that not all transportation impacts are negative, as there is avoided transportation from a reduction in waste collected at the kerbside and from commercial premises. Vehicles are subsequently able to travel longer distances before they reach capacity and need to offload or 'tip' the collected waste, which results in a reduction in the number of journeys made in order to 'tip' the material and hence in the number of overall vehicles required. The overall net benefit of these tangible environmental impacts is \pounds 69M.

We have also taken the first steps towards trying to ascertain the potential negative environmental impacts associated with litter in the environment, and the potential monetised benefit that results from a reduction in beverage containers present in the environment, due to the workings of the DRS. Based upon a study carried out in Australia, we estimate that the benefit of reducing beverage container litter could be in the region of £1.2 billion per annum.¹⁷ This turns out to be highly significant in the analysis of costs and benefits.

The environmental benefits from the parallel system are around £4 million per annum less than those derived from the complementary system. The difference between systems is therefore minimal, and is primarily driven by the lower return rate modelled for the parallel system, which results in a reduction in the benefit derived from the additional recycling of beverage containers.

The GHG benefits of a particular policy, or system, are keenly pored over by policy makers. We therefore present the quantity of GHG emissions saved, above the baseline situation, in Figure E-5.¹⁸

Figure E-5: Greenhouse Gas Savings from the Introduction of a Deposit Refund System, thousand tonnes CO2 equivalent



- 17 Pricewaterhouse Coopers (2010) Estimating Consumers Willingness to Pay for Improvements to Packlaging and Beverage Container Waste Management, Report for the Environment Protection and Heritage Council, June 2010.
- 18 Note that the emissions are presented from a 'global' perspective, as the location of marginal recycling activities is unclear, both in the UK and abroad. In essence, the value of these benefits, as reported under the UK's domestic emissions inventory, would change depending upon where the primary and secondary materials were produced.

Sensitivity Analysis

The robustness of the results was tested through running sensitivities on some key parameters. These were:

- A greater use of automatic take back machines;
- Variations in the extent to which backhauling is utilised;¹⁹
- Change in valuation of air emissions;
- Additional dedicated journeys by consumers to take back empties;
- Change in the average EU emissions standards over the UK fleet; and
- Switch to aluminium use for metal beverage cans.

When the benefits from reduced litter-related disamenity are included, then there is no situation in which the system does not generate net benefits to society. This is in cases where each sensitivity is modelled independently.

To test the analysis further, a multi-variant sensitivity analysis using Monte Carlo simulation was also undertaken to test the robustness of the results and to determine the most sensitive parameters. This analysis, along with other sensitivities that were carried out, suggests that the modelling is robust, and there is a strong likelihood of a DRS generating net benefits to society. In fact, the analysis indicates that there is an 86% certainty that the introduction of a DRS will result in net benefits to society (see Figure E-7).²⁰

- 19 Note that backhauling refers to the return trip that is made by a truck after delivering a load to a specified destination. This return trip, on which the truck would otherwise be empty, is used, where possible, to transport items back to where the truck journey commenced from.
- 20 The aim of Monte Carlo analysis is to explore the sensitivity of outcomes to the random variation in the value of parameters whose value is not completely certain. The value of Monte Carlo analysis is that the value of a number of different parameters can be varied simultaneously to generate a probability weighted distribution of values for key outputs. In this work, the inputs to the model (eq. material revenues, total transport cost, RVM unit cost. litter collection costs. unit damage costs for air emissions) have been assigned an error margin (eg. +/- 50%) according to our certainty of the values that have been assigned. A Monte Carlo simulation was subsequently undertaken. whereby the inputs are randomly generated from probability distributions. simulating the process of sampling from an actual population, and providing a likelihood of a result falling within an upper and lower bound.





Figure E-7: Summary of Annual Ongoing Costs and Benefits from the Introduction of a Complementary Deposit Refund System, £millions 2010 Real Terms

Unsurprisingly, the Monte Carlo analysis suggests that when disamenity is included, it is the most influential parameter in the determination of overall costs and benefits. When it is not, the following five parameters have the most significance:

- 1) The return rate;
- 2) The value of the deposit;
- 3) The costs of transport;
- 4) Retail space costs; and
- 5) The capital costs of Reverse Vending Machines.



CONCLUSIONS

The financial and environmental elements described above provide the basis to answer the question:

'How do the benefits of introducing a UK-wide DRS for certain beverage container packaging compare with the costs of implementation and operation?'

Headline figures for the costs and benefits associated with each of the key components in the analysis, and the total net balance of those costs and benefits to society, are presented for the complementary system in Figure E-6. As has become clear, this is the case which leads to the highest return rates, the lowest revenue from unclaimed deposits and hence, the highest administrative fees under the DRS.

It should be noted that Figure E-6 illustrates the net benefit once the DRS is up and running. It does not include the £84 million one-off costs that would be associated with the initial setting up of the DRS, as these would only be incurred over the first year or two of the system. From society's perspective, depending on the pay-back period, these costs will be covered within the first few years of implementation, and would be met by fees payable by producers and retailers as they join up to the scheme.

Figure E-6 illustrates that, once the system has been set up and is underway, the ongoing benefits appear to outweigh the costs of implementing and operating a DRS in the UK. Important points to draw out from Figure E-6 include:

- The overall costs of operating the DRS, represented as the sum of the unclaimed deposits and the administrative fees, are just over £700 million;
- Not all these costs, however, are subsequently met by producers of beverages. This is because the system's finances are effectively bolstered by unclaimed deposits (£491 million);
- Producers, therefore, would pay £212 million to meet the full cost of the DRS;
- The cost to producers (net of unclaimed deposits) of operating the DRS is roughly equivalent to the savings produced from a reduction in the collection of beverage containers by local authorities and commercial enterprises, and a reduction in costs for operating the PRN system. Therefore the financial costs, net of savings, are close to zero. Other studies have generally focused upon the lost revenue to local authorities where materials are no longer available for collection. Quite apart from the fact it is known that not all local authorities are securing the full benefits associated with this revenue stream, the studies have failed to appreciate that local authorities will save far more in terms of operating logistics than they lose in terms of material revenues. This is true irrespective of whether the DRS operates in a complementary or parallel fashion for the simple reason that a significant proportion of low density packaging materials no longer have to be collected though kerbside recycling / refuse systems;

Local authorities around the UK are expected to save around £160 million per year in avoided waste management costs. This is a saving of around £7 per household per annum. In other words, for an average waste collection authority of 50,000 households, the financial saving in real terms would be around £360,000 per annum. This is a valued means of saving public sector costs at a time when cuts are being made to reduce the deficit, and consideration is being given to the transfer of services to the private sector;

Figure E-6: Summary of Annual Ongoing Costs and Benefits from the Introduction of a Complementary Deposit Refund System, £millions 2010 Real Terms



Note: Positive figures indicate benefits, negative figures indicate costs

- There is an important environmental benefit from recycling and avoided disposal of beverage containers, above what could be achieved through kerbside collection systems alone (note this figure is net of the additional environmental costs associated with air emissions from additional transport requirements);
- A potentially more significant benefit arises from the way people value a reduced-litter environment. The environmental benefit is significantly different with and without the disamenity associated with littering. We have included both figures in order to show the 'worst-case' scenario, where individuals place zero value on the removal of litter from their environment, separately from the modelled scenario, where individuals are willing to pay in the region of £48 per household per annum to remove litter from the environment;
- For society as a whole, there is a net cost of £428 million where no allowance is made for the benefits generated from reduced littering. Once this is factored in, however, the position changes quite dramatically. Indeed, society could derive a net benefit of £1.2 billion. The system, therefore implies a benefit:cost ratio of the order 2:1.

In addition to this Summary Report, a full report is available which contains further information on all the aspects of a UK-wide deposit refund system discussed above.

This report can be downloaded free of charge from www.cpre.org.uk

Have we got the bottle? Implementing a deposit refund scheme in the UK investigates the financial and environmental costs and benefits associated with the introduction of a UK-wide deposit refund scheme. The report has drawn on international experience and conducted innovative research to model a scheme for the UK, which takes into account the potential impact on existing recycling systems. The research demonstrates the impact a deposit refund scheme could have on reducing litter and its disamenity, increasing recycling and diverting waste from landfill.





