Environmental Audit Committee
House of Commons
London
SW1A 0AA

29th September 2017

Environmental Audit Committee Inquiry: Disposable Packaging: Coffee Cups and Plastic Bottles – Written Evidence from Eunomia Research & Consulting Ltd

Eunomia Research & Consulting Ltd. (Eunomia) welcomes this inquiry, and the opportunity to submit evidence. The question of how plastic bottles, other forms of beverage containers, and indeed disposable packaging more generally, might be better managed to prevent litter, and more fully respect the waste hierarchy, is a topic on which Eunomia has published a number of reports in recent years.[1,2,3,4,5]

Importantly, as far as plastic bottles are concerned, measures that have proven to be effective in achieving high levels of high quality (i.e. closed–loop) recycling of plastic bottles already exist in other countries. Such measures (deposit-return systems, also known as container deposit schemes in the US and Australia) have also been shown to

[1] Eunomia Research & Consulting (2010) have We Got the Bottle? Implementing a Deposit Refund Scheme in the UK, Report for CPRE, available at http://www.eunomia.co.uk/reports-tools/have-we-got-the-bottle-implementing-a-deposit-refund-scheme-in-the-uk/

[2] Eunomia Research & Consulting (2011) From Waste to Work: The Potential for a Deposit Refund System to Create Jobs in the UK, Report for CPRE, available at http://www.eunomia.co.uk/reports-tools/from-waste-to-work-the-potential-for-a-deposit-refund-system-to-create-jobs-in-the-uk/

[3] Eunomia Research & Consulting (2015) A Scottish Deposit Refund System, Final Report for Zero Waste Scotland, available at http://www.zerowastescotland.org.uk/sites/default/files/ZWS%20DRS%20Report_MAIN%20REPORT_Final_v2.pdf

[4] Eunomia Research & Consulting (2011) Options and Feasibility of a European Refund System for Metal Beverage Containers, Final Report to DG Environment of the European Commission, November 2011, available at http://ec.europa.eu/environment/waste/packaging/cans/deliverables.htm

[5] Eunomia Research & Consulting (2015) A Clean Sweep: Rethinking the Way we Tackle Litter, March 2015, available at http://www.eunomia.co.uk/reports-tools/a-clean-sweep/

significantly reduce the littering of deposit-bearing items. Furthermore, evidence indicates that such reductions, by leading to a less-littered environment, can reduce the likelihood that other items will in turn be littered.

A further significant effect of such measures is that they shift the financial cost of end-of-life management of used beverage containers away from the general universe of UK citizens, and towards consumers who choose to purchase disposable items. Shifting this burden is entirely in line with the polluter pays principle, and at a time of straitened public sector finances, should be seen by Government as a priority.

Eunomia has also undertaken several studies that assess the impacts, and where possible, identify the costs, of plastics and other items that are littered, on land and in the marine environment.[6,7,8,9] It is clear from our analysis that prevention is better than cure, and that economic instruments, such as deposit-return schemes, and charges on single-use items, can play a key role.

Furthermore, while we still don't fully understand the impacts of plastics in the marine environment, it is clear that the more we learn the worse things appear to be. Accordingly, there is a strong argument that the precautionary principle should be applied, and we should do all that can reasonably be done within the bounds of acceptable cost to prevent plastics getting into the marine environment.

We respond below to a number of specific points as requested in the terms of reference.

What is the environmental impact of waste from coffee cups and plastic bottles?

1) At present, single use plastic beverage containers and single use coffee cups are symbols of our wastefulness as a society. Their consumption and the subsequent fate of the materials leads to significant environmental impacts, some of which are only now becoming understood.
2) Eunomia's calculations suggest that the recycling rate for plastic bottles is currently 52% (see Appendix 1.1) and circa 3% are littered (see Appendix 1.2).

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[6] Eunomia Research & Consulting (2014) Exploring the Indirect Costs of Litter, Report for Keep Britain Tidy, December 2014, available at http://www.eunomia.co.uk/reports-tools/exploring-the-indirect-costs-of-litter-in-england/

[7] Eunomia Research & Consulting (2016) Study to Support the Development of Measures to Combat a Range of Marine Litter Sources, Report to DG Environment of the European Commission, available at http://www.eunomia.co.uk/reports-tools/study-to-support-the-development-of-measures-to-combat-a-range-of-marine-litter-sources/

[8] Eunomia Research & Consulting (2016) Measures to Prevent Marine Plastic Pollution: The Trouble with Targets and the Merit of Measures, September 2016, available at http://www.eunomia.co.uk/reports-tools/measures-to-prevent-marine-plastic-pollution/

[9] Eunomia Research & Consulting (2016) Plastics in the Marine Environment, available at http://www.eunomia.co.uk/reports-tools/plastics-in-the-marine-environment/

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3) This means that 45% enter the residual waste stream. We draw the Committee's attention to the fact that this does not mean that this is all landfilled. Rather, there has been a progressive switch away from landfilling as the basis for managing residual waste in the UK over the last decade in particular. Around 45% of residual waste is now landfilled, with the share being incinerated standing at around 55%: the former share is diminishing, the latter share is rising.
4) This is important where the fate of, and impact from, non-recycled plastics is concerned, especially in respect of climate change, since whilst the landfilling of plastics effectively sequesters fossil carbon, the incineration of plastics liberates all the fossil carbon as CO2.
5) Whilst energy may be generated by an incinerator, the carbon intensity of electricity generated from burning plastics in incineration plants far exceeds that of coal-fired power stations. Indeed, the plastics content of residual waste will become a major stumbling block in decarbonising emissions from the waste sector if residual waste management switches more strongly towards incineration (see Appendix 1.1)
6) Producing 585,000 tonnes of plastic bottles for the UK market each year releases approximately 2.3 million tonnes CO2 equivalent (CO2e) of greenhouse gas into the atmosphere. Assuming high-quality, i.e. closed-loop, recycling takes place, recycling 52% of plastic bottles in the UK avoids 1.2 million tonnes CO2e from production activities alone. Recycling activities also emit greenhouse gases, of the order of 375,000 tonnes CO2e for the bottles recycled in the UK, so the net benefit of recycling is roughly 800,000 tonnes CO2e avoided emissions (see Appendix 1.1.1)
7) Roughly 118,000 tonnes of plastic bottles are landfilled in the UK each year. Whilst this effectively sequesters the carbon embodied in the bottles there are other emissions, e.g. associated with transport, which results in roughly 4,000 tonnes of CO2e emissions (see Appendix 1.1.1)
8) Incinerating plastic bottles releases a large quantity of greenhouse gas – roughly 46 times more than landfill per tonne of plastic bottle waste. In the UK this results in annual emissions of 229,000 tonnes CO2e from the 145,000 tonnes of plastic bottles incinerated (see Appendix 1.1.1).
9) Incinerating plastic has further negative effects on the environment. Incineration releases pollutants into the air which are harmful to human health. For example, the 145,000 tonnes of plastic bottles incinerated each year in the UK releases 159 tonnes of nitrogen oxides (NOx) and 40 tonnes of particulate matter (PM) (see Appendix 1.1.1).
10) Beyond the direct costs of clean-up (for the bottles successfully captured by local authorities and other duty bodies) littering of plastic bottles, can lead to wider impacts. Plastic bottles are one of the most visible components of litter. They are high volume items, and their existence arguably contributes disproportionately (relative to the number of littered items – where cigarette butts and chewing gum staining predominate) to what is termed the 'disamenity' associated with a littered local environment. Disamenity effectively means the 'upset' that people

feel because their local environment is littered, and can be represented in monetary terms.[10]

11) In research for Keep Britain Tidy, Eunomia calculated that in England, the 'willingness-to-pay' to move from the current level of neighbourhood litter to one that is largely litter free lies somewhere between £6.4 billion per annum and £9.7 billion per annum.[11] This does not mean we should spend this much public money on cleaning up litter, rather it is what economists term the 'welfare gain' that citizens would experience from a less littered environment, translated into monetary terms. Seeking to achieve a less littered local environment should, in order to achieve these welfare gains at least cost and in an equitable way, be based on the principles of cost-effectiveness, and fairness.[12]
12) Data suggests that beverage containers (plastic bottles, glass bottles, metal cans and beverage cartons that could be subject to a deposit return scheme) account for roughly 40% of all litter by volume. Therefore, it seems plausible that they might account for a similar proportion of the disamenity.
13) Eunomia's calculations (presented in full in Appendix 1.2) suggest that UK-wide, over 700,000 plastic bottles are littered (not placed in bins, but genuinely littered on the ground and picked up by local authorities) each day.
14) For disposable coffee cups, data is poor, but we estimate (as shown in Appendix 1.4) that due to the predominantly on-the-go nature of consumption, and the non-reusable and non-resealable nature of cups, the rate at which they are littered (i.e. the number littered per 100 consumed) may well be higher than that of metal beverage containers. On the basis that 5 billion are consumed annually, and a 4% littering rate (conservatively) assumed, this would equate to over 500,000 littered each day.

What are the challenges of recycling these products? What obstacles have prevented greater progress in increasing recycling rates?

15) For bottles the main challenge relates to the mixing of polymers
16) For households, the lack of a direct incentive (such as Pay-as You-Throw) to recycle items rather than place them in the residual waste stream means recycling rates for bottles are not as high as they could be. However, much consumption of plastic bottles is 'on the go', and even where street recycling bins are in place, they tend not to deliver meaningful levels of recycling.

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[10] The visibility of plastic bottles in the environment, related to their high volume and mobility, means that plastic bottles contribute significantly to disamenity (in the same way as do / did plastic bags).
[11] Eunomia Research & Consulting (2014) Exploring the Indirect Costs of Litter, Report for Keep Britain Tidy, December 2014, available at http://www.eunomia.co.uk/reports-tools/exploring-the-indirect-costs-of-litter-in-england/
[12] Eunomia Research & Consulting (2015) A Clean Sweep: Rethinking the Way we Tackle Litter, March 2015, available at http://www.eunomia.co.uk/reports-tools/a-clean-sweep/

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17) For paper cups the main technical barrier is the internal PE liner which is tightly bonded to the paper. However, in practical terms the dispersed nature of coffee cups post-consumption, and the fact that they might not be clean (potentially containing, for example dregs of unfinished drinks) means that there are logistical challenges in collecting a relatively homogeneous, clean stream of material for recycling.

Are consumers aware of the complexities of recycling these products?

18) Where plastic bottles are concerned, consumers generally understand that these can be widely recycled
19) Consumers mistakenly think that coffee cups are widely recycled

What actions are being undertaken by industry to reduce waste generated by coffee cups and plastic bottles?

20) The question relates to 'reducing waste' generated by coffee cups and plastic bottles. The way to reduce waste would be to encourage use of multi-trip containers, to make reusable mugs available wherever customers don't need disposables, and to encourage use of refillable bottles.
21) There are plenty of coffee shops where even those 'sitting in' are forced to use disposables as there is simply no option, despite the fact that many might feel this was an inferior experience. Clearly, the message is not getting through to these stores, that they are flouting the waste hierarchy.[13]
22) In terms of encouraging reusable bottles, there has been very little other than discouragement for this. The demise of the reusable milk bottle has been precipitous.

How effective, to date, have Government and local government led initiatives (such as #1MoreShot) been at reducing waste and increasing the recycling of coffee cups and plastic bottles? What progress has been made to develop a viable, recyclable alternative to the polyethylene coated paper cup? What are the pros and cons of the use of such cups?

23) Simply replacing a non-recyclable disposable cup with a recyclable disposable cup is a limited change, will not reduce waste, and might be no less likely to lead to littering. We think that this would be helpful but it should not distract attention from the desirability of greater reuse in respect of both coffee cups and plastic bottles.
24) A number of larger retailers have implemented financial incentives to encourage the use of reusable cups. Starbucks has offered, but not promoted widely, a 25p

[13] The waste hierarchy (Regulation 12 of the Waste (England and Wales) Regulations 2011) is perhaps the piece of waste legislation with the greatest potential to drive change in how waste – and especially commercial waste is managed. Every business must, as part of its Waste Transfer Note, confirm that it has properly applied the hierarchy to its waste. Applying the hierarchy is a duty on businesses that produce or handle waste, and NRW has the duty to enforce compliance in Wales, as the Environment Agency has in England. Coffee shops that do not offer reusable cups, or provide incentives for consumers to use their own cups, are technically in breach of this requirement. This would also apply to transport operators.

discount for a number of years. This was subsequently increased to 50p for a couple of months following Hugh Fearnley-Whittingstall's campaign on coffee cups, before being dropped back to 25p.

25) Costa has also recently introduced a 25p discount, having previously not offered a discount, but instead donated 10p to Keep Britain Tidy every time a customer used a reusable. By contrast, Caffe Nero and Pret-a-Manger do not offer any discount to the best of our knowledge.

26) It is thus a somewhat confusing landscape for the consumer. It is therefore not surprising that Costa recently reported that only 1% of consumers use reusables.[14] The following points should be noted:

- Firstly people value losses more than gains, therefore a 25p charge would be likely to have a stronger effect than a 25p discount on consumer behaviour;
- Secondly, given that not all coffee shops offer a discount, and there may be little confidence among consumers that the discounts offered will endure, they may be less willing to 'invest' in a reusable cup and use it;
- Thirdly, given that there is not a uniform charge applied across all retailers, public awareness is, unsurprisingly, much lower than it would be if it were. Consider, by way of comparison, the awareness-raising and media attention that preceded the bag charge. Such awareness raising would also accompany a uniform charge on disposable cups if introduced in the UK

27) A final point to note is that discounts of the like offered by Costa are not likely to be sustainable at anything other than very low levels of uptake. Small, independent retailers, would be even less likely to be able to offer such a reduction. By contrast, a charge would present no such financial burden on retailers.

What is the likely effect of leaving the EU on UK efforts to reduce coffee cup and plastic bottle waste?

28) It is tempting to answer this question by asking one back: 'Why are you asking us?' The lack of certainty regarding what might happen means that it is a very difficult to give a specific response

29) More generally the main impact may be in respect of Extended Producer Responsibility (EPR). The Government has increased targets for plastics recycling – but the current scheme is ineffective in channelling support to where it is most needed – the scheme simply sucks money from producers and places it into the hands of compliance schemes. The way in which this money is then spent is unclear.

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[14] See https://twitter.com/monsternicola/status/844560744133939200

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30) Propose revisions under the Waste Framework Directive (Article 8a) requiring minimum standards for EPR schemes would lead to significant improvements to EPR (and not just for packaging) in the UK. Brexit means that future uncertainty over EPR in the UK is increased.

What initiatives could be utilised to reduce coffee cup and plastic bottle waste or to lessen the impact of this waste? In particular what are the opportunities and risks associated with:

- **Incentives to encourage the use of reusable alternatives for these products**
- **Charges, taxes, deposits or levies on the use of these products**

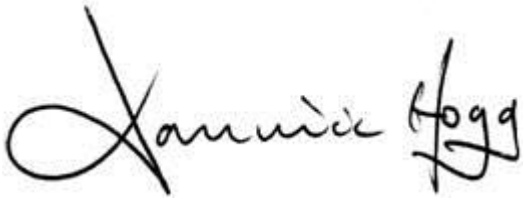
31) A DRS for drinks containers involves the payment, on purchase, of a small deposit (perhaps 10p to 20p) that is then refunded once the bottle is returned to a collection point (either a manual collection point, where the bottle is returned over the counter to a shopkeeper, or to a 'reverse vending machine' (RVM)).
32) There are two types of DRS. A two-way DRS is where the bottle is returned, washed and refilled with the drink to be sold again. This is the kind of DRS that used to exist in the UK, and that leads to waste prevention (which is at the top of the waste hierarchy), by achieving high levels of reuse. A one-way DRS, is where beverage containers are collected to then be recycled, rather than reused. Accordingly, this does not deliver waste prevention. This is the predominant approach, and indeed most, in not all, new DRSs are, to our knowledge, one-way deposit systems (see Appendix 2.1).
33) A one way DRS, of the nature that is currently under consideration in Scotland will bring about a significant reduction in littering of deposit-bearing plastic beverage containers, and lead to high rates of high quality recycling;
34) A Peer Review for Defra from 2005 identified that a DRS implemented in Michigan in the late 1970s reduced litter by at least 85% (see Appendix 2.1.1).
35) However, a more detailed review of the evidence presented by the Peer Review suggests that reductions in littering of deposit bearing items of 95% might reasonably be expected (see Appendix 2.1.2)
36) Applying an arguably conservative assumption of an 80% reduction in littering of beverage containers would lead to 600,000 fewer plastic bottles littered each day in the UK (See Appendix 2.1.1).
37) Evidence suggests that the reduction in litter from deposit-bearing items, in making an area less littered, would reduce the likelihood of other items being littered (See Appendix 2.1.3)
38) Research undertaken by Eunomia for CPRE has identified that a DRS will lead to an increase in employment (see Appendix 2.1.4)
39) It's worth noting that retailers would receive handling fees for taking part in a DRS. It's not clear that this is currently widely understood by retailers (see Appendix 2.1.5)
40) At present, the majority of the cost of managing end-of-life beverage containers is met by taxpayers, i.e. citizens. There is no differentiation in financial contribution in proportion to the amount consumed. One might conceivably consume no beverage containers over an entire year, yet still contribute the

same amount towards end-of-life management as someone who consumes a great deal. A DRS would effectively address this, as described in Appendix 2.1.6

41) A charge on single-use takeaway cups, similarly to charges on single-use carrier bags, would lead to both waste prevention and litter prevention, as described in Appendix 3.1;
42) The rationale for introducing a charge on such cups to prevent waste and litter is arguably greater than it was for single-use carrier bags. It would seem likely that the majority of plastic bags have always been used to carry items home from the shops, and they can be used again. By contrast, the probability that disposable coffee cups (and other disposable cups), which are designed to be consumed on the go, would make it home, would seem much lower.
43) Applying a charge would seem particularly beneficial for smaller retailers, as explained in Appendix 3.1.
44) A charge could also raise money for good causes. Based on annual consumption of 2.5 billion cups (which we now understand to be an under estimate) if a charge of 25p lead to a 30% reduction in consumption, £438 million (gross) could be raised each year (See Appendix 3.1.1).
45) While predicting the likely level of reduction in consumption of disposable cups associated with a charge of a specific level is difficult, a 30% reduction does not seem to be out of the question (see Appendix 3.1.2).

If you have any questions on our evidence, please do not hesitate to get in touch.

Yours sincerely,



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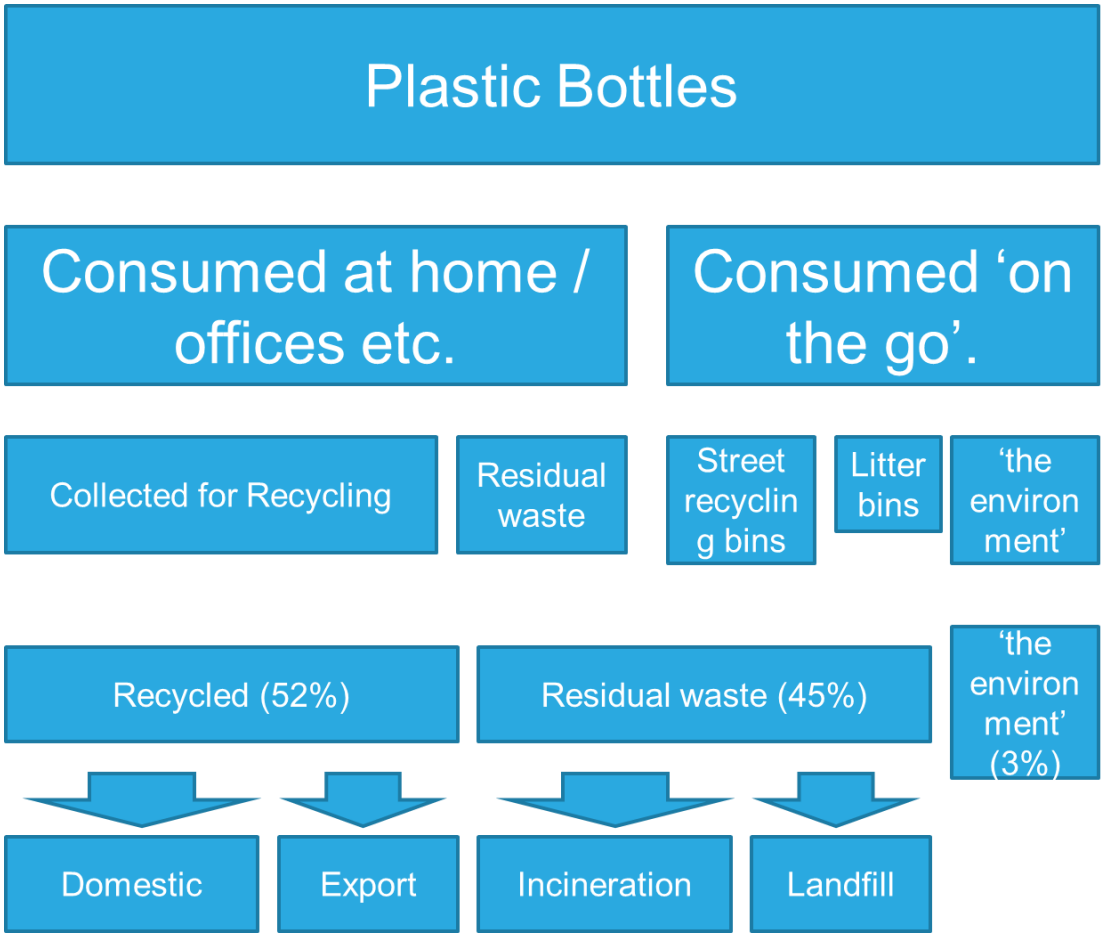
Appendices

1.0 Extent of Recycling and Littering

1.1 Calculation of Plastic Bottle Recycling Rate

Figure 1 gives a broad schematic overview of the fate of plastic bottles in the UK. This is not 'to scale'.

Figure 1: Life Cycle of Plastic Bottles from Consumption to Waste Treatment



This is derived based on the following information:

The WRAP market situation report estimates that in 2014, there were around 585,000 tonnes of 'consumer' plastic bottles generated in the UK waste stream. The largest component of the municipal plastic bottle stream is PET with an estimated 397,000 tonnes arising in the UK in 2014. The growth in municipal bottle collections resulted, according to WRAP, in an estimated 57% of bottles being *collected for* recycling in 2014. The WRAP report's figures are based on 'WasteDataFlow and WRAP estimates' since no

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local authority collecting mixed plastics as a single stream would be able to confidently estimate – without detailed compositional sampling - the proportion of what is collected that are 'bottles'). Furthermore, the amount collected will not necessarily translate into an amount recycled since there are losses in the supply chain between the point of collection and the point at which material is actually recycled. More detailed calculations would be required to understand the amount actually recycled, but it might be conservative to suggest that losses of 10% might occur between the estimate of what is collected, and what actually is recycled. So, the recycling rate could be estimated to be of the order 52%.

In terms of the amount littered, we estimate that around 3% of bottles are littered. The basis of this assumption is described in Appendix 1.2

In terms of the residual waste quantity, this would leave around 45% of all bottles in residual waste. We draw the Committee's attention to the fact that this does not mean that this is all landfilled. Rather, there has been a progressive switch away from landfilling as the basis for managing residual waste in the UK over the last decade in particular. Around 45% of residual waste is now landfilled, with the share being incinerated standing at around 55%: the former share is diminishing, the latter share is rising.

This is important where the fate of, and impact from, non-recycled plastics is concerned, especially in respect of climate change, since whilst the landfilling of plastics effectively sequesters fossil carbon, the incineration of plastics liberates all the fossil carbon as CO_2. Whilst energy may be generated by an incinerator, the carbon intensity of electricity generated from burning plastics in incineration plants far exceeds that of coal-fired power stations. Indeed, the plastics content of residual waste will become a major stumbling block in decarbonising emissions from the waste sector if residual waste management switches more strongly towards incineration. This was a key message of work undertaken by Eunomia for the Committee on Climate Change regarding marginal abatement cost curves for the waste sector.

Material use associated with 585,000 tonnes of primary plastic material for bottle manufacturing (188kt HDPE and 397kt PET) is as follows:

- 19 million GJ fuel
- 24 million GJ feedstock (i.e. energy from oil and gas inputs stored in the plastic polymer)
- 28 million tonnes of water
- Further resources would be used in converting the plastic raw material into bottles.

1.1.1 Recycling benefits (GHGs) associated with 52% recycling

Producing 585,000 tonnes of plastic bottles for the UK market each year releases approximately 2.3 million tonnes CO_2 equivalent (CO_2e) of greenhouse gas into the atmosphere. Assuming high-quality, i.e. closed-loop, recycling takes place, recycling 52% of plastic bottles in the UK avoids 1.2 million tonnes CO_2e from production activities alone. Recycling activities also emit greenhouse gases, of the order of 375,000 tonnes

CO_2e for the bottles recycled in the UK, so the net benefit of recycling is roughly 800,000 tonnes CO_2e avoided emissions.

But not all plastic bottle waste is currently recycled. Treating the remaining fraction via landfill and incineration produces further greenhouse gas emissions.

Landfill

Roughly 118,000 tonnes of plastic bottles are landfilled in the UK each year. Whilst this effectively sequesters the carbon embodied in the bottles there are other emissions, e.g. associated with transport, which results in roughly 4,000 tonnes of CO2e emissions.

Incineration

Incinerating plastic bottles releases a large quantity of greenhouse gas – roughly 46 times more than landfill per tonne of plastic bottle waste. In the UK this results in annual emissions of 229,000 tonnes CO2e from the 145,000 tonnes of plastic bottles incinerated.

Incinerating plastic has further negative effects on the environment. Incineration releases pollutants into the air which are harmful to human health. For example, the 145,000 tonnes of plastic bottles incinerated each year in the UK releases 159 tonnes of nitrogen oxides (NOx) and 40 tonnes of particulate matter (PM).

Recycling rates have increased over time, though they are likely stalling at present, notably in England, but perhaps not in Wales. As shown above, the main environmental benefit of recycling is derived from avoiding the high greenhouse gas emissions associated with production of primary plastic material. However, the treatment of plastic bottle waste that is not recycled also has considerable environmental impacts which will worsen if the UK continues to move from landfill to incineration. It is therefore a priority to reduce the amount of plastic production via means such as waste prevention and recycling and to ensure as much of the waste is recycled as possible.

Another way of understanding the impact of recycling is to look at the number of times material is 'circulated' in manufacturing before it is eventually discarded. To illustrate this in the case of plastic bottles we start with plastic material originally used to contain 1,000 litres of beverages and calculate, over the course of the material lifetime, the total volume of beverage it is used to contain when recycled into new plastic bottles, as shown in Figure 2.

At 50% recycling rate this only equates to 2,000 litres, i.e. the original capacity is doubled over the material lifetime as a result of recycling. Higher recycling rates produce a sharp increase in the total capacity of the material over its lifetime. For example, with a 90% recycling rate the same plastic can contain 10,000 litres of beverages over its lifetime.

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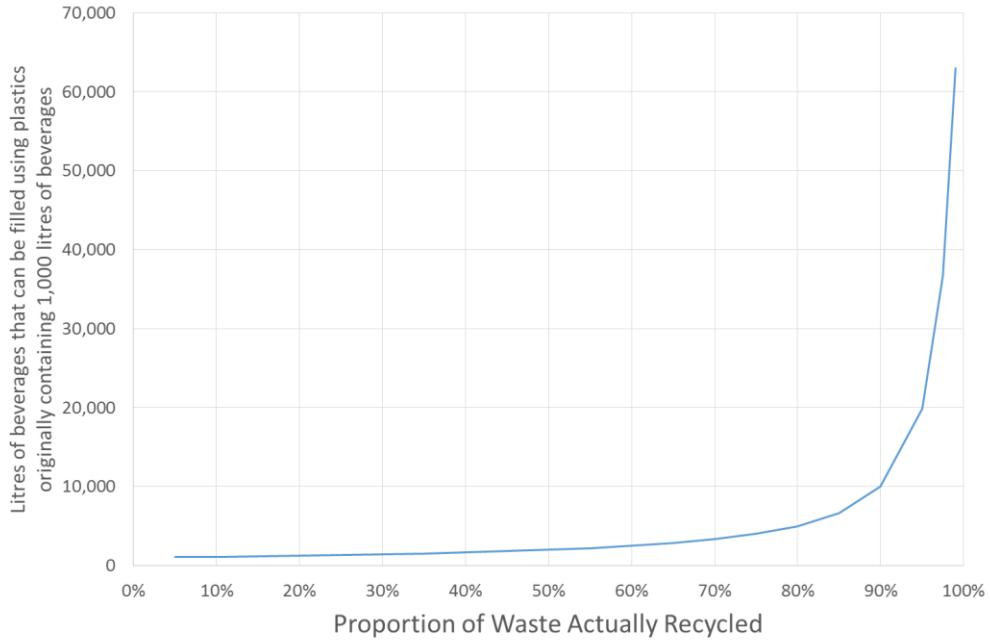
The environmental gains achieved are therefore considerably greater with these higher recycling rates.

Figure 2: Illustrating Benefits of Higher Beverage Container Recycling Rates in Terms of Reduced Primary Material Requirements



1.2 Calculation of Plastic Bottle Littering Rate

The following calculation estimates the number of plastic drinks bottles (and metal beverage cans) littered across the UK each day

A Zero Waste Scotland (ZWS) report from 2013 presents the composition (by weight) of litter in Scotland.[15] This identifies the following proportions:

- Plastic bottles – 8.6%
- Packaging glass - 9.1%
- Metal cans – 4.0%

The ZWS report also puts a figure on the annual tonnage of litter dropped on the ground and subsequently cleared by local authorities in Scotland each year – at least 15,000 tonnes. This is a conservative figure as it does not include:

[15] Zero Waste Scotland (2013) Scotland's Litter Problem: Quantifying the Scale and Cost of Litter and Flytipping, available at http://www.zerowastescotland.org.uk/sites/default/files/Scotland's%20Litter%20Problem%20-%20Full%20Final%20Report.pdf

- litter dropped, and then cleared, on other public land (e.g. hospitals, schools and the transport network) or private land (e.g. stadiums and shopping centres);
- litter that is not picked up, and that either (a) accumulates over a long period of time – although, in due course, much of this might eventually be cleared – or (b) ends up being washed into water courses and ultimately to the sea; and
- litter that is correctly discarded in litter bins.

However, if we take 15,000 tonnes as an estimate of litter dropped and cleared each year in Scotland, the following tonnages can be calculated for specific littered items:

- Plastic bottles – 1,290 tonnes
- Packaging glass – 1,365 tonnes
- Metal cans – 600 tonnes

To understand what this means in terms of an item-specific littering rate we need to know what is placed on the market in Scotland annually. Eunomia's 2015 report for Zero Waste Scotland on the key design features and feasibility of a potential Scottish Deposit Refund Scheme (DRS), and the appendix to the report, provide such figures:[16,17]

- Plastic bottles – 39,000 tonnes
- Glass bottles – 165,000 tonnes
- Metal cans – 14,100 tonnes

On this basis, the following item specific littering rates, i.e. proportion of all items purchased that are littered, can be calculated:

- Plastic bottles – 3.3%
- Glass bottles – 0.8%
- Metal cans – 4.3%

However, alternative figures were put forward by Valpak for the number of items placed on the market each year. These figures were lower, at:

- Plastic bottles – 36,000 tonnes
- Glass bottles – 127,000 tonnes
- Metal cans – 9,000 tonnes

This, of course, would imply higher littering rates of:

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[16] Eunomia Research & Consulting (2015) A Scottish Deposit Refund System, Final Report for Zero Waste Scotland, available at http://www.zerowastescotland.org.uk/sites/default/files/ZWS%20DRS%20Report_MAIN%20REPORT_Final_v2.pdf

[17] Eunomia Research & Consulting (2015) A Scottish Deposit Refund System, Appendix to the Final Report for Zero Waste Scotland, available at http://www.eunomia.co.uk/wp-content/uploads/2015/05/ZWS-DRS-Report_APPENDIX_Final.pdf

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- Plastic bottles – 3.6%
- Glass bottles – 1.1%
- Metal cans – 6.7%

We can further refine our estimates if we note that plastic bottles of two different polymer types are placed on the market. PET bottles are widely used for water and fizzy drinks and water, while HDPE is more commonly used for milk and household products like shampoo.[18,19] While the litter composition data does not distinguish by type of plastic, HDPE bottles are much less likely to be littered given that their contents are predominantly consumed at home.

Figures in the appendix to Eunomia's DRS report show that approximately 60% by weight of the plastic bottles placed on the market is PET. Using a lower figure of circa 21,500 tonnes (60% of 36,000 tonnes) of PET placed on the market, and assuming that almost all littered plastic bottles are PET, the implied littering rate for PET increases to 6%.

Of course, this is all based on a very conservative estimate of the amount littered each year in Scotland of just 15,000 tonnes. The true figure could well be at least several thousand tonnes higher, meaning that the actual littering rates would be greater still.

It's worth reflecting on the relative ordering of the calculated littering rate for the different items:

- Littering of glass, by weight, is relatively low, arguably reflecting the propensity for fewer 'on the go' beverages to be served in glass containers: rather, such containers tend to be used for beverages consumed at home or in pubs or restaurants.
- Plastic bottles are widely used in 'on the go' consumption, but they can be refilled, and so may be kept for reuse, or failing that, they can be compressed, and securely closed with a screw cap to prevent any dregs spilling out. That makes them relatively convenient to put in a bag or pocket and take home or to the nearest litter bin.
- Cans, however, have no such potential for a second use, and cannot be resealed. Putting them in a bag to take home is thus a less attractive prospect, and the incentive to just be rid of them is probably greater than for plastic bottles, which fits with the higher apparent rate of littering.

So what does this mean in terms of the *number* of items littered – not placed in litter bins, but genuinely littered. The appendix to Eunomia's DRS feasibility report indicates that:

- 744 million PET bottles are placed on the market in Scotland each year. Applying a deliberately conservative assumption of just 3% being littered (less than calculated above) this would be over 60,000 littered PET bottles per day, every day.

[18] See http://www.wrap.org.uk/content/pet-plastic-bottles
[19] See http://www.wrap.org.uk/content/hdpe-plastic-bottles

- 148 million ferrous cans and 526 million aluminium cans are placed on the market in Scotland each year. Applying a littering rate of 4% (again a conservative figure, lower than any calculated above) would mean over 70,000 cans littered in Scotland daily.

There is insufficient data to be able to perform such a calculation for England, Wales, or Northern Ireland, but nor is there any evidence, to the best of our knowledge, that demonstrates that the littering behaviour of Scottish consumers is significantly different to that of consumers in other UK nations.

On that basis, it is possible to derive an estimate by scaling the above figures using relative population sizes (Scotland has circa 8.3% of the UK population). This would suggest that over 700,000 plastic bottles and nearly 900,000 cans are littered across the UK each day (1.6 million plastic bottles and cans in total).

1.3 Consumption of Single-use Takeaway Cups

It is widely reported that annual consumption of single-use coffee cups in the UK is circa 2.5 billion. However, this figure, from 2014, is now considered by an industry expert to be an underestimate. Furthermore, this figure only related to coffee cups, which have been the focus of recent media attention, due to the reported challenges of recycling them. However, given that waste prevention should, in line with the waste hierarchy, be the priority, the focus of Government attention should be broadened to include single-use cups used to contain sodas, freshly made smoothies etc. as are often purchased from quick service restaurants and other outlets. Such items are often served with both a lid and a single-use plastic drinking straw.

In a recent article, Peter Goodwin, the founder of Simply Cups, and the source of the 2014 estimate of 2.5 billion coffee cups used each year, states that:[20]

> *When we started Simply Cups in 2014, we conservatively estimated that 2.5 billion cups were being used each year. Three years in, we now believe the true figure is closer to twice this amount and, when you add in plastic cups which also suffer the same fate, the overall size of the problem is likely to be over 10 billion cups per annum, and is set to grow further.*

[20] Edie.net (2016) To keep the momentum of circular economy brimming, we need to battle for the cup, available at https://www.edie.net/blog/To-keep-the-momentum-of-circular-economy-brimming-we-need-to-battle-for-the-cup/6098093

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1.4 Littering of Single-use Takeaway Cups

Peter Goodwin of Simply Cups further notes that:[21]

> *Whilst paper cups are light in weight, they are extremely voluminous, so it doesn't take many to fill a bin or a bag. You only have to visit a typical high street or floor walk an office to realise how visible cups are and how easily they clog up waste bins, which significantly increases waste costs for both the taxpayer and businesses*

Thus, similarly to used beverage containers, as high-volume items, littered single-use takeaway cups are likely to contribute disproportionately (relative to the number of littered *items* – where cigarette butts and chewing gum staining predominate) to the 'disamenity' or 'welfare loss' associated with a littered local environment.

It's also worth reflecting on the characteristics that could make an item more or less likely to be littered. In Appendix 1.2, we calculated that metal beverage cans appear to be littered at a higher rate that plastic bottles, which would seem intuitive given that plastic bottles can be resealed and used again, while drinks cans cannot. Applying the same thinking to single-use takeaway cups, they are more similar to drinks cans than plastic bottles, in that they cannot be resealed.

Furthermore, given the similarity in attributes, there is reason to think that the actual littering rate for single-use takeaway cups may be higher than for cans, and that is the 'on-the-go' nature of consumption. The reason for this is that one would expect a reasonable proportion of beverage cans to be consumed in a domestic setting, where littering is highly unlikely, whereas single-use take-away cups might be expected, by their very nature, to be largely used in 'on-the-go' consumption. Indeed, recent research shows that approximately half of cans are consumed on the go, while for disposable cups the level is likely to be higher[22]

[21] Edie.net (2016) To keep the momentum of circular economy brimming, we need to battle for the cup, available at https://www.edie.net/blog/To-keep-the-momentum-of-circular-economy-brimming-we-need-to-battle-for-the-cup/6098093

[22] Letsrecycle (2016) Study highlights need for more can recycling points, available at http://www.letsrecycle.com/news/latest-news/study-highlights-need-for-more-can-recycling-points/

2.0 Solutions for Plastic Bottles

2.1 Deposit Return Schemes

A deposit return scheme (DRS) for drinks containers involves the payment, on purchase, of a small deposit (perhaps 10p to 20p) that is then refunded once the bottle is returned to a collection point (either a manual collection point, where the bottle is returned to a shopkeeper, or to a 'reverse vending machine' (RVM)). This is also known as a Container Deposit Scheme (CDS) in some jurisdictions, notably the United States and Australia.

There are two types of DRS. A two-way DRS is where the bottle is returned, washed and refilled with the drink to be sold again. This is the kind of DRS that used to exist in the UK, and that leads to waste prevention (which is at the top of the waste hierarchy), by achieving high levels of reuse. A one-way DRS is where beverage containers are collected to then be recycled, rather than reused. Accordingly, this does not deliver waste prevention. This is the predominant approach, and indeed all new DRSs are, to our knowledge, one-way deposit systems.

This distinction is important, as many who remember the old style two-way DRS may declare that a DRS (for, in their mind, refillables) "just won't work given the longer and more complex supply chains that we now have". However, this is not what is typically being proposed. A one-way DRS is a much better fit with modern supply chains. References to deposit return in the following sections relate to one-way deposit return systems.

2.1.1 Impacts on Litter and Recycling

Deposit return schemes for beverage containers are successful at discouraging littering through providing a small financial incentive for consumers to return the container for recycling. A 2005 peer review of a DRS study for Defra, which, in general terms, was not supportive of introducing a DRS, highlighted examples from the United States where reductions in beverage container litter in excess of 80% occurred once a DRS was implemented.[23]

Indeed a 2011 study from PwC reporting on the German Einwegpfand, or one-way deposit, noted that:[24]

[23] Perchards (2005) Deposit Return Systems for Packaging: Applying International Experience to the UK. Peer Review of a Study by Oakdene Hollins. Report to Defra, available at http://www.oakdenehollins.com/pdf/Deposit_Returns_2005_Peer_Review.pdf

[24] PWC (2011) Reuse and Recycling Systems for Selected Beverage Packaging from a Sustainability Perspective: An analysis of the Ecological, Economic and Social Impacts of Reuse and Recycling Systems and Approaches to Solutions for Further Development, available at

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> *With a deposit system, there is practically no longer any littering of single-use beverage containers bearing deposits.*

Such an approach also leads to very high rates of collection and subsequent recycling (due to the high quality of the collected packaging). The same report states that:

> *98.5% of the PET bottles bearing a deposit are collected in the deposit system and recycled, while only 25-31% of the PET bottles which do not bear a deposit are collected and subsequently recycled in the German green dot (*kerbside*) system.*

Assuming, conservatively, that a Scottish DRS reduces littering by 80%, and applying this to the figures calculated in Section 1.2 to estimate the number of plastic bottles and cans littered each day, it would mean that 50,000 fewer PET bottles and 60,000 fewer metal drinks cans would be littered each day in Scotland.

As noted previously, our calculations suggest that over 700,000 plastic bottles and nearly 900,000 cans are littered across the UK each day (1.6 million plastic bottles and cans in total). We might therefore expect that if a DRS were applied in each of the UK nations, leading to an 80% reduction in littering of used beverage containers, there would be roughly 600,000 fewer plastic bottles, and 700,000 fewer cans littered each day (so together 1.3 million fewer plastic bottles and cans littered each day).

However, as shown in Section 2.1.2, the estimate of an 80% reduction in littering from a DRS may itself be conservative.

2.1.2 Detailed Analysis of Litter Reduction Evidence

Perhaps surprisingly, to the best of our knowledge, no specific research has been undertaken in the European context to identify the effect of a DRS on littering of beverage containers. It is therefore necessary to look to studies undertaken in the US. A 2005 peer review for Defra, by Perchards, of a study on DRS systems for packaging highlights a number of examples.[25] The peer review notes that:

> *Mandatory deposits came into force in nine US states between 1972 and 1983 (the only deposit law adopted since then was in Hawaii in 2002, though a related measure was California's Advance Disposal Fee, adopted in 1986). The leading US authority on litter measurement, Dan Syrek of the Institute of Applied Research, conducted a series of litter studies in a number of US states during this period, including a series of "before and after" studies in the states where mandatory deposits were imposed on non-refillables, and "side- by - side" studies comparing results in adjacent deposit and non-deposit states.*

http://www.duh.de/fileadmin/user_upload/download/Projektinformation/Kreislaufwirtschaft/PwC-Study_reading_version.pdf

[25] Perchards (2005) Deposit Return Systems for Packaging Applying International Experience to the UK, Peer Review of a Study by Oakdene Hollins Ltd., Report to Defra 14 March 2005, available at http://www.oakdenehollins.com/pdf/Deposit_Returns_2005_Peer_Review.pdf

> *These studies were carried out with a very robust methodology and they present an unsurpassed view of the effect of this policy measure on littering. We are unaware of any European studies of comparable comprehensiveness.*

The Perchards peer review highlights that one of Syrek's studies, prepared for a Special Joint Committee of the Michigan Legislature to study the impact of the Beverage Container Deposit Law, collected samples in September 1978 and September 1979. The deposit law came into force on 3 December 1978. It appears that this may well be the *only* dedicated piece of research implemented on behalf of a state government specifically to determine the effects on littering of a DRS on beverage containers. Perchards notes, in respect of the Michigan study that:[26]

> *It was found that while beverage container litter had declined by 85%-88%, the changes in total litter rates were not statistically significant*

Perchards then offers the data shown in Table 1.

[26] Perchards (2005) Deposit Return Systems for Packaging Applying International Experience to the UK, Peer Review of a Study by Oakdene Hollins Ltd., Report to Defra 14 March 2005, available at http://www.oakdenehollins.com/pdf/Deposit_Returns_2005_Peer_Review.pdf

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Table 1: Results presented in Perchards (2005) for Before-and-After Studies

IAR FINDINGS ON DEPOSIT LEGISLATION EFFECTIVENESS				
	Measurement Parameter	**Beverage container Litter rate**	**Other Litter rate**	**Total Litter rate**
BEFORE-AND-AFTER STUDIES				
Michigan 1978	Visible items per mile	226.0	1447	1673
Michigan 1979	Visible items per mile	6.3	808	815
	% change	*-91.5%*	*+2.1%*	*-10.5%*
California 1986	Visible items per mile	70.0	1836	1953
California 1993	Visible items per mile	42.2	1970	2013
	% change	*-63.9%*	*+7.3%*	*+3.1%*

Source: Perchards 2005, reporting Syrek

The first thing to note about this table is that the 85%-88% reduction in beverage container litter reported in the text for Michigan is not matched by that shown in the table, which is a reduction of 91.5%. However, if the reported number of visible items per mile are accurately presented, then the 91.5% shown in the table is also inaccurate. A reduction in the beverage container litter rate from 226 to 6.3 visible items per mile is actually a 97.2% reduction in beverage container litter.

An error has also been made in presenting the 'other litter rate' and the 'total litter rate'. For 'other', i.e. non-beverage container litter, the reduction from 1447 to 808 items is a decline of 44.2% rather than an increase of 2.1% as indicated. For total litter, the drop from 1673 to 814.3 visible items per mile is a reduction of 51.3%, rather than a reduction of 10.5% as in the table.

The key figure in respect of considering impacts of a DRS is the 97.2% reduction in beverage container litter. This is consistent with the findings from a study by PwC on the German Einwegpfand (one-way deposit) that stated:[27]

> *With a deposit system, there is practically no longer any littering of single-use beverage containers bearing deposits*

Interestingly, the percentage changes calculated in the Perchards report based on the findings from the California studies are also incorrect. The number of visible items per mile that are beverage containers drops from 70 in 1986, to 42.2 in 1993, which is a reduction of only 39.7%, rather than the 63.9% indicated. The total number of visible items per mile in 1986 is also incorrect - it's overstated - and should be 1906 rather than

[27] PWC (2011) Reuse and Recycling Systems for Selected Beverage Packaging from a Sustainability Perspective: An analysis of the Ecological, Economic and Social Impacts of Reuse and Recycling Systems and Approaches to Solutions for Further Development, available at http://www.duh.de/fileadmin/user_upload/download/Projektinformation/Kreislaufwirtschaft/PwC-Study_reading_version.pdf

1953. This means that the total increase in visible items per mile between 1986 and 1993 is 5.6%.

Notwithstanding these errors, it's remarkable that the California scheme is presented as one of the two examples of 'before and after' studies that apparently, according to Perchards:[28]

Present an unsurpassed view of the effect of this policy measure on littering

Firstly, it's important to note that the level of the deposit in California, at only 2.5 cents (on beverage containers smaller than 24oz, 5 cents on those above this size), meant the financial incentive to return the beverage container was far smaller than in other schemes. For example, the deposit level in Michigan, upon scheme implementation in 1979, was 10 cents on non-refillables (i.e. one-way beverage containers). Even without accounting for the effect of inflation between 1979 and 1987, it is clear that a 2.5 cents payment on return is unlikely to lead to the same reduction in littering as a 10 cents deposit/refund.

Secondly, there are seven years between the 'before' and 'after' study. In this time, overall consumption of beverage containers will most likely have increased, and the value of the 2.5 cent or 5 cent payment for return of the beverage container will have been further eroded by inflation.

That the California example is presented here strongly suggests that the Michigan study, which as we can see showed a 97.2% reduction in beverage container litter, was the only credible 'before and after' study undertaken by Dan Syrek and the Institute for Applied Research.[29]

The Perchards peer review also presents the findings from adjacent state studies by Syrek. These findings are reproduced in Table 2.

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[28] Perchards (2005) Deposit Return Systems for Packaging Applying International Experience to the UK, Peer Review of a Study by Oakdene Hollins Ltd., Report to Defra 14 March 2005, available at http://www.oakdenehollins.com/pdf/Deposit_Returns_2005_Peer_Review.pdf

[29] Perchards, in their 2005 peer review, do not provide a reference for Syrek's work, although they do indicate that one of his studies was published in 2003. In fact in another paper by Perchards ('Peer Review of the Boomerang Alliance Report: National Packaging Covenant – Say No to the Waste Club', 3 March 2005, available at http://www.pca.org.au/application/files/5614/3769/2418/Oz_Boomerang_Report.pdf) in which the same miscalculations are presented, the list of references include Syrek (1980) Michigan: After – a study of the impact of beverage container deposit legislation on street, roadside and recreation area litter in Michigan. The Institute for Applied Research; and Syrek (2003) What we now know about controlling litter – Findings pertinent to Michigan derived from thirty years of litter research. The Institute for Applied Research. It has not been possible to find either of these papers online

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Table 2: Results presented in Perchards (2005) for Adjacent State Studies

IAR FINDINGS ON DEPOSIT LEGISLATION EFFECTIVENESS				
	Measurement Parameter	**Beverage container Litter rate**	**Other Litter rate**	**Total Litter rate**
ADJACENT STATE STUDIES				
California 1974	Visible items per mile	228.2	1998	2226
Oregon 1977	Visible items per mile	27.6	1930	1958
	% difference	*-87.9%*	*-3.4%*	*-12.0%*
Pennsylvania 1984	Visible items per mile	167.5	3117	3285
New York 1984	Visible items per mile	52.7	3485	3538
	% difference	*-68.5%*	*+11.8%*	*+7.7%*

Source: Perchards 2005, reporting Syrek

Assuming the number of visible items per mile are correctly reported, the percentage changes shown are accurate. Unfortunately it has not been possible to find the original analysis from which these figures are derived. Again, it does seem strange that studies that apparently present 'an unsurpassed view of the effects of a DRS on littering' includes a survey of two adjacent states, but taken three years apart (California 1974, and Oregon 1997).

It's interesting to note that while the Perchards peer review reports on Pennsylvania and New York as adjacent states, it neglects to mention a 1986 study published in a peer reviewed journal, that compares the 'before' and 'after' situation in New York (either side of the September 12, 1983 implementation of the New York State Bottle Bill), with measurements, at the same time, in the adjacent state of New Jersey.[30] The study considered both highway exits and railroad tracks, where groups 'tend to party' according to the authors. For deposit-bearing beverage containers, the authors reported immediate reductions of between 95% and 99% depending on the location. Clearly not all beverage containers were deposit-bearing, and the authors report that the overall reduction in beverage container litter was more moderate – an initial 44% reduction at highway exits in New York, for example.

What's therefore important to note is that Syrek's figures reporting the number of visible beverage containers per mile, as presented in Perchards' peer review, may not distinguish between those that are deposit-bearing and those that are not deposit-bearing. The figures thus presented may therefore *understate* the reduction in littering of deposit-bearing beverage containers.

These findings strongly suggest that reductions in littering of deposit-bearing beverage containers in excess of 95% could reasonably be expected in the UK.

[30] Levitt, L. & Leventhal, G. (1986) Litter Reduction: How Effective is the New York State Bottle Bill? Environment and Behavior, Vol. 18 No. 4, July 1986, 467-479.

2.1.3 Impacts on Other Litter

Evidence suggests that a lightly littered environment 'breeds' litter at a slower rate than a more heavily littered environment. This expectation is supported by the academic literature. Cialdini et al. report this finding in their 1990 paper, as does a 2013 study by Schultz et al.[31,32] This latter research identified that the level of pre-existing litter (which the researchers rated on a scale from 0-10) was predictive of observed littering behaviour. For every 'unit' increase in existing litter, the observed rate of littering increased by 2%.

Therefore, a DRS for beverage containers, in reducing the quantity of such items that are littered, leading to less packaging litter in the environment, would also be predicted to cut the rate of littering of non-deposit bearing items.

2.1.4 Impacts on Employment

Eunomia undertook a study for CPRE in 2011 that explored the potential employment impacts of a one-way DRS in the UK.[33] The report specifically examined the impacts of introducing a DRS on the number, type and location of jobs involved in the collection and processing of beverage containers. The calculations were based on the DRS system modelled for an earlier study for CPRE that considered the costs and benefits of a DRS.[34]

If it is assumed that all additional reprocessing jobs that result from higher separate collection of beverage containers under a DRS are created in the UK and are thus included in the overall labour impacts, the introduction of a DRS leads to a 4,248 to 4,292 increase in full-time equivalent (FTE) posts, with a higher net increase in jobs from an 80% compared to a 90% return rate scenario.

Even without the inclusion of any FTE posts from reprocessing (i.e. assuming it all takes place overseas), there remains an overall increase in FTEs ranging from 3,062 to 3,156 for the 90% and 80% return rate scenarios respectively. The majority of jobs created are at a similar skill level to the existing jobs, though there is perhaps a slight increase in the total number of higher skilled jobs.

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[31] Cialdini R. B., Reno R. R., Kallgren C. A. (1990). A focus theory of normative conduct: Recycling the concept of norms to reduce littering in public places. Journal of Personality and Social Psychology, 58, 1015-1026, available at http://www-personal.umich.edu/~prestos/Downloads/DC/pdfs/Krupka_Oct13_Cialdinietal1990.pdf

[32] Schultz, PW., Bator, RJ., Large, LB., Bruni, CM., Tabanico, JJ. (2011) Littering in Context: personal and Environmental Predictors of Littering Behaviour, Environment and Behaviour, 45 (1) , pp 35-59, available at http://journals.sagepub.com/doi/abs/10.1177/0013916511412179

[33] Eunomia (2011) From Waste to Work: The Potential for a Deposit Refund System to Create Jobs in the UK

[34] Eunomia (2010) Have We Got The Bottle? Implementing a Deposit Refund System in the UK, Report for CPRE

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Another observed benefit of DRS, albeit one for which there is no data, is that bottles that are littered may sometimes be collected by the poorest in society who return them for recycling and redeem deposits. Indeed in Germany this approach has been 'formalised' as some litter bins have 'collars' in which used beverage containers can be placed if consumers cannot be bothered to return them, with the intention being that these are held in place until someone else picks them up.

2.1.5 Impacts on Small Retailers

Deposit-return schemes can be implemented as 'return to depot' or 'return to retail'. Under the former approach, consumers return their used beverage containers (UBCs) to centralised depots to redeem their deposit. Under the latter, consumers are able to return their UBCs to retailers. This approach, which is more common in European schemes, is much more convenient for consumers.[35]

Accordingly, a return to retail approach is recommended in the 2015 feasibility study for Zero Waste Scotland, which looked at the ways in which a DRS could operate in Scotland.[36] An important aspect of such schemes is that retailers receive handling fees from the deposit system operator to compensate them for taking back used beverage containers.

The Association of Convenience Stores, in their response to the ZWS Consultation on a DRS highlighted a number of concerns about the scheme, such as inconvenience of taking back beverage containers, and the cost of doing so. However, the ACS did not mention handling fees that are designed to compensate for such costs. [37] It's not clear whether among retailers the fact they will receive handling fees is well understood.

2.1.6 Shifting the Burden from Citizens to Consumers

At present, best estimates suggest that approximately 90% of the cost of managing end-of-life beverage containers is met by taxpayers, i.e. citizens.[38] There is no differentiation in financial contribution in proportion to the amount consumed. One might conceivably consume no beverage containers over an entire year, yet still contribute the same amount towards end-of-life management as someone who consumes a great deal.

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[35] North American schemes tend towards 'return to depot' approaches

[36] Eunomia (2015) A Scottish Deposit Refund System, Final Report for Zero Waste Scotland, available at http://www.zerowastescotland.org.uk/sites/default/files/ZWS%20DRS%20Report_MAIN%20REPORT_Final_v2.pdf

[37] SGF & ACS (2015) Deposit Returns Scheme – Response from the Scottish Grocers Federation & the Association of Convenience Stores, available at https://www.acs.org.uk/download/deposit-return-system-call-for-evidence-scotland/

[38] Bio by Deloitte (2014) Development of Guidance on Extended Producer Responsibility, Final Report to DG Environment of the European Commission

A study commissioned by Every Can Counts illustrates this point (albeit in respect of metal beverage containers rather than plastic bottles). While the study has not been published, a news item presents some key findings.[39] The news item notes that:

> *The report showed us that the UK public drink an average of 6.5 cans a week each, rising to 9.3 in the warmer months, an increase of 43% – and half of all cans purchased in the UK, are consumed on-the-go.*

The news item goes on to indicate that:[40]

> *The study showed that nearly 80% of the country's population purchase at least one canned drink a week*

This means that more than 20% of the UK population drink less than one canned drink a week, but the average is 6.5%. Someone is drinking a lot of canned drinks, and it turns out, according to the news item, to be 24-44 year olds, described as:[41]

> *The most voracious consumers of cans*

This is not a situation that could reasonably be considered to be fair. A deposit return scheme would ensure the burden is shifted to more closely reflect an individual's consumption.

[39] Letsrecycle (2016) Study highlights need for more can recycling points, available at http://www.letsrecycle.com/news/latest-news/study-highlights-need-for-more-can-recycling-points/
[40] Letsrecycle (2016) Study highlights need for more can recycling points, available at http://www.letsrecycle.com/news/latest-news/study-highlights-need-for-more-can-recycling-points/
[41] Letsrecycle (2016) Study highlights need for more can recycling points, available at http://www.letsrecycle.com/news/latest-news/study-highlights-need-for-more-can-recycling-points/

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3.0 Solutions for Disposable Coffee Cups

3.1 A Charge on Single-use Takeaway Cups

A financial incentive for consumers to opt for reusable over single use cups would encourage *both* litter prevention *and* waste prevention, thereby targeting the top rung of the waste hierarchy – which all waste producers are already legally required to take into account.[42] It could also go some way to reducing consumption of plastic straws if applied to colas and sodas etc.

The rationale for introducing a charge on such cups to prevent waste and litter is arguably greater than it was for single-use carrier bags. It would seem likely that the majority of plastic bags have always been used to carry items home from the shops, and they can be used again. By contrast, the probability that disposable coffee cups (and other disposable cups), which are designed to be consumed on the go, would make it home, would seem much lower. Some may end up in offices after the morning commute to work, but it would seem highly likely that many end up in public litter bins, or indeed littered. The chances of such being used again would seem to be very slim.

Applying a charge would seem particularly beneficial for small independent coffee shops. Single-use cups and lids together can cost about 10 pence a time.[43] These then have to be stored somewhere. If customers bring their own mug to be filled, there is an immediate saving of ten pence to the café. It seems likely that large chains will be able to negotiate a much better price per disposable cup than independent cafes, and they therefore might not see such a big saving.

3.1.1 Potential to Raise Money for Good Causes

The amount raised by such an economic instrument, as in the case of single-use carrier bag charges, depends on:

1) The level of the charge; and
1) The level of reduction achieved.

A range of possible options and associated revenues are included in Table 3. This is based on annual consumption of 2.5 billion cups. As can be seen, if a 25p charge were to be implemented, with 30% of consumption switching to reusables to avoid the charge, £438 million would be raised. As per the carrier bag charge, larger retailers could be encouraged to donate money raised (after deducting administration costs) to good causes, while smaller retailers could be similarly encouraged, or may be able to keep the proceeds of the charge.

[42] HM Government (2011) The Waste (England and Wales) Regulations 2011, S.I. 2011/988
[43] See Isonomia (2016) Levelling a Charge: Small Business and Levies, available at http://www.isonomia.co.uk/?p=4413

Table 3: Revenues (£m per annum) from a Levy on Single-use Takeaway Cups: Varying Level of Charge and % Reduction

Reduction	Level of Charge				
	5p	10p	15p	20p	25p
10%	112	225	338	450	563
20%	100	200	300	400	500
30%	87	175	263	350	438
40%	75	150	225	300	375
50%	62	125	186	250	313
60%	50	100	150	200	250
70%	38	75	113	150	188
80%	25	50	75	100	125

However, as noted in Section 1.3, the estimated annual consumption has been revised upwards to 5 billion for paper coffee cups, and to 10 billion if all single-use takeaway cups are included. Assuming a 25p charge were applied to all such cups, a 30% switch away from disposables would deliver revenue of over £1.7 billion per annum (gross) to potentially be spent on good causes.

However, a more significant reduction would of course be desirable. While reductions in consumption of circa 80% have been seen for single-use plastic bags, there is unlikely to be such a dramatic shift from reusable coffee cups. This is because for the consumer, a 5p charge on a carrier bag that was previously given to them 'for free', is an infinite increase in cost. By contrast, a 25p charge on a coffee that may already be over £2 does not present such a dramatic change to the consumer. However, what it would do is change the social norm, particularly if universally applied, including to small retailers.

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3.1.2 Likely Levels of Reduction in Use of Disposable Cups

A recent study by academics at Cardiff University involving a trial at a small number of coffee shops noted that:[44]

> *Through clear messaging, the provision of reusable alternatives, and financial incentives, the use of reusable coffee cups can be increased by (on average) 2.3 to 12.5%.*

The authors also emphasised that:

> *A charge may be more effective than a discount. These results are in line with prospect theory, which suggests that people are more sensitive to losses than to gains when making decisions. A charge on disposable cups (a loss) is therefore more likely to produce behaviour change than a discount on a reusable cup (a gain).*[45]

The authors further note that the experiment was small in scale and introduced at a limited number of sites. They further state that:[46]

> *It is likely that the reduction would be even greater with a mandatory charge on disposable coffee cups at the national level. It then becomes more worthwhile for consumers to adapt to the widespread introduction of the charge by using reusable alternatives.*

Of course the aim of a charge would be to reduce consumption of single-use takeaway cups, but the fact that it would also raise funds for good causes is a co-benefit of this economic instrument.

It is difficult to estimate the extent to which a reduction in use of disposable coffee cups might be achieved, but reductions in the order of 30% -perhaps not immediately, but over time - do not feel wildly wide of the mark.

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[44] Poortinga, W. (2017). Results of a field experiments to reduce coffee cup waste. Summary report to Bewley's Tea & Coffee UK Ltd. Cardiff: Welsh School of Architecture & School of Psychology, Cardiff University, available at http://orca.cf.ac.uk/99366/1/Coffee%20cup%20summary%20report%20-%20Poortinga%20%28FINAL%29.pdf

[45] Kahneman, D., & Tversky, A. (1979). Prospect theory: an analysis of decision under risk. Econometrica, 47 (2), 263-292.

[46] Poortinga, W. (2017). Results of a field experiments to reduce coffee cup waste. Summary report to Bewley's Tea & Coffee UK Ltd. Cardiff: Welsh School of Architecture & School of Psychology, Cardiff University, available at http://orca.cf.ac.uk/99366/1/Coffee%20cup%20summary%20report%20-%20Poortinga%20%28FINAL%29.pdf