## Colm Lambert (DECC)

**From:** [redacted]
**Sent:** Thursday 6 May 2021 12:19
**To:** wastecomments
**Subject:** IWMA Submission on DRS
**Attachments:** 210429_501.181.8_IWMA submission on DRS Consultation_CW_Rev0 Final.pdf; 210505-501.181.9 _SLR SmartDRS_CarbonStudy_BriefingNote for IWMA_Final.pdf

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Hi,

Please find attached IWMA submission on Deposit Return Systems, which includes the attached SLR Report as an enclosure.

Regards,

[redacted]

**SLR's response to Coronavirus COVID-19** - In response to the ongoing global pandemic, we are actively following the advice provided by our national and state governments. As a flexible, full-service organisation we are open for business and will continue to operate and deliver advice and services to our clients wherever possible and in line with government guidance.


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Irish Waste Management Association

Deposit Return Scheme Consultation,
Waste Policy and Resource Efficiency,
Department of the Environment, Climate and Communications,
Newtown Road,
Carricklawn,
Wexford,
Y35 AP50.

By email only to Wastecomments@decc.gov.ie

29th April 2021

**Re: Consultation Document on a Legislative Framework for a Deposit Return Scheme**

Dear Sir/Madam,

Further to your call for consultation on the above-referenced subject, I offer the following responses and comments on behalf of the Irish waste Management Association (IWMA). The IWMA is comprised of 41 members that operate 50 waste companies, as shown below:

Our website, www.iwma.ie, provides details of our members. Note that some members have acquired other companies in recent years and therefore trade under several brand names.

Our members handle household, commercial, C&D, liquid and hazardous wastes and are involved in the following waste management activities:

- Waste Collection
- Waste Transfer
- Recycling Operations
- Composting
- Anaerobic Digestion
- Hazardous Waste Management
- Specialist Treatments (such as Sterilisation)
- Soil Treatment and Recovery
- Waste to Energy
- SRF Production
- Landfill Operations
- Export of Waste for Treatment Abroad

It is clear that the IWMA represents a broad spectrum of waste management activities, so we have no inherent bias towards or against any particular waste management options. Our main goals are to raise standards in the industry, to promote compliance with all legislation and to assist Ireland in meeting the targets set by the EU in a variety of Directives. All our submissions are available publicly on our website.

## 1.0 IWMA POSITION

The IWMA submitted a detailed document on DRS to DECC in November 2020 as part of the previous consultation on this matter. That document put forward our view that a Digital (or Smart) DRS is a much better option than a conventional 'return to retail' DRS. Our position has not changed and we urge the Government to give due consideration to that option.

A conventional 'return to retail' DRS may be *'tried and tested'*, but we argue that:

- it is expensive,
- it is not convenient for the consumer,
- it has a higher environmental footprint,
- it is not flexible,
- it is open to fraud, and
- it is not future-proofed.

Over the counter banking was *'tried and tested'* before ATMs and then electronic banking. Landline phones were *'tried and tested'* before mobile phones. *'Tried and tested'* is a poor excuse for inertia when there is a much better option available. If we introduce a conventional DRS now, we will undoubtedly look back with regret in future years.

We welcome the following statement in the consultation document:

> *"Waste collectors or operators of municipal recycling facility operators will also be eligible to claim the deposit in respect of containers that are not returned to retailers but which are placed in recycling bins and thereafter directed to MRFs for sorting."*

This has the potential to neutralise the impact on the existing recycling system, so it may protect against a serious impact on the existing kerbside recycling system. However, we still argue that a digital DRS is far superior to a conventional 'return to retail' DRS. This is not a self-serving position for our members, as they will hopefully be protected by the statement quoted above. Our interest is in the future of waste management in Ireland and that includes maintaining a simple recycling system that encourages consumer engagement with the best possible environmental outcome. A digital DRS system is best placed to achieve that result.

In our previous submission to DECC, we included the following comparison between conventional DRS and Digital DRS. We have updated it now based on new information in some areas:

**Table 1**
**Comparison of Conventional DRS Versus Smart DRS for Ireland**

| Issue | Conventional DRS | Digital / Smart DRS |
|---|---|---|
| **Cost** | €70m to €100m per annum | €20m to €25m per annum |
| **Surplus Revenue** | None - €30m unredeemed deposits plus €10 to €15m material value leaves a shortfall of €25m to €60m. | €15m to €25m surplus if only PET Bottles and Aluminium Cans.<br>Could be €50m to €100m if extended to other materials such as HDPE bottles, tetra-pak, glass, steel cans, etc. The surplus can support wider recycling efforts. |
| **Flexibility** | None – reverse vending machines only accept round items.<br>Also, space limitations in shops make it difficult to add more materials.<br>It is also more difficult to change the deposit level. | Very flexible. Any item can be added quite simply by amending the label and using the technology.<br>Variable deposits and revision of deposit levels are easily managed in this digital system. |
| **Impact on Litter** | Limited - reverse vending machines do not accept crush cans or bottles. | Excellent – any deposit item can be returned to a wide range of convenient locations and the deposit reclaimed regardless of whether or not it is crushed or squashed. |
| **Impact on Existing Recycling System** | Expected to cause a €7m per annum impact on the existing recycling system, which is a threat to its viability. This can be neutralised by MRFs claiming unredeemed deposits on materials that end up in MRFs. | Expected to have a positive impact as people place more recyclable items in their recycling bins and the surplus revenue supports the introduction of more collection points for recyclables. |
| **Integration with Northern Ireland** | Difficult due to currency difference and the use of non-unique identifier on the labelling. | Easier, as the electronic system can easily manage the currency difference and the unique identifier will reveal the source of the item. |

| Issue | Conventional DRS | Digital / Smart DRS |
|---|---|---|
| **Consumer Engagement** | Very difficult for consumers as they must store deposit items uncrushed in their homes and deliver them to shops periodically, where they queue to manually deliver the items to gain store credit. | Easy for consumers as they can reclaim the deposit in their home, at work, on the street, in shopping centres, at sports events, in train stations, at airports, at civic amenity sites, at bring banks, etc.<br>Also, consumers get cash to their account, not credit.<br>Also, the App will provide useful information to consumers.<br>Less convenient for people that do not have smartphones, but adequate provision will be included.<br>(In a recent survey of 1,000 people representing a cross-section of society, iReach found that 94% of people surveyed had a smartphone or other device with Apps and a camera that could be used in a Digital DRS.) |
| **Impact on Retailers** | Difficult to manage returns and storage of materials. | Involved only on a voluntary basis with a scanner that make returns easier. |
| **Quality of Materials** | High quality. | Relies on a higher level of sorting to reach high quality, but equivalent quality is expected at the end of that process and has been proven. |
| **Security** | Good at ensuring the items are returned before deposit is returned, but more open to fraud as items are not uniquely identified and there is a history of fraud with conventional DRS systems around the world. | Relies upon a degree of trust in the sense that people are expected to place the item in the recycling bin that they scan with their smartphone.<br>However, less susceptible to fraud as:<br>• Individual coding means that no item can be recycled more than once – eliminating fraud.<br>• Unique coding also identifies cross border contamination eliminating fraud in this area.<br>• Uses digital intelligence for fraud detection surveillance.<br>• Secure green blockchain and AI brings immutability and ability to track packaging throughout the circular economy for cradle to grave accountability on every single bottle. |
| **Positive Environmental Impacts** | Increase in recycling rates for PET bottles and aluminium cans combined with disincentive to purchase these items. | Increase in recycling rates for PET bottles, aluminium cans, cartons, tetra-pak, glass bottles, etc. combined with disincentive to purchase these items. Also offers potential to support re-use, e.g. higher returns for re-using glass bottles. |
| **Negative Environmental Impacts** | Significant carbon emissions associated with additional traffic and transport needed to deliver and collect the deposit items to and from shops and also with the development and operation of 5 new counting/sorting centres. | Negative environmental impacts will be very modest as existing collection and processing system is used and enhanced with more convenient drop-off points. |

| Issue | Conventional DRS | Digital / Smart DRS |
|---|---|---|
| | A recent SLR Report estimates that the additional carbon impact associated with a conventional DRS versus Digital DRS is likely to be 20,000 tonnes of $CO_2$ equivalent per annum (with a range of 13,000 and 30,000 tonnes depending on the assumptions). This is equivalent to burning 10,000 tonnes of coal or 46,300 barrels of oil each year. | |
| **Potential Health Impacts** | Returned containers are likely to contain traces of product including sugary drinks and alcohol in open bottles and cans. This could attract flies and rodents to the storage area of shops, where the materials are securely stored alongside food products. There is a health risk associated with this arrangement. | Containers are mostly returned to non-retail locations, avoiding this risk altogether.<br>When/if returned to retail, the items are scanned and can be placed in standard recycling bins without the need for secure storage, as the deposit cannot be reclaimed twice. The bins will be managed as waste in an appropriate manner, not as stock in the storage rooms. |
| **Development Timeframe** | 4 to 5 years.<br>The need for 5 new counting/sorting centres will involve site selection, site procurement, EIA, planning permission, EPA licensing, design, construction and equipment installation. This will take at least 3 years. | 2 years.<br>Main items required to get started are:<br>• Trials<br>• Labelling of deposit items<br>• Labelling of recycling bins<br>• Provision of more recycling bins<br>• Procurement of App technology<br>The trials could be completed in the next 6 months and none of the other tasks should take more than 12 months to complete. |
| **Risks** | The system is proven elsewhere which is a positive.<br>However, countries that have introduced a successful DRS have a much higher proportion of apartment-dwellers and they have a tradition of delivering recyclables to drop-off points. Ireland has a different way of recycling with greater emphasis on kerbside MDR bins.<br>There is a high risk that the public will not engage fully with a conventional DRS and will resent the inconvenience involved, with knock effects on overall recycling.<br>There is also a planning risk associated with the development of 5 new counting/sorting centres.<br>The risk of fraud is higher. | This is a novel system with the risks associated with any new development.<br>However, there are lower risks in a number of ways, as follows:<br>• The investment level is much lower.<br>• Public involvement is much more convenient, so there is a lower risk of public rejection of the scheme.<br>• There is no risk of negative impacts on the current recycling system.<br>• The flexibility of the system allows it to start small and progress over time to more materials.<br>• The risk of fraud is lower. |

## 2.0 TIMEFRAME FOR DELIVERY OF A DRS

We understand that the speed of delivery of a DRS is important for the Government, as it is included in the Programme for Government and should be delivered within the term of the current Government. The IWMA believes that a Digital DRS can easily be delivered within that timeframe, but we advise that a conventional DRS is unlikely to be delivered before 2025 at the earliest. A conventional DRS as proposed by Eunomia requires the agreement of 15,500 retail premises and the installation of collection and storage infrastructure at those premises and reverse vending machines in some cases. We envisage protracted negotiations to secure the agreement of that many players in the system.

A conventional DRS also requires the development of 5 new sorting centres. These will require planning permission and waste permits as well as site selection, site acquisition, design, construction and procurement of equipment. We expect that it will take at least 3 years for these facilities to be developed from a starting point that is likely to be more than a year away from this point in time, so 2025 at the earliest. That assumes no opposition or legal challenges to those developments.

A conventional DRS will also require the procurement of collection and sorting contracts, with the potential for legal challenges that could delay the process even further.

A digital DRS can move forward at a much faster pace, as there are approximately 1.5 million existing collection points that can be used. Those bins can be labelled simply by posting the labels to the bin owners, who would place them on their bins if they intend to use those bins to reclaim their deposits.

A digital DRS will not require additional collection vehicles or additional sorting centres as the material will be managed by the existing collection and sorting infrastructure.

A number of companies have already developed Apps that would be used in a Digital DRS system. Several Apps could be available to be used in the system, ensuring competition and providing reassurance and security in the event that one App fails to deliver a good quality product. For example, public parking can be paid by using several Apps available in the market.

A digital DRS will require unique identifier QR code labelling on each item. Whilst this is a challenge for the packaging producers, we understand that the challenge relates to the speed of printing rather than the labelling itself. The labels for PET bottles are produced separately from the bottles themselves, so we see this as an added cost rather than a more substantive issue that would cause a time delay. We expect that this added cost is marginal in the context of the cost differential between conventional DRS and digital DRS, which we expect to be more than €50m per annum, so this is not a significant issue in our view.

We conclude that a Digital DRS can be delivered in Ireland in a much shorter time-period than a conventional DRS using the 'return to retail' model.

## 3.0 FURTHER RESEARCH OF DIGITAL DRS

### 3.1 Introduction

We are disappointed that the packaging producers and the Irish Government appear to be moving ahead with a Conventional 'return to retail' DRS model, without giving due consideration to a Digital DRS. This is not consistent with the positions taken by the Governments in Northern Ireland and Wales, where Digital DRS trials have been supported by the authorities.

In the absence of due consideration by the Irish Government, the IWMA is progressing research in this area, as follows:

1. We commissioned SLR Consulting to conduct a Carbon Assessment to measure the difference in carbon emissions between conventional DRS and digital DRS.
2. We commissioned iReach to carry out a survey of 1,000 people representing a cross-section of society with questions about DRS.
3. We have recently commissioned Cryptocycle and Beauparc to carry out a Digital DRS trial in North Dublin.

We provide some details of this research in the following sections.

### 3.2 Carbon Assessment

SLR Consulting was commissioned by the IWMA to prepare a report that compares the difference in carbon emissions between conventional DRS and digital DRS. The report was completed in April 2021 and is entitled "*High Level Study to Assess the Carbon Impacts of Smart DRS*" and is attached to this submission. The report concluded the following:

*"When comparing the carbon impacts of a Smart DRS system to those of a conventional DRS (the baseline system assumed to be implemented), a Smart DRS system would deliver a net benefit of circa 20,000 $tCO_2e$ per annum (with a net benefit range of between circa 13,000 and 30,000 $tCO_2e$ per annum).*

*This high level carbon impact analysis, which is conservative with respect to many of the assumptions applied, clearly demonstrates that the implementation of a Smart DRS system would have a lower environmental impact in terms of carbon emissions than implementation of a conventional DRS.*

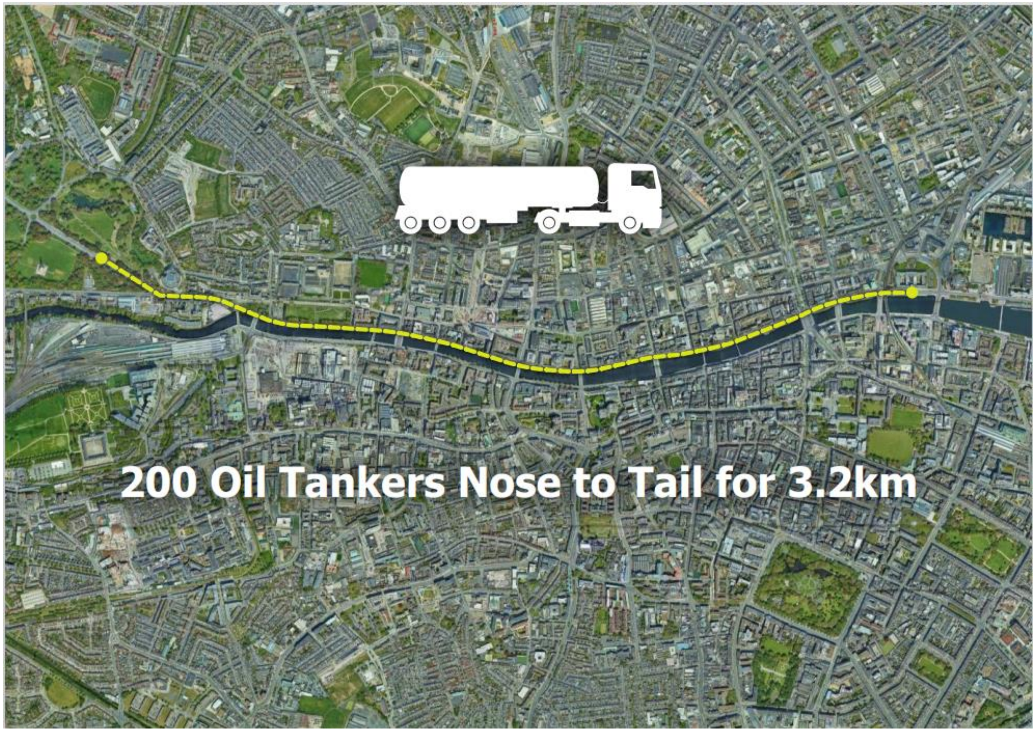
*Conversion of the carbon saving of 20,000 tonnes of $CO_2e$ per annum into something more meaningful in the real world is the equivalent to:*

- *9,996 tonnes of coal burned each year:*
    - *If the coal was stockpiled on the pitch at the Aviva Stadium in a pyramid style it would be 6.5m high.*
- *46,304 barrels of oil consumed each year:*
    - *This is equivalent to approximately 200 oil tanker articulated trucks which if lined up nose to tail would stretch 3.2km across Dublin City from The Custom House on the River Liffey to the People's Garden in the Phoenix Park.*

*In addition to the carbon impact benefits of Smart DRS, the other key benefits of Smart DRS over conventional DRS should be noted (which will deliver additional carbon impact benefits), including (but not limited to):*

- *The ability of a Smart DRS as a flexible and adaptable system to access other material streams (such as tetra pak and juice cartons) and thus deliver a further carbon benefit (this assessment is therefore a conservative estimate of the true potential of Smart DRS);*
- *Smart DRS has the ability to mobilise quicker and get peak carbon benefits sooner. The mobilisation period for conventional DRS will be slower (and therefore achievement of carbon impacts delayed) due to the ramp up period for manufacture and installation of 2,500+ RVMs and also the development timescales required for sorting centre infrastructure (site identification, planning, environmental permit, construction, commissioning and testing)."*

To reiterate the carbon impact of a conventional DRS, that would be avoided in a Digital DRS, we provide the following images:


### 3.3 Consumer Survey

The IWMA commissioned iReach HQ to conduct a consumer survey on DRS options in April 2021. The highlights of the survey are as follows:

- 61% of people would prefer to get their deposit back using their existing recycling bin.
- More than 4 in 5 (84%) would prefer to get their deposit as money back directly rather than in the form of store credit.
- More than 3 in 4 (76%) find it convenient to recycle bottles/cans at home in a recycling bin.

- 75% favour a DRS that won't result in increased transport and energy impacts on the environment.

- Two thirds (67%) favour a DRS that lets them claim their deposit back at home due to the convenience.

- 94% have a smartphone, tablet, or other device that allows them to download an app and take a photo.

The survey results clearly show that consumers will respond favourably to a Digital DRS as it allows them to use their recycling bins at home, in their workplace or on the go. It is clearly the more convenient option and will have a higher uptake.

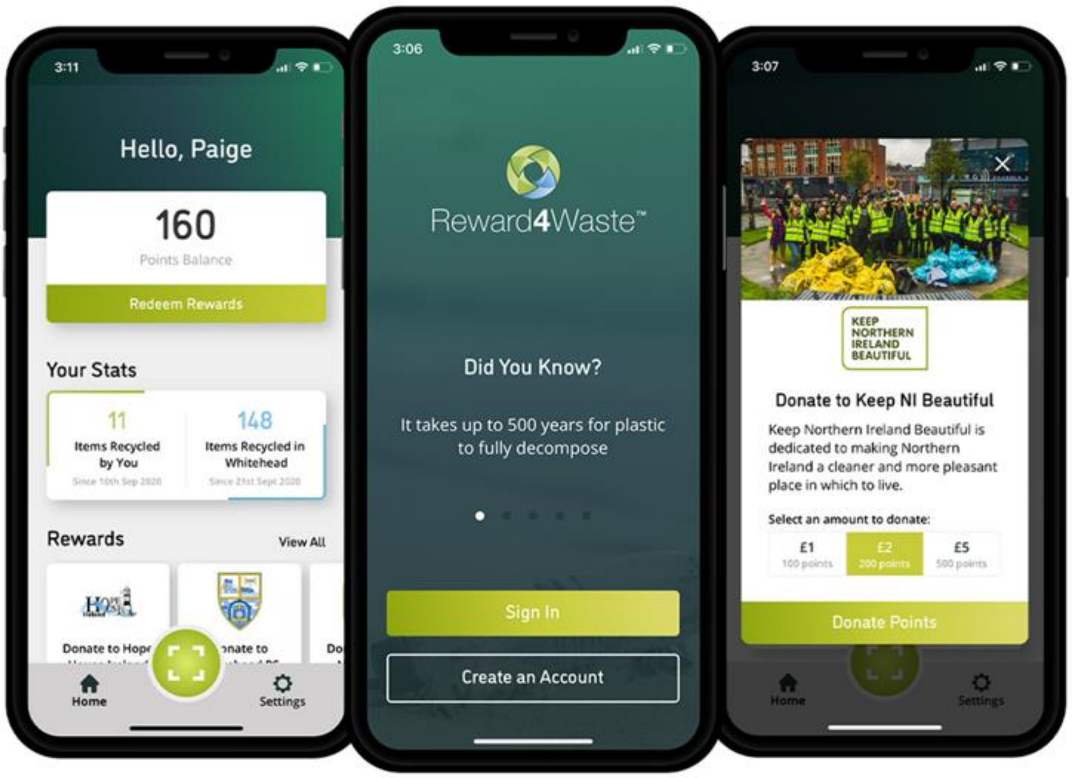
## 3.4 Digital DRS Trials

Digital DRS is a new concept, as are many new applications of smartphone technology. We see it as a natural progression from a manual system to a digital one as we see in so many other areas in the modern world. We are unaware of any full scale Digital DRS systems currently in place, but there are trials completed and others progressing at a rapid pace.

### *3.4.1 Reward4Waste Trial*

A trial of a Digital DRS, called Reward4Waste, was completed in Whitehead near Carrickfergus in County Antrim, Northern Ireland. The company behind the technology used in the trial was Cryptocycle, who has developed an App for a Digital DRS, as shown in the image below.

**Photo 1 – Cryptocycle App used for Reward4Waste Trial in Whitehead**



Mid & East Antrim Borough Council and Bryson Recycling were partners in the trial, which was also supported by Britvic, SPAR, PepsiCo and Encirc. Details of the trial can be found here: https://reward4waste.com/ .

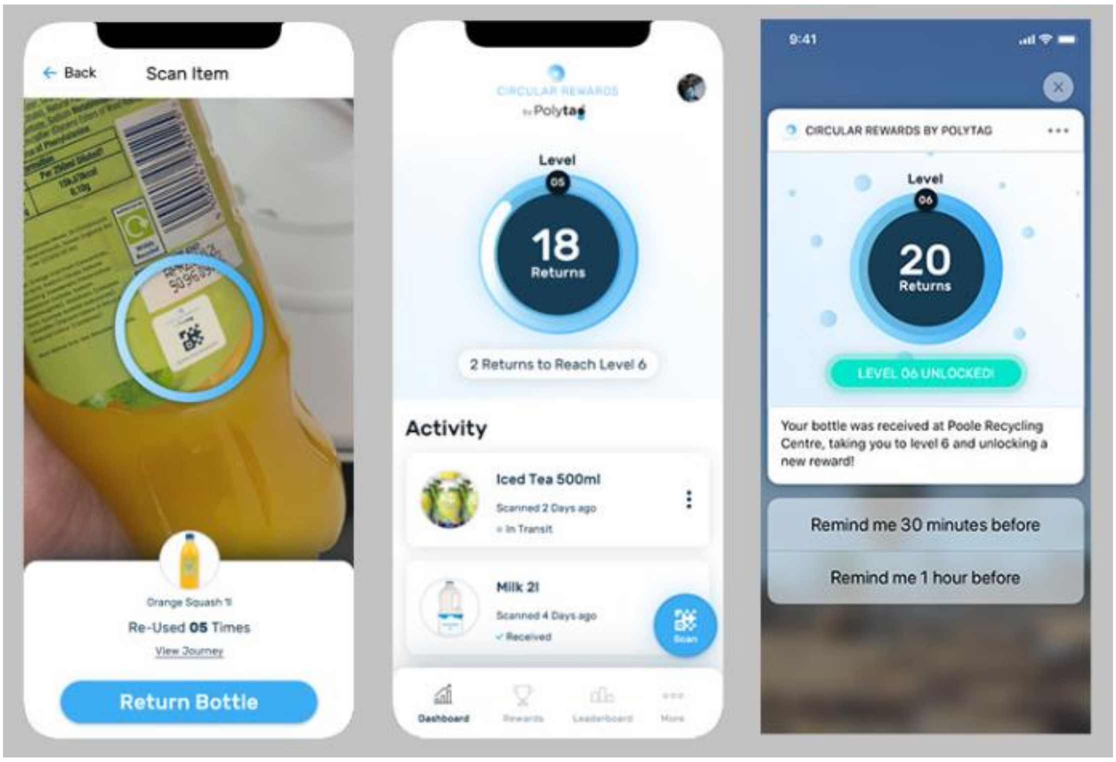
The Whitehead trial was based on rewards rather than deposits that are returned. The trial involved 47,000 labelled items, so it was quite extensive and was designed to prove that the technology worked on all items. The time period was too short to prove a high return rate as a large portion of the stock remained on the shelves of the supermarket long after the trial was finished. Also, as there was no deposit paid, customers were not fully incentivised to scan all items as they placed them in their recycling bins. So it was successful in it aim, which was to prove that the technology works.

### *3.4.2 Welsh Trial*

Cryptocycle is not the only technology provider in this field. The IWMA has also engaged with EconPro, a technology company that also provides a Smart DRS solution called PolyTag.

The Polytag smart DRS uses the same QR code combined with block-chain technology for tracing of packages as Cryptocycle, but is also developing a printing process to 'tag', at the point of manufacturing specific packages. The tracing function will be facilitated through the use of a Polytag mobile phone app which enables consumers to scan the Polytag QR codes. We provide an image of the PolyTag App below.

**Photo 2 – PolyTag App used for tracing packaging items**




EconPro is engaged in a Smart DRS Pilot Project in Conwy in Wales in partnership with the Welsh Government and WRAP. The trial will cover 550 houses and involves supplying houses with water bottles labelled with unique codes and tracking the return of those bottles.

### *3.4.3 IWMA Digital DRS Trial*

The IWMA, in conjunction with Beauparc (Panda Recycling) and Cryptocycle, will shortly commence a trial to prove that Digital DRS works in Ireland and a high return rate can be expected. The trial will engage 200 households from Panda's domestic waste collection business in North Dublin.

This trial will build on the learnings from previous trials designed to prove the Smart / Digital DRS technology but will ensure that consumers pay a deposit and have the facility to redeem that deposit. The trial will also track the packaging materials from delivery, consumer, collector and arrival at a sorting facility.

The primary goal of the trial is to prove that consumers will engage easily and conveniently with the Digital DRS and will claim deposits on a high percentage of materials, giving confidence that future recycling targets for packaging waste and single use plastics can be met using this system.

The trial will be carried out using milk, as milk is perishable. Milk must be used in 7 days or discarded, either way the packaged will hopefully be recycled. The trial will utilise a milk delivery service with Digital DRS coded packages delivered to participants doors.

Participants will sign up to the scheme, install the app and label their bin before they receive delivery of coded packages of milk.

Participants will pay for the milk, 75c per litre, and pay a 25c deposit. Milk will be delivered 2 times per week for 4 weeks and the cost of the Milk will be added as a separate line item to the participant's Panda services bill. Return of the 25c deposit will be clearly shown on the following bill once the milk is consumed and the packaging returned to the domestic recycling bin.

All 200 participants will have the same bin collection day. Panda will send a dedicated truck with crew to collect these bins separately on the normal day participants expect to put out their bin. This will facilitate the package recovery / verification part of the trial.

The material will be tipped in Panda's MRF in Ballymount where it will be sorted by hand to recover the returned materials and to verify that users used the scheme correctly.

The trial will be completed within 6 to 8 weeks of commencement and the results should be openly available early in Q3 2021.

## 4.0 QUALITY ISSUES

In early discussion on a DRS, the packaging producers expressed concern about the quality of recycled PET sourced from co-mingled dry recyclable collections, which are prevalent in Ireland and would be used in a Digital DRS.

We have engaged extensively with Clean Tech UK on this issue. Clean Tech is part of the Plastipak group, a global leader in plastic recycling with 60 facilities worldwide. Plastipak operates 4 global recycling centres utilizing the most advanced recycling technologies in converting collected and recycled plastic containers into high-quality post-consumer recycled PET resin and HDPE resin. Post-consumer recycled resin is converted back into containers for food, laundry detergent, household cleaners and other common products.

Clean Tech has reassured us that the rPET from co-mingled dry recycling is processed to achieve an equivalent quality to rPET from conventional DRS systems with an equivalent quantity of food grade PET produced. The processing steps are different due to the mix of materials in co-mingled collections, but the same quality of rPET can be achieved and this has been proven at a Plastipak facility in France that processes large quantities of rPET sourced from co-mingled dry recyclable collections.

The IWMA can provide further information on the quality issue upon request.

We hope that this submission is helpful and we look forward to further positive engagement with the DECC on this and other issues.

Yours Sincerely,

[redacted]

[redacted]

[redacted]

www.iwma.ie

**encl.**
SLR Report entitled "*HIGH LEVEL STUDY TO ASSESS THE CARBON IMPACTS OF SMART DRS*", published May 2021.

# HIGH LEVEL STUDY TO ASSESS THE CARBON IMPACTS OF SMART DRS

Irish Waste Management Association

SLR Ref: 501.00181.00009
Version No: Final
May / 2021

# BASIS OF REPORT

This document has been prepared by SLR with reasonable skill, care and diligence, and taking account of the manpower, timescales and resources devoted to it by agreement with the Irish Waste Management Association (the Client) as part or all of the services it has been appointed by the Client to carry out. It is subject to the terms and conditions of that appointment.

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# CONTENTS



# DOCUMENT REFERENCES

## TABLES



## FIGURES



## APPENDICES

None

# 1.0 Introduction

Deposit Return Schemes (DRS) involve the purchaser paying a deposit on a beverage container at the point of purchase, with the deposit being redeemed once the empty container is returned to an approved location. Introduction of DRS aims to increase capture rates of the target materials for recycling. In the Republic of Ireland the proposed DRS is to include PET drinks bottles and aluminium cans.

The potential for the development of DRS in the Republic of Ireland (ROI) has been set out in a report titled 'Improving the Capture Rate of Single Use Beverage Containers in Ireland' prepared for the Department of Communications, Climate Action & Environment (DCCAE) by Eunomia Research & Consulting in November 2019. The report proposes the adoption of a conventional DRS whereby empty containers are returned to locations with reverse vending machines (RVMs) or in the case of smaller outlets a manual system of returning deposits.

The Irish Waste Management Association (IWMA) has identified that (as an alternative to a conventional DRS) a Smart DRS (or digital DRS) could be implemented in the ROI in order to deliver the higher recycling levels for PET drinks bottles and aluminium cans. A Smart DRS would largely operate using a smartphone application (with unique codes placed on beverage containers and on existing bin infrastructure to track returns and deposit refunds) and would be supplemented with a small number (compared to conventional DRS) of RVMs at strategic locations.

A Smart DRS system has the potential to deliver the same benefits as a conventional DRS scheme in terms of materials captured, with (largely) the use of existing infrastructure and existing waste collection solutions. Smart DRS therefore has the potential to deliver a DRS scheme with a lower carbon impact than a conventional DRS.

A Smart DRS system also offers significant opportunities to easily introduce new items to the DRS in the future, whereas a conventional system would require more wholesale changes to infrastructure (and at present cannot handle non-cylindrical container shapes). This study however focusses only on the capture of PET bottles and aluminium cans to ensure a like for like comparison is achieved.

## 1.1 Purpose of Study

The outputs of this study are intended to help inform the debate surrounding whether a conventional or Smart DRS system should be implemented in Ireland. This study provides a view of the environmental impacts of both systems in terms of carbon impact.

The details provided in the Eunomia Report for DCCAE are used as the basis to assess the conventional DRS that is proposed and we compare that with a Smart DRS system that seeks to achieve the same result in capturing the target materials. The conventional and Smart DRS systems are compared in terms of carbon impacts. The results presented in this briefing note are a high level assessment and are by no means intended to be a full life cycle assessment / carbon footprint analysis of both the conventional and Smart DRS systems.

The study outputs do however allow the determination of whether a Smart DRS has the potential to offer carbon impact benefits over and above the implementation of a conventional DRS.

# 2.0 Methodology and Assumptions

This section summarises the methodology and assumptions including source reports utilised to characterise the conventional and Smart DRS systems, the scope of the carbon assessment (including inclusions / exclusions), an overview of the elements assessed in the carbon calculation model and key assumptions, and also details of the carbon intensity factors (CIFs) utilised.

## 2.1 Source Reports for the Characterisation of the DRS Systems

### 2.1.1 Conventional DRS

The report titled 'Improving the Capture Rate of Single Use Beverage Containers in Ireland' prepared for the Department of Communications, Climate Action & Environment (DCCAE) by Eunomia Research & Consulting in November 2019 has been utilised to characterise the key features of the conventional DRS system and its infrastructure and logistics requirements.

### 2.1.2 Smart DRS

The Irish Waste Management Association (IWMA) 'submission to the Department of Environment, Climate & Communications on the potential development of a deposit return scheme in Ireland' (date 12th November 2020) has been utilised to characterise the key features of the Smart DRS system.

## 2.2 Study Scope

The above two reports were reviewed for key relevant parameters which would result in a carbon impact. The information and data available / extractable in the reports (and associated appendices) were utilised to characterise the two options to be compared (the conventional DRS and Smart DRS).

The key elements of the DRS systems are summarised in Table **2-1** below, with commentary for conventional and Smart DRS systems provided in column 2 and 3 respectively; column 4 details where elements were scoped out of the study and provides the justification for this decision.

**Table 2-1**
**Characterisation of Conventional and Smart DRS Systems.**

| Element | Conventional DRS | Smart DRS | Scoped In or Out |
|---|---|---|---|
| **Positive Carbon Impact** | Recycle 90% of PET Bottles and Aluminium Cans | Recycle 90% of PET Bottles and Aluminium Cans | Scoped out, as the result will be the same for both conventional and Smart DRS. |
| **Installation of collection infrastructure** | Roll-out 2,592 RVMs at 1,915 main supermarket premises and 13,809 additional manual collection points at supermarkets, petrol stations, cafes, hotels, convenience stores, etc. (these are all new and specifically designed for the conventional DRS) | Use existing mixed dry recycling (MDR) Bins at houses, apartments and business premises.<br><br>Introduce c.500 RVMs at CA sites, shopping centres, train stations, airports, sports arenas, etc. | Scoped in. |

| | | | |
|---|---|---|---|
| **Delivery of materials to collection points** | Assume a % dedicated trips to the RVMs or take-back points (as currently occurs with glass banks) due to participant behaviour / limited storage space in dwellings. | No need for dedicated trips. Containers can be returned at home, in work, on the street, at events, in train stations, at entrance to park, etc. | Scoped in. |
| **Transport of Materials to Sorting Centres** | Based on collection from 15,724 drop-off points to 5 centralised Sorting Centres. Manual drop-off points will have uncrushed containers in bags/cages. RVMs will have compacted items. | Collection of materials from 500 RVMs located at CA sites, shopping centres, train stations, airports, sports arenas, etc. These would be compacted materials delivered to existing MRFs. | Scoped in. |
| **Sorting Centres/MRFs** | 5 new Sorting Centres to be developed. | No new sorting centres needed. Smart DRS option to account for increased throughput at existing MRFs. | Scoped in. |
| **Quality of Materials** | Higher quality. | Relies on a higher level of sorting to reach high quality, but food grade raw materials can be produced. Allow for additional plastics sorting equipment at front end of plastic flake manufacturing facility for the processing of material collected co-mingled. | Scoped in. |
| **Other** | Impact of printed voucher receipts from RVMs (paper and ink); electricity consumption associated with central computer systems / data centre storage. | Electricity consumption associated with central computer systems / data centre storage. | Scoped out of high level carbon assessment. Complex calculations, with both options requiring data management. Assessment is conservative as arguably the conventional system (which produces printed receipts) would have a greater carbon impact for this element. |

## 2.3 Carbon Calculation Model and Key Assumptions

A carbon calculation model was developed in Microsoft Excel to assess each of the elements identified above which were scoped into the assessment. Data regarding the key elements of the respective DRS systems were extracted from the source reports. Where the required data was not explicitely stated in the reports, the key elements / sub-elements were researched / calculated. Where required, interim calculations were undertaken before carbon intensity factors (CIFs) were applied in order to detemine the carbon impact of the element / sub-element.

Where some uncertainty exists regarding the element or component assumptions, a lower, middle and upper assumption were sourced / calculated. This provides a range of outcomes for the overall results of the carbon assessment to show the potential range of carbon impacts resulting from the conventional and Smart DRS systems.

The key elements, sub-elements and assumptions contained within the carbon calculation model are detailed in Table 2-2 below.

**Table 2-2**
**Key Model Assumptions.**

| Element | Sub-element | Conventional DRS | Smart DRS |
|---|---|---|---|
| **Installation of collection infrastructure** | Number of Locations | Installation of 2,592 RVMs and 13,809 manual collection points. | Installation of 500 RVMs |
| | Space requirement | Each RVM assumed to require 1m$^2$ of floorspace for RVM and a further 3m$^2$ of floorspace back of house for storage or recyclables awaiting collection.<br>Manual collection points assumed to require 1m$^2$ of back of house area for storage of recyclables awaiting collection. | Assumption as per conventional DRS for the RVMs. |
| | Electricity requirement for RVM operation | Calculation of annual electricity demand per RVM unit based on supplier data. | Assumption as per conventional DRS. |

| Element | Sub-element | Conventional DRS | Smart DRS |
|---|---|---|---|
| **Delivery of materials to collection points** | Distance driven for dedicated trips by householders to deliver containers to RVMs or manual collections points. | Number of beverage containers recycled divided by 15 (number of containers collected by a household before visiting a RVM or manual collection point) to derive the total number of visits annually.<br>Total number of visits multiplied by assumed proportion of dedicated visits[1] applied (lower, middle and upper assumptions applied[2]), and then multiplied by an assumed distance to RVM or manual collection point to derive total annual distance driven for dedicated trips to collection points.<br>Distance to collection points weighted based on population within Ireland living in urban, town/village and rural locations (also lower, middle and upper assumptions applied[3]). | Assumed that 10% of households do not want to use smartphones. Total number of visits annually (as calculated in conventional DRS) multiplied by 10%, then multiplied by proportion of dedicated visits (approach as per conventional DRS) and then multiplied by assumed round trip distance of 10km (given that the Smart DRS system will have a lower density of RVMs). |
| **Transport of Materials to Sorting Centres** | Number of vehicle trips required from RVMs | Tonnage of material collected in RVMs divided by density of compacted material to derive total collection volume. | Assumption as per conventional DRS, however tonnage collected in RVMs proportioned from 2,592 RVMs in conventional DRS to the 500 RVMs in Smart DRS. |

[1] A 'dedicated' visit or trip is one where the only purpose of the journey is to return the beverage containers to reclaim the deposit. We assume that the majority of trips made to reclaim deposits are combined with shopping trips and are not 'dedicated' solely to returning beverage containers.

[2] 20%, 30% and 40% respectively, which are considered to be conservative.

[3] Weighted average distance resulted in 2.2 km, 3.1 km and 4.0 km respectively, which are considered to be conservative.

| Element | Sub-element | Conventional DRS | Smart DRS |
|---|---|---|---|
| | | Collection volume divided by HGV volume (90% utilisation of $86m^3$) to obtain the optimised vehicle trips required per annum. | |
| | Number of vehicle trips required from manual collection points. | As above, albeit density factors for uncompacted material used and volume of smaller collection vehicle (90% utilisation of $39m^3$) applied. | N/a as no manual collection points required in Smart DRS system. |
| | Distance travelled transporting materials to sorting centres | Average vehicle trip distance calculated based on area of ROI and 5 sorting centres. Approach assumes even spread of infrastructure, which is simplistic but suitable for a high level study. | Average vehicle trip distance calculated based on area of ROI and 9 MRFs. Approach assumes even spread of infrastructure, which is simplistic but suitable for a high level study. |
| **Sorting Centres/MRFs** | Additional infrastructure development and operational impacts associated with the 5 new sorting centres. | CIF applied to all tonnage captured as redirected away from existing MRFs to new sorting centres. | N/a no new sorting centres being developed. |
| | Additional operational impacts associated with the increased tonnage (directly associated with Smart DRS implementation) being processed through MRFs. | N/a no use of existing MRFs. | CIF applied to increased tonnage captured over and above current estimated recycling rates. |

| Element | Sub-element | Conventional DRS | Smart DRS |
|---|---|---|---|
| **Quality of Materials** | Electricity requirement for equipment associated with additional sorting of PET from co-mingled collections to meet specification of flake manufacturing. | N/a PET derived from conventional DRS assumed to meet standards without additional processing. | An additional pre-sort using an extra optical sorting machine may be required for PET delivered from co-mingled collections. Electricity requirement of such equipment derived from SLR in-house database of MRF equipment (ultimately sourced from equipment suppliers). CIF applied to tonnage from comingled collection (i.e. PET from RVMs does not require the pre-processing). |

## 2.4 Carbon Intensity Factors

**The CIFs have been derived from a number of published sources or generated in Life Cycle Assessment (LCA) model software. Table 2-3 below summarises the source of the CIF values utilised in this assessment against each element / sub-element.**

**Table 2-3**
**Carbon Intensity Factor Sources.**

| Element | Sub-element | Conventional DRS | Smart DRS |
|---|---|---|---|
| **Installation of collection infrastructure** | Space requirement | Due to the ever competing space demands of retail units (and equivalent commercial spaces) it is assumed that any space required by RVM equipment and back of house storage will result in the development of equivalent floorspace to ensure no net reduction in commercial area available.<br>The capital carbon impacts of developing the floorspace (in terms of materials, construction, maintenance and end of life, but excluding any operational burdens (and therefore results are conservative)) is derived from the study 'An assessment of carbon emissions from retail fit-out in the United Kingdom', Fieldson & Rai (2009). | |
| | Electricity requirement for RVM operation | The GHG emission factors for electricity generation have been utilised from the UK Government GHG Conversion Factors for Company Reporting 2020 dataset. | |

<table>
<tr><th>Element</th><th>Sub-element</th><th>Conventional DRS</th><th>Smart DRS</th></tr>
<tr><td>Delivery of materials to collection points</td><td>Distance driven for dedicated trips to deliver containers to RVMs or manual collections points.</td><td colspan="2">The GHG emission factors for an average car / passenger vehicle have been utilised from the UK Government GHG Conversion Factors for Company Reporting 2020 dataset.<br>Emissions data was proportionally weighted between different vehicle types (i.e. petrol, diesel, hybrid etc) based on ROI vehicle types data sourced from a report by ACEA (the European Automobile Manufacturers Association) titled ‘Vehicles in Use Europe’, published January 2021.</td></tr>
<tr><td>Transport of Materials to Sorting Centres</td><td>Distance travelled transporting materials to sorting centres</td><td colspan="2">The GHG emission factors for goods vehicles have been utilised from the UK Government GHG Conversion Factors for Company Reporting 2020 dataset.<br>Due to the complexity associated with how vehicle collection rounds would be developed, the emissions factor for ‘average laden’ was selected for this high level study.</td></tr>
<tr><td>Sorting Centres/MRFs</td><td>Additional infrastructure development and operational impacts associated with the 5 new sorting centres.</td><td>The LCA software Waste and Resource Assessment Tool for the Environment (WRATE) was utilised to obtain a CIF for the development and operation of a MRF. It is assumed that the sorting centres will be similar in nature to a MRF with sorting equipment, compaction and balers.</td><td>N/a</td></tr>
</table>

| Element | Sub-element | Conventional DRS | Smart DRS |
|---|---|---|---|
| | Additional operational impacts associated with the increased tonnage (directly associated with Smart DRS implementation) being processed through MRFs. | N/a | Data regarding tonnage processed and electricity consumed was obtained from a number of MRF operators in the ROI over a 3 to 5 year period. The analysis of this data showed that there were numerous site related factors that impacted energy consumption over and above a basic throughput : energy consumed relationship. As such, components[4] of the results for a MRF from the WRATE software were utilised – this recognises that although an increased throughput associated with higher capture rates from DRS does not necessarily translate to additional electricity demand from the MRF, it will result in increased demands in certain areas such as fuel consumption for mobile plant, bale wire usage, maintenance materials. |
| **Quality of Materials** | Electricity requirement for equipment associated with additional sorting of PET from co-mingled collections to meet specification of flake manufacturing. | N/a | The GHG emission factors for electricity generation have been utilised from the UK Government GHG Conversion Factors for Company Reporting 2020 dataset. |

The carbon impact modelling is conservative, as it does not take into consideration the carbon impacts of manufacturing the 2,592 RVMs.

The CIFs include those gaseous compounds that are known to contribute to the warming of the atmosphere, the so called ‘global warming’ effect. The most common greenhouse gas is carbon dioxide (CO2) however other species, primarily methane (CH4) and nitrous oxide (N2O), can be significant.

[4] direct process burdens, maintenance material input, maintenance material output, operational material input and operational water input.

The degree to which a greenhouse gas contributes to global warming is measured by its Global Warming Potential (GWP). This is a relative scale which compares the gas in question to that of the same mass of carbon dioxide (whose GWP is, by definition, 1).

A carbon impact (sometimes referred to as a carbon footprint) is expressed in the form of mass carbon dioxide equivalency (CO2e or CO2eq), a concept that describes, for a given mixture and amount of greenhouse gas, the amount of CO2 that would have the same global warming potential. The carbon dioxide equivalency for a gas is obtained by multiplying together the mass and the GWP of the gas.

Where possible, the CIFs utilised in this assessment were $CO_2$e, carbon dioxide equivalents, to ensure all greenhouse gas species were accounted for.

# 3.0 Results and Commentary

The results of the carbon calculation model are presented and discussed below. As detailed previously, the results are presented as carbon dioxide equivalent, and the summary results are presented in tonnes ($tCO_2e$).

Having obtained or calculated the elements / sub-elements identified in Table 2-2 (in the units tonnes, km, kWh etc) and identified appropriate CIFs as presented in Table 2-3 (which are in units kgCO2e per tonne or km or kWh), the elements / sub-elements are multiplied by the CIFs to derive the carbon impact result for each element or sub-element. All sub-element or element carbon impacts are summed to derive the total carbon impact result for each option. The results are then converted from $kgCO_2e$ to $tCO_2e$ for ease of reporting.

## 3.1 Total Negative Environmental Impact of Conventional and Smart DRS

We recognise that recycling beverage containers has a positive environmental impact in carbon terms and in this report we assume that the positive impact is equal for both Conventional and Smart DRS, as both should achieve a minimum 90% recycling rate for the target materials. This report is solely focussed on the negative environmental impacts associated with each option, so our results do not estimate the total carbon impact, they estimate the difference in the carbon impact between options.

The total negative environmental impact is presented in Figure 3-1 below for both the conventional DRS and Smart DRS systems. As lower, middle and upper assumptions were applied in some cases, the results are presented as a range, with the dark grey dash in the figure (and subsequent figures) representing the medium value.

Figure 3-1 clearly shows that the development of a conventional DRS would result in significantly higher carbon impacts (i.e. negative environmental impact) than adoption of a Smart DRS (which would use largely existing infrastructure and established logistics systems).

The conventional DRS is estimated to generate between circa 17,500 and 38,000 $tCO_2e$, with a medium value of circa 26,000 $tCO_2e$. By comparison, a Smart DRS system is estimated to generate between circa 4,500 and 8,000 $tCO_2e$, with a medium value of circa 6,250 $tCO_2e$.

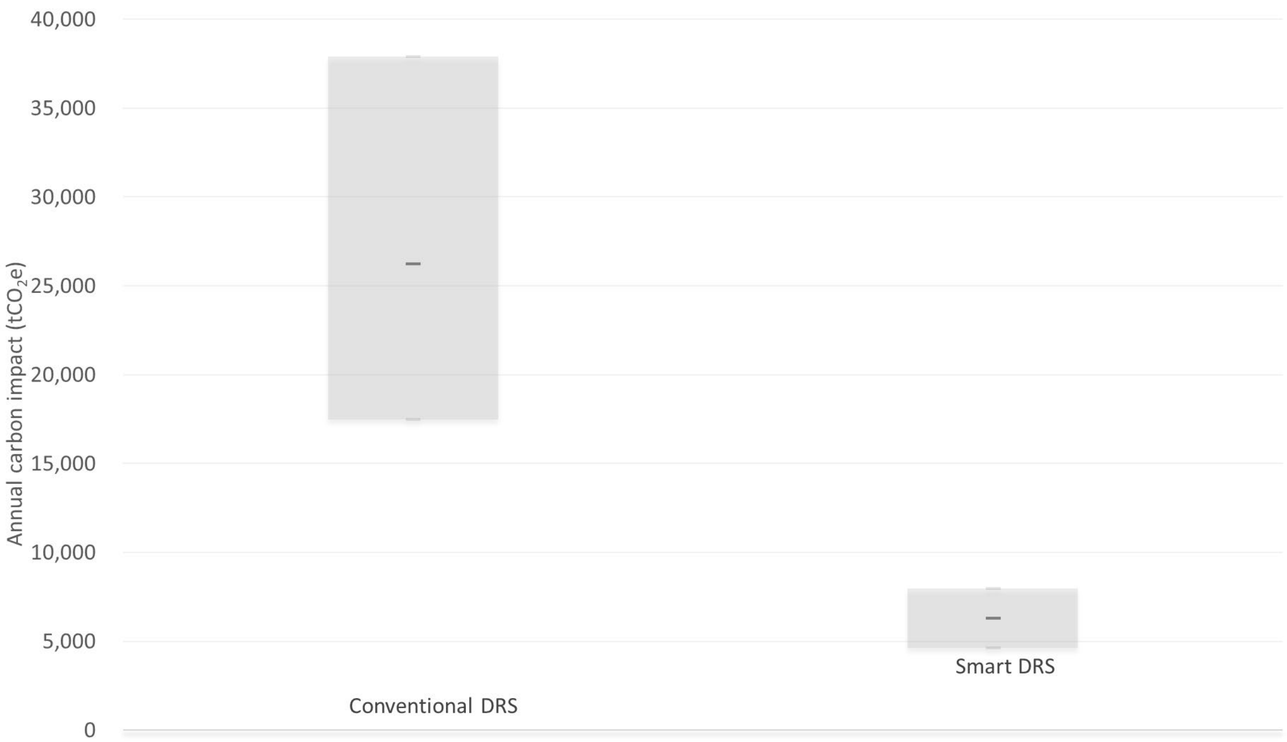


**Figure 3-1**
**Total Negative Environmental Impact of Conventional and Smart DRS Systems**

## 3.2 Carbon Impact by Component Elements

Figure 3-2 and Figure 3-3 below show the breakdown of the carbon impact by element for the conventional DRS and Smart DRS respectively.

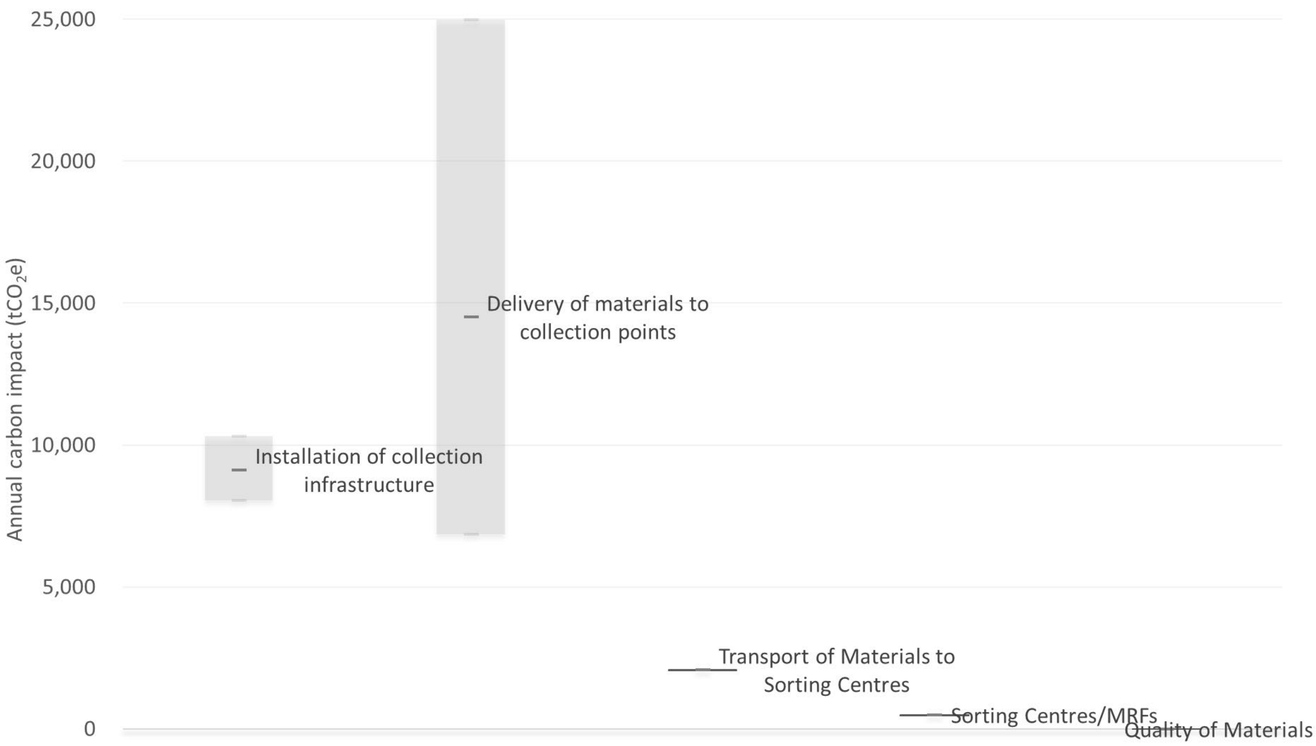


**Figure 3-2**
**Conventional DRS – Breakdown of Carbon Impact by Element**

The largest component of the carbon impact for the conventional DRS is associated with the delivery of materials to collection points. The carbon impact of the dedicated trips to RVMs and manual collection points account for between 39% and 66% of the estimated total carbon impact.

As containers will have to be stored at home uncrushed (to enable return to RVM or manual collection point, with latter then have to be processed by counting machine) these containers will be bulky in nature, and as such SLR considers that the assumptions applied in the carbon modelling are conservative; given the bulky nature of the containers (and the potentially limited storage space in some homes) trips might have to be more frequent and a higher number of dedicated trips may occur.

The second largest component of the carbon impact is the installation of the collection infrastructure. This carbon impact is a combination of the development of new floorspace and the electricity requirements of the 2,592 RVMs to be installed (the latter being the dominant impact).

The other components of the conventional DRS system result in relatively modest carbon impacts when compared to installation of collection infrastructure and delivery of materials to collection points.

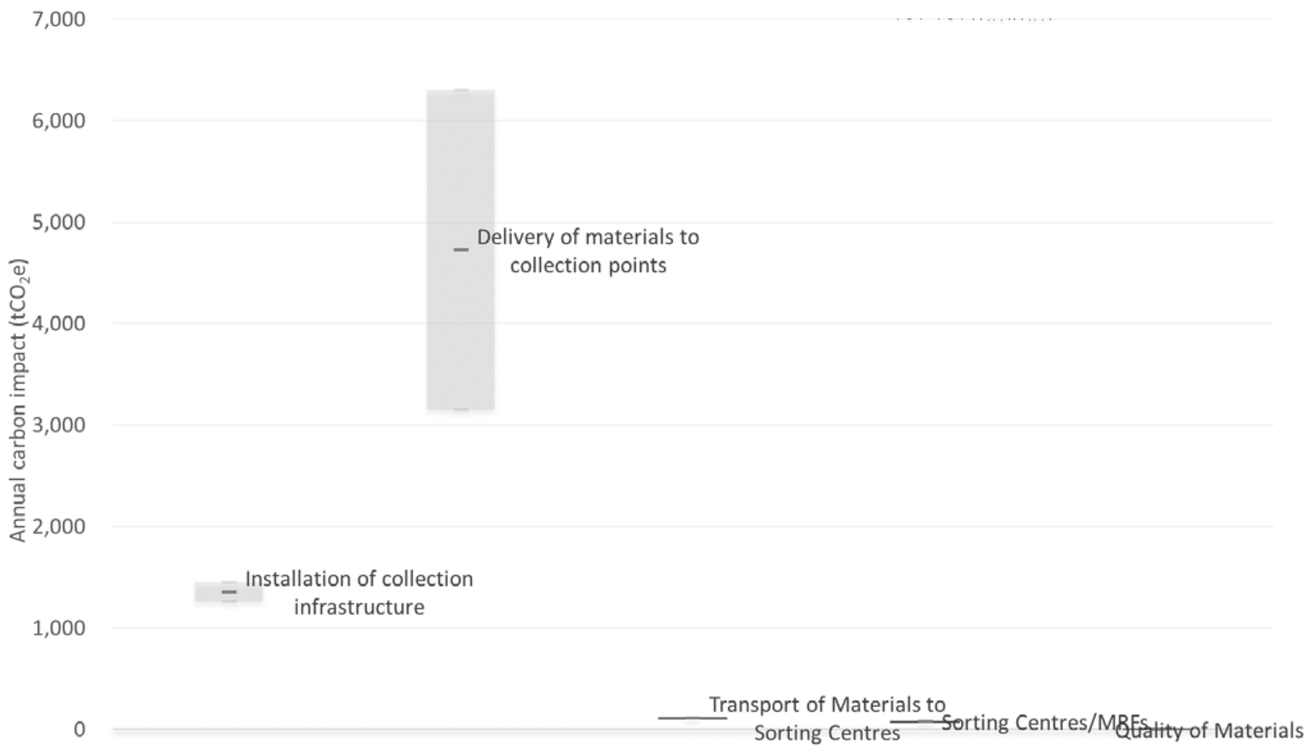


**Figure 3-3**
**Smart DRS – Breakdown of Carbon Impact by Element**

In the Smart DRS system, the carbon impact is also dominated (circa 68-79% of the total carbon impact) by the delivery of materials to collection points; this accounts for an assumed longer dedicated trip distance as the 500 RVMs will have a lower density than in the conventional DRS system.

## 3.3 Net Benefit of Smart DRS

When comparing the carbon impacts of a Smart DRS system to those of a conventional DRS (the baseline system assumed to be implemented), a Smart DRS system would deliver a net benefit of circa 20,000 $tCO_2e$ per annum (with a net benefit range of between circa 13,000 and 30,000 $tCO_2e$ per annum), as shown in Figure 3-4.

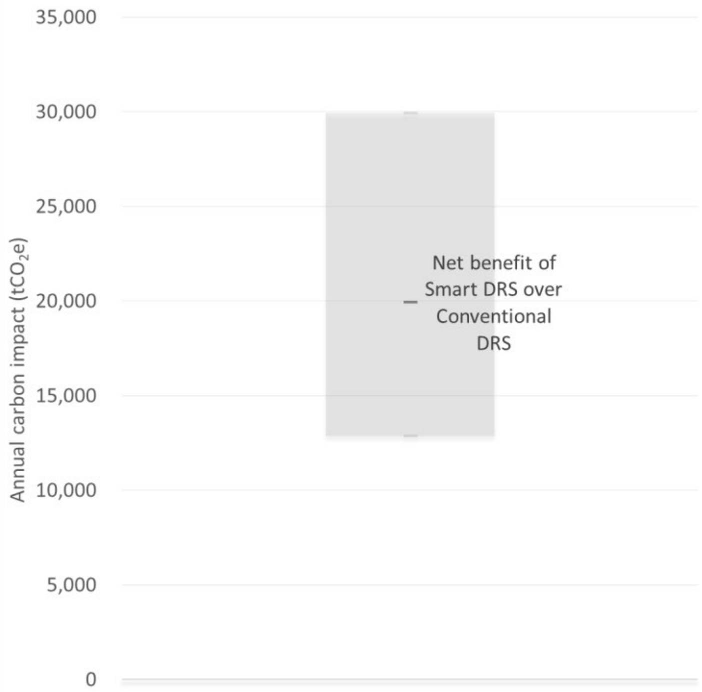


**Figure 3-4**
**Net Benefit of Smart DRS Compared to Conventional DRS**

This high level carbon impact analysis, which is conservative with respect to many of the assumptions applied, clearly demonstrates that the implementation of a Smart DRS system would have a lower environmental impact in terms of carbon emissions than implementation of a conventional DRS.

Conversion of the carbon saving of 20,000 tonnes of $CO_2e$ pr annum into something more meaningful in the real world is the equivalent to:

- 9,996 tonnes of coal burned each year:
  - If the coal was stockpiled on the pitch at the Aviva Stadium in a pyramid style it would be 6.5m high.
- 46,304 barrels of oil consumed each year:
  - This is equivalent to approximately 200 oil tanker articulated trucks which if lined up nose to tail would stretch 3.2km across Dublin City from The Custom House on the River Liffey to the People's Garden in the Phoenix Park.

In addition to the carbon impact benefits of Smart DRS, the other key benefits of Smart DRS over conventional DRS should be noted (which will deliver additional carbon impact benefits), including (but not limited to):

- The ability of a Smart DRS as a flexible and adaptable system to access other material streams (such as tetra pak and juice cartons) and thus deliver a further carbon benefit (this assessment is therefore a conservative estimate of the true potential of Smart DRS);
- Smart DRS has the ability to mobilise quicker and get peak carbon benefits sooner. The mobilisation period for conventional DRS will be slower (and therefore achievement of carbon impacts delayed) due to the ramp up period for manufacture and installation of 2,500+ RVMs and also the development timescales required for sorting centre infrastructure (site identification, planning, environmental permit, construction, commissioning and testing.

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