# Examining the Cost of Introducing a Deposit Refund System in Spain

## Final Report for Retorna

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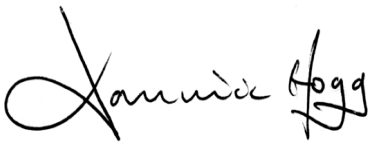

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*Disclaimer*

## Retorna

Retorna is a non-profit organisation comprised of social stakeholders, businesses, environmental NGOs and institutions, whose aim is to promote a sustainable production and consumption model, encouraging the recovery and recycling of waste. Retorna is founded on several key objectives:

1) To help develop "Zero Waste" policies with the goal of moving from the current "throwaway culture" to the maximised and efficient use of resources through the reuse and high-quality recycling of packaging high-quality materials.
2) To influence the implementation of policies, measures and instruments that promote the prevention, reuse and recycling of waste.
3) To contribute to the debate on the need to manage waste up the hierarchy and to find alternative waste treatment options to landfill for the waste that is not currently re-used or recycled.

In particular, Retorna's initial goal is to move towards the sound and efficient management of packaging waste in Spain, focusing on the following key activities:

1) Contribute to the discussion on the use of a deposit refund system for beverage packaging to enable maximum recovery and recycling of packaging materials in order to meet and exceed the rates established by law.
2) Facilitate open discussion on the potential social and economic impacts that may result from the need for further regulation and management of packaging waste.
3) Support projects and actions which promote increased awareness of the environmental impacts of current consumption and the factors to be considered in moving towards more responsible consumption patterns.

## Eunomia Research & Consulting

Eunomia is an environmental consultancy that supports positive change. Our clients, from both government and the private sector, turn to us for policy development and analysis, service design, procurement and review, technology and market assessment, bid development, regulatory compliance and project management.

*Policy Development* - Eunomia seeks to lead the way in policy formulation and implementation. We are able to marry perspectives from science, economics, politics and social science to bring forward practical proposals with the potential to deliver cost-effective benefits. We are recognised as leaders in understanding the direction and trajectory of waste and energy policy across the UK, Europe and beyond.

*Local Government* - Our technical skills, commercial experience and local government know-how mean our clients turn to us when they want to achieve high recycling rates and high levels of resident satisfaction as cost effectively as possible. In recent years we have worked with over 100 local authorities across the UK, supporting them with strategy development, contract procurements, partnership development, service efficiency reviews and service design.

*Private Sector* - We act on behalf of a range of organisations operating in the waste and energy sectors, including financial institutions, waste companies, utilities, property companies and technology providers. As a leader in understanding the direction of environmental policy, we are able to provide key insight to ensure that our clients are one step ahead and can make key commercial decisions quickly and effectively.

# EXECUTIVE SUMMARY

This report, commissioned by Retorna, investigates the financial consequences of the introduction of a deposit refund system (DRS) across Spain. The report comes at a critical time as Spain is reviewing its current waste policy, with the new Law on Waste and Contaminated Land, approved by Parliament on 14th July 2011, explicitly including the possibility of the introduction of a DRS for one-way (non-refillable) beverage containers. This report forms one of a series of reports looking at the impacts of the introduction of a DRS in Spain.[1]

Discussion regarding DRSs is often polarised between the views of ardent supporters, and those of equally vehement opponents. The available theoretical literature, however, suggests that such systems can be an efficient means of increasing recycling rates and reducing litter, though a key issue in moving from theory to practice is determining the costs of administering and implementing a DRS.

There are few doubts that, if well-designed, such a system could increase recycling rates for beverage containers in Spain. The objective of this study is to explore the financial implications of the implementation of a DRS in Spain, looking in particular at the following key elements:

1) The net cost effect to producers from the costs they would bear in the DRS compared with the reduction in payments they would need to make for the existing producer responsibility system;
2) The financial impacts on the retailers (note these are met by handling fees payable to the retailers for every container returned to them);
3) The economic benefits to local authority budgets of removing their need to collect deposit-bearing packaging (including street sweeping); and
4) The potential cost to the consumer (including any unclaimed deposits which would contribute towards the running costs of the DRS).

This report does not consider the environmental costs and benefits of a DRS; these are covered elsewhere in a separate report commissioned by Retorna.[2] The focus of this report is on the financial consequences only. However, it does highlight the increases in recycling which could be expected from such a scheme.

[1] The other reports are Inèdit (2011) *Análisis de Ciclo de Vida de la gestión de residuos de envases de PET, latas y bricks mediante SIG y SDDR en España*, available at http://retorna.org/mm/file/Documentacion/febrero2011_estudiocompletoACV.pdf ; and ISTAS (2011) *Estimación del empleo potencial en la implantación y desarrollo de la primera fase del SDDR en España*, available at http://retorna.org/mm/file/Documentacion/EstudioEmpleo.pdf.

[2] Inèdit (2011) *Análisis de Ciclo de Vida de la gestión de residuos de envases de PET, latas y bricks mediante SIG y SDDR en España*, available at http://retorna.org/mm/file/Documentacion/febrero2011_estudiocompletoACV.pdf

# E.1.0 Approach

In order to examine the potential costs and savings associated with the introduction of a DRS in Spain, the basis of the approach was to establish mass flows of beverage containers for two Scenarios:

1) One without a DRS in place, reflecting current practice, and with beverage containers managed through collection systems supported by Ecoembes and Ecovidrio. This was the baseline scenario; and
2) One with the DRS in place, with the containers managed primarily through the DRS.

The modelling then considered the costs and savings associated with the move from the baseline scenario to the situation where the DRS was in operation.

The DRS was deemed to include:

A) Plastic bottles predominantly made from PET (Polyethylene Terepthalate) and HDPE (High-Density Polyethylene) e.g. carbonated soft drinks, mineral water, squash bottles, but *excluding* milk.

B) Metal cans, both steel and aluminium e.g. containers for fizzy soft drinks, alcoholic beverages, energy drinks etc.

C) Glass beverage containers e.g. beer bottles, soft drink bottles etc, but *excluding* wine and spirits bottles.

D) Beverage cartons e.g. soft drinks, including brands such as Tetrapak©.

As is made clear below, and in the Main Report, we modelled a Central Case, as well as a range of sensitivities (to explore the robustness of the analysis).

For the Central Case, we modelled that the household bring site system for containers would continue to operate in parallel to the DRS, but that householders would no longer place the majority of their deposit-bearing beverage containers in the kerbside system, instead deciding to put these containers into the DRS and claim back their deposits. Thus the existing bring site containers would fill less rapidly and therefore require less frequent emptying.

The deposit was set at €0.20 per container, irrespective of container size or material type. Based on deposits and return rates from other systems around the world, the return rate was plotted as a function of the deposit across existing schemes. In setting a deposit of €0.20 per container, the return rate for the system was therefore estimated to be 89%.

The system was modelled as requiring a collection point at most retail outlets that sell beverage containers, to ensure that a sufficient number of return points would be available to consumers in the Spanish system. To maintain comparability with the recently published Sismega summary report, the types and total numbers of grocery store outlets in Spain which might accept returned containers were based on data from the same source as used in that study (data provided by Nielsen, a global market research company).[3,4] To this was added data on the number of Horeca across Spain that might also sell beverage containers, but

[3] Sismega. S. L., (2011) *Untitled Document* looking at the analysis of the effects of introducing a DRS in Spain, accessed 15th July 2011, available at http://www.cecobi.es/images/prensa/Mon20110523154500SDDR.pdf

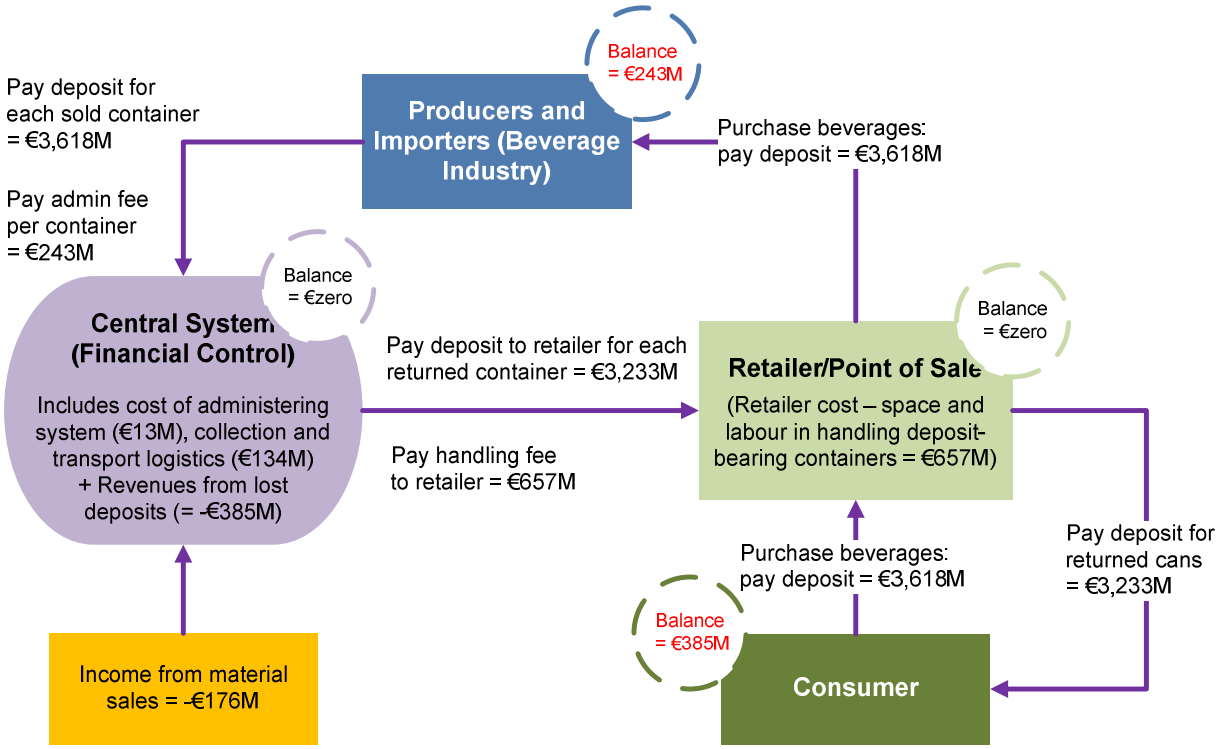
[4] 2010 data provided by Nielsen, covering all hypermarkets and supermarkets, traditional stores, restaurants and hotels, clubs, bars, pubs and cafes.

which were not considered as part of the Sismega summary report (namely food stores, gas stations/service areas/convenience stores and catering facilities in the workplace).[5,6,7]

## E.2.0 Key Findings

Figure E-1-1~~Figure E-1-1~~ illustrates the annual flows of money throughout the DRS for each of the key stakeholders involved in the system. Figure E-1-2 shows a breakdown of the ongoing costs of each of the key components of the system. The majority of the system costs are split between compensating the retailers for the loss of space and time in taking back DRS containers from consumers (the handling fee is calculated at €0.04 per container returned), and the system's internal costs of collection, clearing and logistics. The administration of the system only absorbs a small part of the overall system costs. At an 89% return rate and €0.20 deposit rate, the costs of the DRS are partially offset by the materials income received for the material collected through the DRS and by the unclaimed deposits that are forfeited by the consumers that choose not to return their containers into the DRS. The remaining balance of costs for the DRS is assumed to be met by producers in the form of an administration fee per container placed on the market. The on-going cost to the producers for the running of the DRS was calculated at €243 million per annum, which equates to €0.013 per container placed on the Spanish market.

Figure E-1-1: Cash Flows in the Spanish DRS, €millions



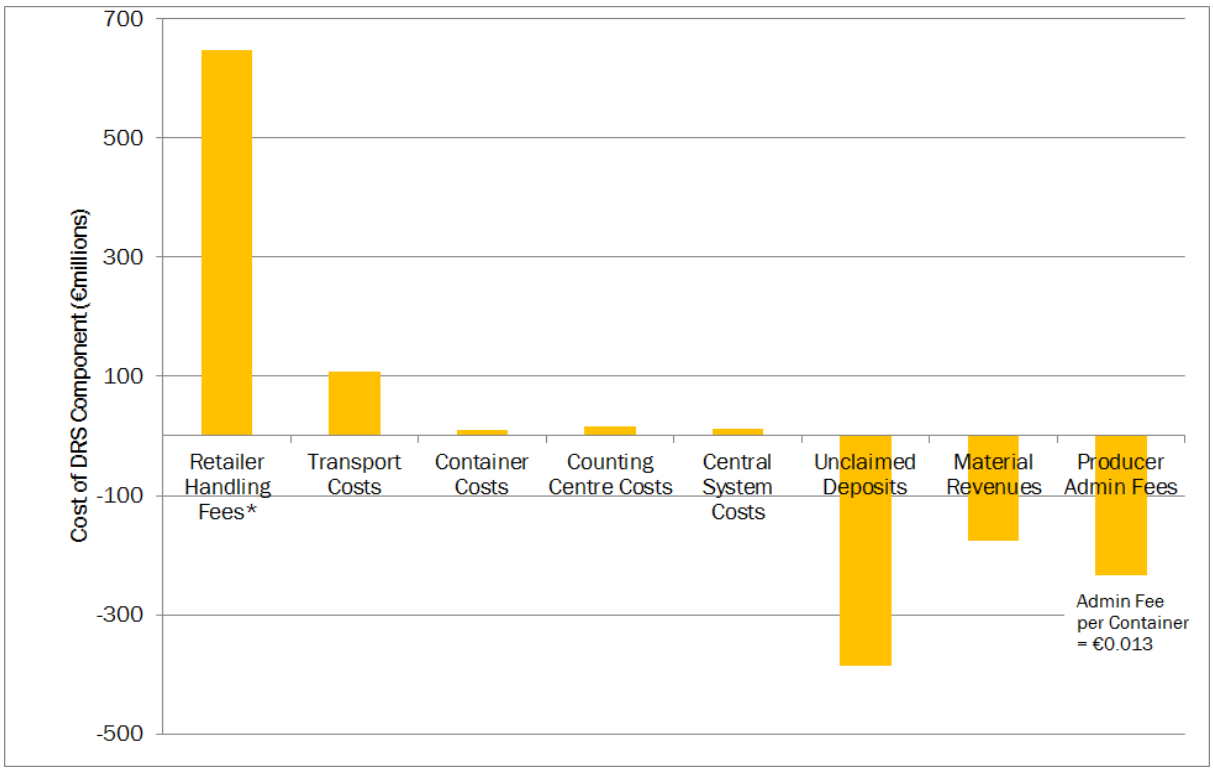

*Note negative figures indicate an income into the system, positive figures indicate a cost.*

[5] Fundación Hostelería de España (2010) *Los Sectores de la Hostelería en 2009.*

[6] La Caixa (2009) *Anuario Económico de España 2009,* available at http://www.anuarieco.lacaixa.comunicacions.com/java/X?cgi=caixa.anuari99.util.ChangeLanguage&lang=cat

[7] Alimarket (2010) *Informe anual Alimarket de Distribución 2010.*

Figure E-1-2: Cost of Each DRS Component, €millions




The calculation of the admin fees payable by producers for every container placed on the market varies from DRS to DRS. Whilst it might be argued that the collection costs for the different materials are unlikely to vary substantially, the material revenues subsequently obtained will vary quite significantly. The central system might, therefore, decide to vary the admin fees payable (through discussions with stakeholders and the shareholders of the DRS), with the fees adjusted periodically according to the material revenues generated from different beverage container material types. Based purely on the income that would be obtained for each material stream, Table E-1-1~~Table E-1-1~~ illustrates the resultant admin fees that would be payable according to material type. In reality, the Spanish government would need to be careful in how they structure their pricing mechanisms; lower admin fees for, for example, aluminium compared to steel may lead to beverage can manufacturers switching from steel to aluminium, and the government would need to take a view as to whether the resulting environmental impacts would be in keeping with the DRS as an environmental policy.

Table E-1-1: Varying Producer Admin Fees According to Material Revenue Generated

| | Aluminium | Steel | Plastic | Carton | Glass |
|---|---|---|---|---|---|
| Cost per Container (€) | €0.023 | €0.023 | €0.023 | €0.023 | €0.023 |
| Total Material Income (€m) | -€105.7 | -€6.2 | -€53.5 | €0 | -€10.9 |
| Income Per Container (€) | -€0.020 | -€0.005 | -€0.009 | €0.000 | -€0.003 |

| | | | | | |
|---|---|---|---|---|---|
| **Adjusted Admin Fee (€ per container)** | **€0.004** | **€0.019** | **€0.014** | **€0.023** | **€0.020** |

The figures given above do not, however, tell the whole story with regards to the overall financial impact from the introduction of a DRS in Spain. Whilst additional cost would be incurred in setting up the collection logistics for the DRS, the majority of the deposit-bearing containers would no longer be collected through the existing household and non-household collection systems, thereby resulting in financial savings for those systems. The key impact on collection logistics related to a reduction in the amount of packaging in the current bring site system is to reduce the fill rate of the bring sites, reducing the collection frequency required. There will also be similar effects on the collection of litter bins and commercial waste collections. The savings from this must also be combined with those derived from the avoided disposal of those containers which are currently collected in residual waste (and either recovered or sent to landfill), but which are subsequently collected and recycled in the DRS.

The wider financial impacts of the introduction of the DRS on the key stakeholders involved in or directly impacted by the DRS are illustrated in Figure E-1-3. Key comments on these are made below:

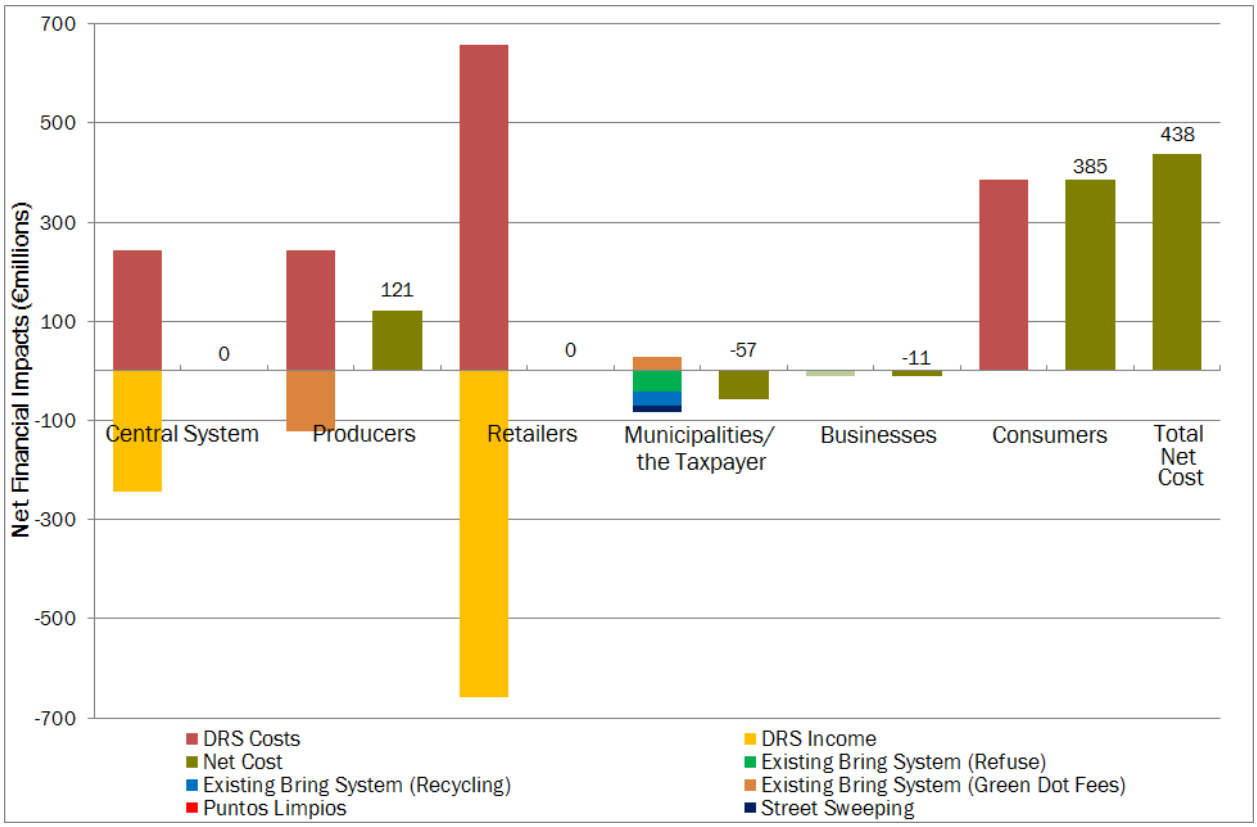
1. A government body authorising the system and associated finances, and setting recycling targets for the various materials
   The financial consequences for the Spanish Government should be minimal, as Government already has to set recycling targets and associated policies; the DRS and, potentially, associated recycling rate targets are means of delivering policy objectives. In terms of setting up the system, our expectation is that the DRS would be a not-for-profit entity designed and managed by relevant stakeholders, rather than this being the responsibility of the Government, so again there would be minimal financial impact on the Government.
2. A central organisation owned and run by (within the constraints set by the authorising body), for example, non-governmental organisations, industry bodies, producers, breweries and retailers (i.e. the 'central system')
   The costs of running the central system in the DRS amount to €12.8million per annum. This cost would be met through revenues accruing to the system.
3. The manufacturers of containers, producers of beverages and industries that 'fill' the containers (the 'producers')
   The producers incur an annual cost from the introduction of the DRS of €243 million (equivalent to a €0.013 per container admin fee). We have also modelled an additional one-off investment cost for producers of €1.7 million for the new labelling required for the DRS (in reality, this cost may be avoided by allowing a sufficient lead-in time for the introduction of the DRS so that producers can incorporate any changes as part of their periodical packaging/labelling re-design). It might also be argued that the producers will pay a significant portion if not all of the costs associated with setting up the DRS, the total cost of which is €31.3 million, which would be paid for through joining fees (though it is difficult to say exactly what percentage of the one-off set-up costs would be met by the producers, as it may be that other key stakeholders such as retailers also contribute towards the set-up costs).

   Although the producers incur a cost from the introduction of the DRS, in contributing to the DRS through admin fees, they will no longer be required to pay the existing Green Dot fees for that packaging which is considered in scope for the DRS. Based on the

existing Green Dot fees payable for different material types in the Ecoembes and Ecovidrio systems (which averages at €0.007 per container placed on the market), multiplied by the numbers of containers that would be included in the DRS, the producers would save a total of €123 million per annum in existing Green Dot fees. Thus the net overall financial impact on producers of the introduction of a DRS is €120 million per annum, equivalent to an additional €0.007 per container on top of what they currently pay for the existing Green Dot systems.

It is important to note that, based on our bring site modelling, we estimate the saving in the existing bring site packaging collection costs to be somewhat lower than the estimated reduction in Green Dot fees. If the reduction in Green Dot fees predicted here is in excess of the savings implied through reduced collection costs, this could leave a shortfall in funding the existing Green Dot schemes. In Germany, a similar effect was observed, and this shortfall was met by a combination of reduced overheads in the existing Green Dot schemes, tackling the issue of free-riders in the existing schemes and via improved efficiency of infrastructure. Another approach would be to raise the fees for the remaining packaging in the existing Green Dot schemes, but clearly this would be less preferable to producers.

Figure E-1-3: Wider Financial Costs and Benefits to each Key Stakeholder from the Introduction of the DRS, €millions




4. Any retailer which sells beverages (non-refillables) in Spain
   Based on the key cost components of the DRS, the costs to the retailer of the required space and resources for the DRS are by far the largest component of the total costs of the DRS (€657 million per annum). The cost to the retailer is fully reimbursed by the handling fees that are paid to the retailer by the central system on a per container

returned basis (equivalent to €0.04 per container returned). The handling fees compensate the retailer for the following:

a. RVM installation and operating costs;

b. Shop floor space used to house RVMs and to store returned containers; and

c. Labour costs associated with the emptying of RVMs, the manual take-back of containers by the cashier, and facilitating the pick-up of the returned containers by contracted logistics companies or the retailer's own haulage.

This includes a cost for additional labour for manual collections of €134 million; in reality, it could be argued that this is a somewhat conservative estimate, as staff employed by some retailers, particularly the smaller stores, will be likely to be able to absorb a significant amount of the time required for manual take back into their existing contracted hours without requiring additional payment. Nonetheless, this cost has been included here to ensure that the cost to the retailer is fully reimbursed by the handling fees that are paid to the retailer by the central system. Over time, as components such as the RVMs and any infrastructure alterations reach the end of their payback periods, the handling fees may effectively start to generate a net income for some retailers. The retailers may, however, be required to contribute to the initial set-up costs of the system via retailer joining fees (as noted in the discussion regarding 'producers' costs above).

5. <u>All consumers which purchase beverages in Spain</u>
The consumers who do not return the containers they purchase will lose the deposits they have paid into the DRS. At an overall 89% return rate, consumers would forfeit a total of €385 million of unclaimed deposits. In our model, this revenue helps fund the operation of the system. For this reason, it is important to have complementary targets in place to ensure that the system is not designed so as to 'deliberately underperform', and enable full funding through unclaimed deposits. With targets in place, the system would likely be designed with a deposit set at a rate designed to deliver the desired performance level, consistent with the level of infrastructure provision. The provision of many easily-reached return points should minimise the level of unclaimed deposits as long as the deposit it set at a reasonable level.

6. <u>Municipality/taxpayer</u>
Savings to the municipality/taxpayer are calculated from a combination of a reduction in residual waste bring site collection and disposal costs, and a reduction in street sweeping and puntos limpios operational and disposal costs. The total savings to the municipality/taxpayer amount to between €57 million per annum (at the current disposal cost of €36.17 per tonne) and €93 million per annum (assuming a higher disposal cost saving of €80 per tonne).

The introduction of the DRS may also result in additional savings to the municipality if/where the Green Dot scheme payments made by the PROs to the municipalities do not cover the full costs of the separate collection of lightweight packaging and glass at bring sites. Given the lack of detailed financial data on a municipality by municipality basis in terms of the costs of running each element of the bring site service compared to the payments received by the PROs, in order to provide a conservative approach we have assumed that the Green Dot fees paid to municipalities cover the full costs of these separation collection services. Thus, although the municipality saves money through the reduction in collection costs of lightweight packaging and glass, this is matched by a reduction in fees paid by the existing PROs to the municipality for those collections. However, further savings may be available to those municipalities which

currently have to meet the shortfall between PRO payments and running the separate collection schemes.

7. Businesses receiving Commercial Waste Collections
   Following the introduction of the DRS in Spain, we also modelled a small reduction in the tonnages of residual waste, lightweight packaging and separate glass obtained through commercial waste collections. A saving of between €11 million and €15 million per annum (depending on the assumed cost of disposal) was calculated to businesses for the reduction in collection and disposal costs associated with commercial waste collections.

The overall financial impact resulting from the introduction of a DRS in Spain is a net cost of between €398 million and €438 million per annum (depending on the avoided cost of disposal). The highest costs are met by those consumers that choose not to return their containers to the DRS in order to redeem their deposit i.e. in accordance with the 'polluter pays' principle. The municipality receives the greatest financial benefit from the introduction of the DRS in the form of avoided costs for the existing bring site residual waste collections, as well as from avoided street sweeping and litter bin emptying costs. In terms of improved recycling performance, the introduction of a DRS is projected to lead to an increase in recycling of the separately collected DRS-targeted packaging of 59 percentage points (from 33.7% to 92.5%), an increase of 18 percentage points (from 33.7% to 51.4%) in the overall separately collected recycling of metals, plastics and glass, and an increase of 14 percentage points (from 34.2% to 48.4%) in the overall separately collected recycling of all packaging materials across Spain.

In order to understand the robustness of the results, a series of sensitivity analyses were also undertaken around the financial costs of implementing the DRS. The key points to note from this analysis are as follows:

1) Varying the deposit from €0.15 to €0.25 only leads to a small (2%) variation in return rates, and hence a relatively small difference in system costs. A higher deposit must be levied in order to achieve a higher return rate, so these two factors (higher costs due to lower returns and lower costs due to higher deposit value) will play off against one another in determining the cost of the system. In this range of deposits/return rates, the admin fee payable by the producer is higher (€0.017) at a lower deposit value and the cost decreases (to €0.010) as the value of the unclaimed deposit increases. This assumes a weak response in the rate of return as the deposit changes. The analysis is sensitive to the shape of this curve. It would be prudent to retain the deposit at a reasonable level to ensure that the response rate is such as to deliver a high (around 90%) return rate;
2) The return rate has a particularly significant impact on the overall costs of the DRS. Other things being equal, a scheme with a higher return rate will lead to reduced revenues in the form of unclaimed deposits, with a corresponding increase in the revenue which must be raised from producers in the form of administrative fees. If the DRS were to achieve a 100% return rate, at a €0.20 deposit value, the revenue gap to be filled by administrative fees would increase from €243 million to €628 million, equivalent to an increase in admin fees from €0.013 to €0.035 per container placed on the market. On the other hand, if one assumes that the assumed return rate (89%) can be achieved based on a higher deposit, then this would mean that the value of the unclaimed deposits would increase and the administrative fees could be reduced.
3) Since DRS costs to producers are lower with lower return rates, it would appear sensible to introduce target recycling rates for these materials to encourage higher return rates from the system, and reduce the incentive for poor system design / inadequate

infrastructure. The effect of this is to lower the revenue generated from unclaimed deposits, thus leading to slightly higher administrative fees, but with the ultimate outcome that greater environmental benefits are delivered.

4) The number of Horeca assumed to be included in the DRS is a relatively important assumption; our lower end estimate would reduce the overall admin fee to €0.007 per container placed on the market. At the higher-end estimate, if we assume that 25% of clubs, pubs, restaurants and hotels, and 50% of cafeterias would need to be included, the admin fee increases to €0.018 per container. It will thus be important for the Spanish government to determine which stores are to be included within the DRS and, where retailers are considered outside the DRS, the rules that apply regarding whether or not they have to take back containers. The combined financial impact of varying the deposit rate and the proportion of Horeca that are assumed to be in the system is summarised in Table E-1-2.

Table E-1-2: Combined Impact of Varying both the Deposit Value and the Proportion of Horeca in the DRS on the Producer Admin Fee (€)

| | Low % Horeca Registered in the DRS | Central % Horeca Registered in the DRS | High % Horeca Registered in the DRS |
|---|---|---|---|
| Low Deposit (€0.15) | €0.011 | €0.017 | €0.021 |
| Central Deposit (€0.20) | €0.007 | *Central Case* €0.013 | €0.018 |
| High Deposit (€0.25) | €0.005 | €0.010 | €0.015 |

5) A significant number of variables are included in the cost benefit model. A simulation tool called Crystal Ball® was used to perform Monte Carlo analysis on the key inputs to the model and to determine the likely impact on the overall costs associated with introducing a DRS. This analysis showed that the overall costs associated with introducing a DRS in Spain i.e. the revenue required from producer administration fees has an 80% likelihood of lying between €137 and €349 million annually and that the net financial cost resulting from the introduction of a DRS in Spain has an 80% likelihood of lying between €329 and €541 million annually (based on the current average disposal cost of €36.17 per tonne).

## E.3.0 Conclusions

In modelling a potential deposit refund model for Spain, we were able to examine closely the costs and revenues that might be involved in the implementation of a DRS. Using existing examples, we estimated that a deposit of €0.20 would achieve a return rate in the region of 89% for the glass bottles, cans, PET bottles and cartons that we included in the DRS. Assuming that existing recycling performance would be maintained for packaging that remains in the household bring site collection system, we calculated that an 89% return rate in the DRS would result in an increase in the recycling of DRS-targeted packaging of 59 percentage points, an increase of 18 percentage points in the overall recycling of metals, plastics and glass, and an increase of 14 percentage points in the overall recycling of all separately collected packaging materials across Spain.

The overall annual running cost of the DRS (i.e. the amount of admin fees that would need to

be paid by the producer) was calculated at €243 million. With an assumed 89% return rate, the costs are distributed across producers in the form of a €0.013 administration fee on each container placed on the market, and on consumers, to the extent that they choose to forego the possible income from the deposit.

Importantly, we also included the resultant savings that would be achieved in other waste management routes, particularly in the existing bring site collection schemes, as a result of the introduction of a DRS. The net overall financial impact of the introduction of a DRS was determined as follows:

1) There is a net annual cost to producers of €120 million (€0.007 per container placed on the market). This cost reflects the balance of producer admin fees payable into the DRS and the reduction in payments producers would need to make for the existing producer responsibility system;
2) The cost to the retailer of handling and processing the returned DRS containers is fully reimbursed by the handling fees that are paid to the retailer by the central system on a per container returned basis. Hence there is no net financial impact on the retailers;
3) The total savings to the municipality/taxpayer amount to between €57 million per annum and €93 million per annum (depending on the assumed cost of disposal). The savings result from a reduction in collection and disposal costs associated with existing residual waste bring site systems, street sweeping and litter bin emptying and from puntos limpios. Additional savings to those shown here may also be available if/where the payments made by the existing Green Dot schemes do not fully cover the collection costs (for example, if the municipality chooses to collect the bins more frequency that was assumed in the calculations that were undertaken by the PROs to establish the fees payable to the municipality);
4) Total savings to businesses that currently pay for commercial waste collections amounts to between €11 million per annum and €15 million per annum (depending on the assumed cost of disposal);
5) At an overall 89% return rate, the cost to the consumer would be €385 million per annum, paid by those consumers that choose not to return their container to the DRS and who thus forfeit their deposit; and
6) The overall financial impact resulting from the introduction of a DRS in Spain is a net cost of between €398 million and €438 million per annum (depending on the cost of disposal). The overall cost of collecting packaging is shifted specifically onto producers and consumers rather than being paid for by the population as a whole through municipality collection and disposal.

We also attempted to construct the one-off costs that would be associated with the set-up of a DRS in Spain. Based on the modelling, a total cost of €32 million would be required to set up the central DRS, plus an additional €1.7 million for the producers to change their labelling. These one-off costs are certainly not insignificant; however, given the large number of producers and retailers involved in the Spanish market, it should be possible to split the costs sensibly in order to ensure that the subsequent joining fees are both reasonable and manageable for both producers and retailers.

# Contents

# 1.0 Introduction and Background

This report, commissioned by Retorna, investigates the financial consequences of the introduction of a deposit refund system (DRS) across Spain. The report comes at a time when Spain is reviewing its current waste policy, with the new Law on Waste and Contaminated Land, approved by Parliament on 14th July 2011, explicitly including the possibility of the introduction of a DRS for one-way (non-refillable) beverage containers. This report forms one of a series of reports looking at the impacts of the introduction of a DRS in Spain.[8]

Discussion regarding DRSs is often polarised between the views of ardent supporters, and those of equally vehement opponents. The available theoretical literature, however, suggests that such systems can be an efficient means of increasing recycling rates and reducing litter, though a key issue in moving from theory to practice is determining the costs of administering and implementing a DRS. The objective of this study is to explore the financial implications of the implementation of a DRS in Spain, looking in particular at the following key elements:

1) The balance of costs to producers, accounting for the costs they would bear in the DRS, and the reduction in payments they would need to make for the existing producer responsibility system;
2) The financial impacts on retailers (note that in the system we have modelled, these are intended to be offset by handling fees payable to the retailers for every container returned to them);
3) The effect on local authority budgets of removing their need to collect deposit-bearing packaging (including street sweeping); and
4) The potential costs to the consumer (including any unclaimed deposits which would contribute towards the running costs of the DRS).

This report does not consider the environmental costs and benefits of a DRS; these are covered elsewhere in a separate report commissioned by Retorna.[9] The focus of this report is on the financial consequences only. However, the report does highlight the increases in recycling which could be expected from such a scheme.

## 1.1 Deposit Refund Systems in Spain

Spain has long supported the idea of applying a deposit on beverage containers in order that they are returned to their point of sale after use. Historically, the idea of the

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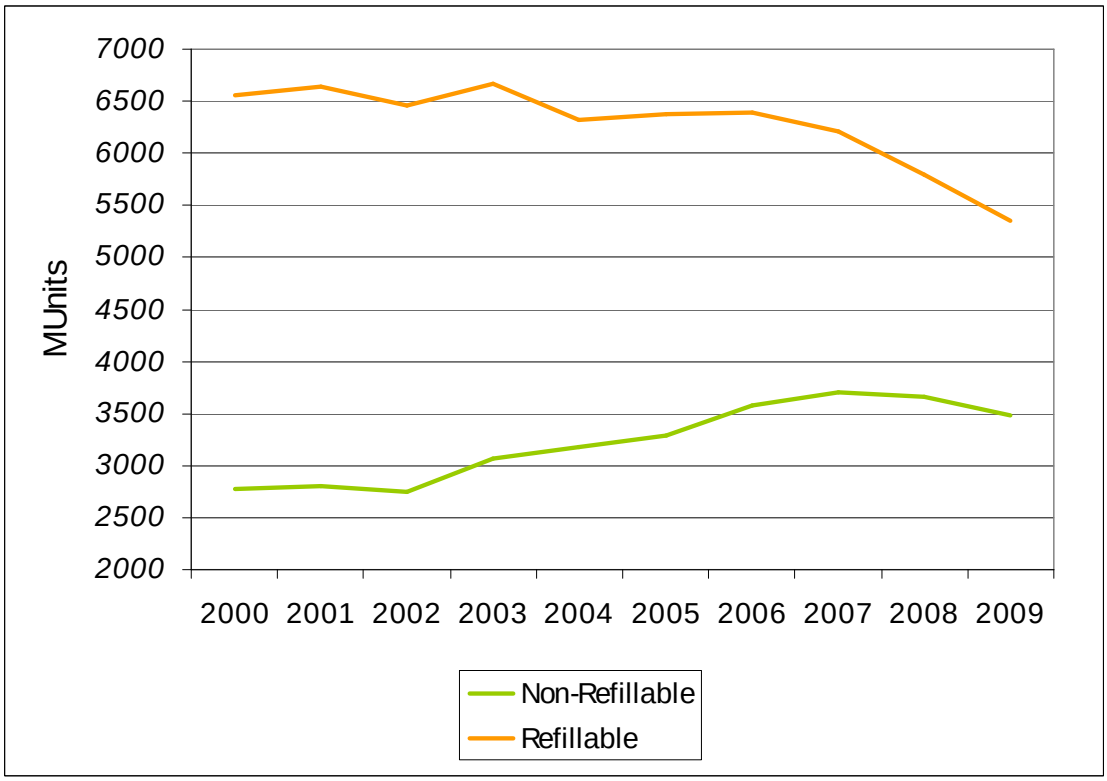
[8] The other reports are Inèdit (2011) *Análisis de Ciclo de Vida de la gestión de residuos de envases de PET, latas y bricks mediante SIG y SDDR en España*, available at http://retorna.org/mm/file/Documentacion/febrero2011_estudiocompletoACV.pdf; and ISTAS (2011) *Estimación del empleo potencial en la implantación y desarrollo de la primera fase del SDDR en España*, available at http://retorna.org/mm/file/Documentacion/EstudioEmpleo.pdf

[9] Inèdit (2011) *Análisis de Ciclo de Vida de la gestión de residuos de envases de PET, latas y bricks mediante SIG y SDDR en España*, available at http://retorna.org/mm/file/Documentacion/febrero2011_estudiocompletoACV.pdf

system was to encourage people to return their glass bottles for re-use, particularly in relation to beer bottles from breweries. In recent years however, there has been a shift in the type of packaging used for items such as beverages, with reusable packaging being steadily replaced by one-way (non-refillable) packaging, due in part to the consolidation of the packaging industry, and in part to the availability of cheap, disposable packaging. Changes in both transport logistics and technology have enabled beverage container 'fillers' to concentrate in fewer locations to improve the efficiency of their distribution and to reduce costs, with the increased cost of transporting re-usable glass bottles greater distances pushing producers towards increasing the amount of beverages being sold in lighter, non-refillable containers.[10]

Figure 1-1~~Figure 1-1~~ illustrates the shift in packaging placed on the market in Spain over the past ten years.[11]

Figure 1-1: Refillable vs Non-refillable Glass Bottles Placed on the Market in Spain 2000 - 2009 (Million Units)




*Source: Canadean (2010) Canadean's Wisdom Database, http://www.canadean.com*

[10] FPRC (2009). *Tendències i Efectes Ambientals i Socials de les Polítiques de la Producció, Distribució I Consum d'Envasos a Catalunya*.

[11] Canadean (2010) Canadean's Wisdom Database, http://www.canadean.com

Schemes for refillables in Spain are now restricted to the Horeca circuit (bars, cafeterias, restaurants, hotels); though there are some small shops that still sell refillables, their numbers are relatively small. Cerveceros de España (The Association for the Brewers of Spain) states that;

> *Aunque la tendencia del mercado en los últimos años indica una disminución de los envases reutilizables, el sector cervecero sigue con su esfuerzo para que se mantenga la cuota de producto puesto a través de los envases reutilizables.*[12] [Although the market trend in recent years indicates a decrease in reusable packaging, the beer industry continues its effort to maintain the share of product offered through reusable packaging].

A number of key pieces of legislation have been introduced over the years in Spain which specifically address the use of a deposit on packaging wastes as a way of encouraging its return for subsequent re-use or recycling. Stretching back as far as 1976, the legislation includes:

- Order of December 31st 1976; established a compulsory deposit (of a pre-specified amount) on packages for beer and soft drinks. This deposit was applied across all waste streams i.e. both household, and commercial and industrial (C&I) wastes;
- Order of December 16th 1979 and Resolution of February 27th 1980; determined a compulsory deposit (of a pre-specified amount) on packages for water. This deposit applied to both household and C&I wastes;
- Order of November 30th 1981; modified the Order of December 31st 1976 and established that the deposit amount would be freely determined by fillers and beverage companies, provided that the deposit is not greater than the replacement cost of the package. Again this Order applied to both household and C&I waste streams;
- Law 11/1997; this Law established a DRS as the packaging waste management system by default. However, the Law also enabled stakeholders to opt out of implementing such a system if they were to participate in an integrated packaging management system that could guarantee particular recycling rates (later revised to the current targets by weight at 60% for paper and card, 50% for metals, 22.5% for plastics and 60% for glass). This Law only applies to household waste;
- Order of April 27th 1998; identified the deposit amounts to be charged and the identification symbol for those packages that are put into the market by a DRS according to Law 11/1997; and
- Legislative Decree 1/2009 of July 21st; applying only to the autonomous region of Catalunya, this Decree established that the government must promote DRSs,

[12] Cerveceros de España (The Brewers of Spain) (2011) Informe de Seguimiento Plan Empresarial Prevencion Section Cerveza, http://www.cerveceros.org/ingles/pdf/Seguimiento-PEP-cerveza-2010.pdf

particularly for containers of more than 2 litres and for those containing poisonous or dangerous products.

The law on packaging and packaging waste (Law No. 11/1997) transposed the European Parliament and Council Directive 94/62/CE on Packaging and Packaging Waste into national legislation. In response to Law 11/1997, rather than implementing a DRS, two key producer responsibility organisations (PROs, in Spanish "SIG") were set up in Spain to deliver increased recycling of packaging wastes from households only; Ecoembes, which covers plastics, cans, paper and cardboard; and Ecovidrio, which covers glass packaging.

With no DRS in place, responsibility for the separate collection of packaging wastes falls to autonomous communities. Both PROs either pay financial contributions to the communities in lieu of the costs of the collection and processing of separately-collected packaging wastes or, in the case of Ecovidrio, alternatively provide the necessary infrastructure and collection and treatment logistics for the separate collection of glass on the autonomous community's behalf, at no cost to that community.

In theory, the PRO schemes are supposed to make a financial contribution equivalent to the additional cost of this separate collection as compared to the costs of the collection and disposal of this waste if it remained in the residual waste stream. This type of approach tends to limit the extent to which producers are financially responsible for dealing with packaging. For a start, it implies that producers should bear only incremental costs over and above the costs of dealing with residual waste. The presumption appears to be that residual waste collection costs should always be borne by local government. In addition, it would follow that if Government introduced, for example, a landfill tax, then the financial contribution payable by the PROs to support the separate collection of packaging would decline simply because disposal costs have risen (so the incremental costs associated with a recycling service would fall). A model of full financial responsibility ought to require producers to fund the full costs of recycling of all packaging, and in theory, it should also oblige them also to fund the costs of dealing with whatever materials still remain in residual waste (as happens with the Fost Plus system for household packaging in Belgium). Under such a system, producers would have a stronger incentive to reduce the amount of packaging placed on the market, and would also have an incentive to increase recycling rates as disposal costs rose. The current financial contribution system has the opposite effect, with the financial incentive to producers to reduce packaging (and recycle it) actually becoming weaker as the costs of disposal increase (although subject to targets being met). The proportion of costs of dealing with packaging born by local authorities would, on the other hand, increase.

Where a financial contribution is made to an autonomous community rather than the direct provision of the necessary infrastructure and logistics, the amount paid to local authorities is based upon calculations made by the PROs, based upon a model of how collection systems should perform, and what they would then be expected to cost, this then determining the level of payments to be made.

In practice, we are uncertain as to how much of the additional cost associated with the separate collection of packaging is covered by the financial contributions that are made by the PROs. We found one report which provided a cost breakdown for the

separate collection of light packaging in Madrid, which suggests that Ecoembes contributes 16.4% of the total cost of the separate collection and processing of light packaging.[13] However, even in this study, it is unclear how much of the increased cost of the separate collection is counter-balanced by a reduction in residual waste collection and treatment costs incurred by the autonomous community. It is therefore difficult, without far more detailed investigations, to draw any conclusions as to whether the financial payments made by the PROs are sufficient to cover even the additional costs of separately collected packaging, but it is quite clear that producers are 'let off the hook' in respect of much of the cost of dealing with packaging currently in the residual waste stream which, in principle, they would be expected to pay for under a system of full financial responsibility. Furthermore, it remains of some interest, as well as concern, that the extent to which the PROs support the recycling service, especially of light packaging, is not well established.

In this study, we assume that the payments from PROs do cover the additional costs of separate collection, and thus that any reduced collection costs incurred in existing systems through the introduction of a DRS would imply savings to the producer/PRO through a reduced requirement to make payments to the autonomous communities. The autonomous communities would reduce spending on recycling, but this would be offset by the reduction in funds received from the PROs, so that the change in the use of the existing recycling system is deemed to have no net financial implications for the autonomous communities. The autonomous communities will, however, benefit from reduced outlays on the collection and disposal / treatment of packaging collected as residual waste.

In order to deliver separate collections of packaging wastes, the majority of municipalities in Spain have set up collections via local bring sites. These are effectively small communal bin areas consisting of separate containers for different waste streams. For the majority of municipalities, a separate container is provided for plastics, cans and cartons, one for glass, and one for paper and card. According to Ecoembes' and Ecovidrio's official figures, such systems are achieving packaging recycling rates of around 68% for all packaging materials except glass, and around 60.3% specifically for glass.[14] Both figures are thus higher than the target recycling rate that forms part of the requirement of Law 11/1997.[15] It should be noted that these reported recycling rates include not only separately collected packaging, but also recycling from MBT plants, incinerators and other sources.

However, a recent report by the Jaume I University in Castelló de la Plana (Spain), and analysis of 2008/09 waste data by the Fundació per a la Prevenció dels Residus i el

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[13] Molero Caballero, P. (2008) *Análisis Económico de la Gestión de Residuos Urbanos en la Comunidad de Madrid. Aplicación a los Municipios de la Zona Norte,* Final project, the Superior Technical School for Engineering (ETSI) of the Universidad Pontifica Comillas.

[14] Observatario de la Sostenibilidad en España (2010) Sostenibilidad en España 2010,

[15] Sismega. S. L., (2011) *Untitled Document* looking at the analysis of the effects of introducing a DRS in Spain, accessed 15th July 2011, available at http://www.cecobi.es/images/prensa/Mon20110523154500SDDR.pdf

Consum Responsible, both raise doubts over the accuracy of the reported 68% figure.[16,17] In the report by Gallardo *et al.* the evaluation of the effectiveness of four urban bring site collection configurations was measured in cities of 50,000 and above inhabitants. This analysis showed that only five out of thirty-seven of the cities studied achieved separate collection rates greater than the lowest minimum statutory recycling rate for any of the lightweight packaging materials (i.e. 22.5% for plastics), and this was before factoring in any contamination in the lightweight packaging collection bins. Only in the case of glass packaging were values found to be exceeding the minimum requirement. In addition, analysis of the 68% recycling rate statistics by the Fundació per a la Prevenció dels Residus i el Consum Responsible indicated that the statistics include the recovery as well as the recycling of packaging materials; it is also unclear whether the recycling rate includes, or is reported net of, contrary material that is collected in the bring banks, but which is then subsequently rejected/removed during the sorting and processing phases (and sent for either recovery or disposal rather than being recycled).

In our experience, quality data regarding the recycling rates achieved for packaging is not straightforward to obtain. In an ideal world, one would know:

1) How much packaging material is placed on the market and how much of this material is actually licensed in the current producer responsibility system, i.e. how much 'free-riding' is occurring whereby packaging material is being placed on the market, but the material is not being 'declared' in the system and the associated fees are thus not being paid. Free-riding will result in an under-estimation in the baseline amount of material being placed on the market from which the recycling rate is subsequently calculated;[18]
2) How much packaging material is actually collected for recycling;
3) What proportion of this collected packaging fraction is rejected at sorting and reprocessing facilities (note some of this rejected material may subsequently be recovered through incineration, but this is not 'recycling' unless one is considering metals extracted at the front or rear of the incinerator, in which case, it is difficult to know the extent to which this material was 'packaging', or other material (such as old saucepans, etc.)); and
4) What waste packaging materials remain in the residual waste streams. These streams would need to include not simply standard residual waste streams, but

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[16] Fundació per a la Prevenció dels Residus i el Consum Responsible (2011) *Análisis de los Resultados de Recuperación de Residuos de Envases en 2008,* July 2011.

[17] Gallardo, A., Bovea, M. D., Colomer, F. J., Prades, M. and Carlos, M. (2010) Comparison of Different Collection Systems for Sorted Household Waste in Spain, *Waste Management*, 30, 2430-2439.

[18] Ecoembes estimates free-riding of around 15% in the Spanish system, see Ecoembes (2011) *IV Jornada de Trabajo con las Comunidades Autónomas: Persecución del Incumplimiento de la Ley de Envases*, available at: http://www.ecoembes.com/es/Documentos_generales/Ponencias/Persecuci%C3%B3n%20del%20incumplimiento%20de%20la%20Ley%20de%20Envases.pdf

also the flows of residual waste into litter, as well as material which simply resides in the environment; and

5) What packaging material is subsequently recycled from the residual waste streams (and in order to understand how much of this was packaging as opposed to other forms of metal, one would need to understand the relation between the input waste composition, and its output).

Quality data in this regard is actually very difficult to obtain. Member States report based on a range of data sources, often including sales data, and frequently based on data provided by the companies who are required to comply with obligations under producer responsibility. This information rarely makes allowance for import and export of goods (and hence, the effect on material flows into the waste stream). In other cases (for example, in Ireland), composition analysis plays a strong role, but this places considerable emphasis upon the quality of such analysis, which is not always especially high.

The discrepancy in figures in Spain is, for these reasons, perhaps unsurprising. Its impact on the calculated mass flows for this modelling is given further consideration later in this report. It is important to note that this report does not seek to determine whether or not the current system meets the requirements of Law 11/1997; rather it focuses on the cost implications of moving from the current Ecoembes and Ecovidrio system to a DRS. Nonetheless, the performance of the current system will be an important underlying factor in determining the costs, and the extent of improvement in recycling performance (and hence, the environmental effects) that result from the introduction of a DRS on non-refillable beverage containers in Spain.

# 2.0 Existing Studies on DRSs

This Section briefly discusses existing literature on both the benefits and potential financial impacts of the DRS as an environmental policy. It then looks in particular detail at the recently published summary report by Sismega on the cost and performance implications of the introduction of a DRS in Spain compared to the existing Ecoembes producer responsibility system.

## 2.1 Potential Benefits of a DRS

A number of key potential environmental benefits are associated with literature on DRSs, including:

1) Increased recycling of those containers covered by deposits (for refill or recycling);
2) A reduction in the extent of littering;
3) Increased use of / reduced extent of decline in the use of refillables (this is not a key aspect of the scheme we propose, but may nonetheless be one of the impacts of the introduction of a DRS for non-refillables[19]); and
4) Avoidance of harmful chemicals being mobilised in the environment (usually not in beverage schemes, e.g. lead acid batteries, or pesticides).

Quantifying the benefit derived from the introduction of a DRS has proven to be quite difficult. Few studies have actually been undertaken whereby the baseline pre-DRS situation has been sufficiently well characterised in order to calculate the change in performance that results purely from the introduction of a DRS.

Studies have either tended to compare the performance in locations with and without deposit systems as a proxy for an *ex-ante* and *ex-poste* study, or to compare, for example, recycling rates before and after the implementation of a DRS. Some data allows for comparison of performance in areas with and without deposits. In the US, in 1999, the recycling performance of states with and without deposits in place is shown in Figure 2-1~~Figure 2-1~~. The recycling rates, and the number of containers recovered per capita, were far higher in the deposit states. However, this could simply be evidence of the absence of adequate collection infrastructure in the no-deposit states, so it cannot be considered as robust evidence.

[19] For a discussion regarding the refillables issue, see Eunomia et al. (2009) *International Review of Waste Management Policy: Annexes to Main Report,* Report for Department of the Environment, Heritage and Local Government, Ireland, September 2009.

Figure 2-1: Performance of US States With and Without Deposits, 1999

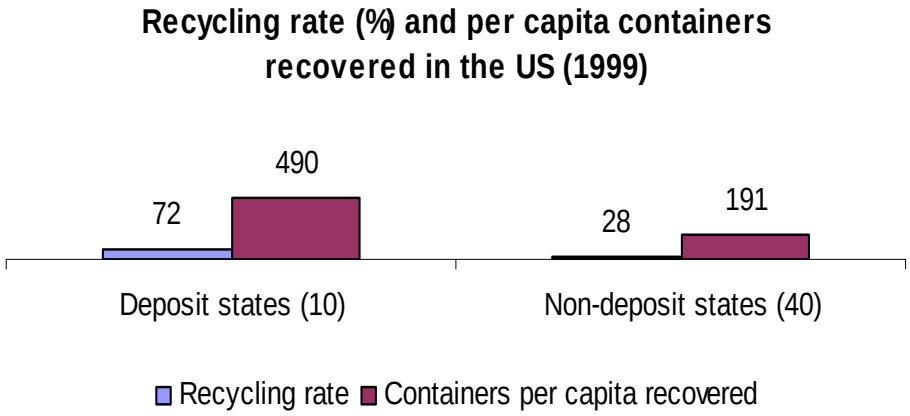



Figure 2-2

~~Figure 2-2~~ illustrates what we believe to be best available data on metal beverage container recycling rates across the EU, with data provided from a variety of sources including the European Aluminium Association and individual countries' Green Dot schemes and deposit refund systems.[20] In cases where both the source separation and final residual waste sorting (RWS) system recycling rates are known (Austria, Spain, Luxembourg, Norway and Germany) then the data for such countries is shown in two bars within the chart. RWS systems include recycling from MBT or thermal processes. Error bars are shown in proportion to the level confidence in the data.

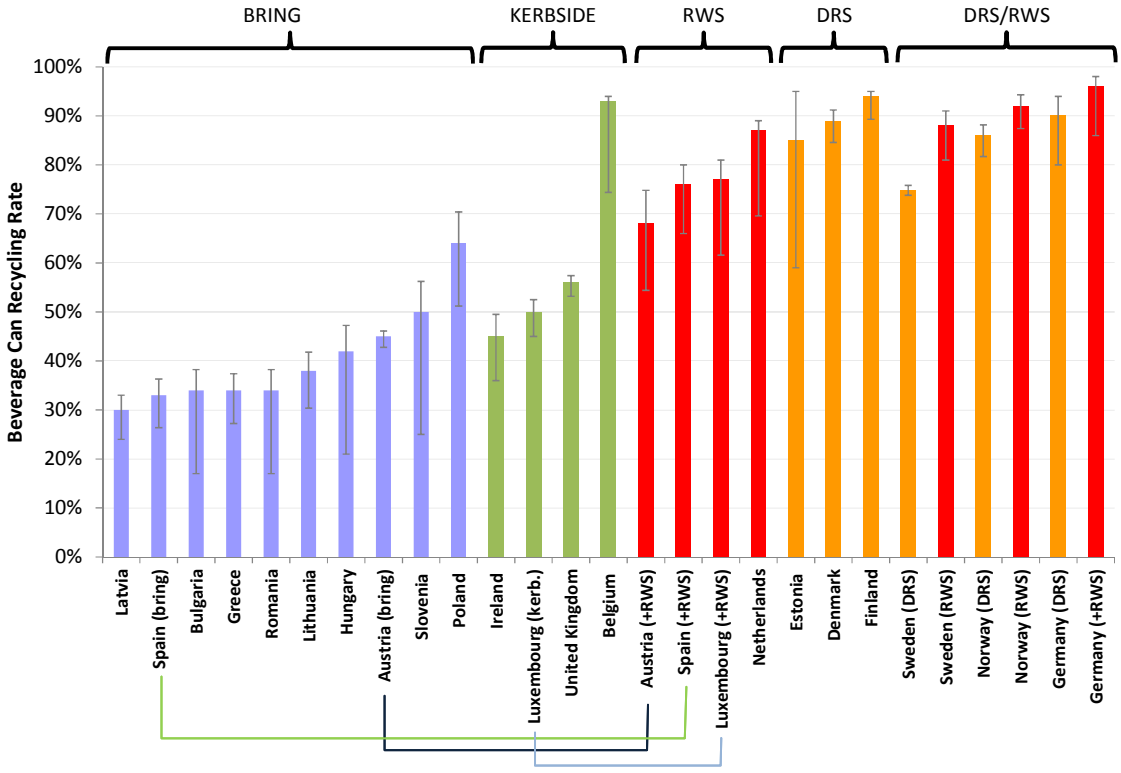
As the data in Figure 2-2 suggests, the system which most commonly delivers high recycling rates is the DRS. One country using a kerbside system has a similarly high rate of recycling to DRS systems (Belgium), whilst another (the Netherlands) where metal is separated from residual waste in waste to energy plants in both pre- and post-combustion treatment steps also reports a high recycling rate, though the basis for this remains somewhat questionable. The highest rate achieved overall (Germany) involves a combination of systems, including a DRS, as well as additional metals recovery via kerbside and residual waste sorting systems.

Of some interest are the reported return rates pre- and post-implementation of a DRS, particularly in the context of wider recycling systems. In Sweden, for example, the recycling rate for all plastic packaging increased from 17% to 30% between 2003 and 2005 (44% in 2006). In the same period, recycling rates for Polyethylene terephthalate (PET) plastics under the deposit scheme were 77% to 82% (85% in 2007). Once again, this, in itself, might not prove much. The components of plastic packaging are many and varied, and PET bottles are readily recyclable.

[20] Eunomia *et al.* (2011) *Options and Feasibility of a European Refund System for Metal Beverage Cans: Appendix 2*, Final Report for DG-Environment, November 2011, pages 13-17.

Perhaps more telling, however, is the performance in respect of metals. Recycling rates for all metal packaging were around 65% in 2004-2005, but the recycling rate for aluminium under the DRS was 85% to 86% in the years 2002 to 2007. The return rate for glass bottles is 99% on 33cl bottles and 90% on 50cl bottles.[21]

Figure 2-2: Best Available Data on Metal Beverage Containers Recycling




*Source: Eunomia et al. (2011) Options and Feasibility of a European Refund System for Metal Beverage Cans: Appendix 2, Final Report for DG-Environment, November 2011, page 16.*

In Denmark, return rates in 2007 were 84% for cans, 93% for plastic bottles and 91% for glass bottles.[22] Similarly, in Germany, recycling rates in 2005 were 50%, 85%, 76% and 79% for plastics, tinplate, aluminium and glass respectively.[23] The reported return rates under the deposit scheme are 95 to 99%.[24,25]

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[21] http://www.sverigesbryggerier.se/eng/1-emballage/1-index.html, accessed January 2009.

[22] ERM (2008) *Review of Packaging Deposit Systems for the UK, Report for DEFRA,* December 2008, accessed from http://randd.defra.gov.uk/Document.aspx?Document=WR1203_7722_FRP.pdf

[23] The report by PWC (2011) criticised the 50% pre-DRS recycling figure for plastics, specifying a lower plastics recycling figure of between 25 to 31% for prior to the DRS. PWC (2011) *Mehrweg- und Recyclingsysteme fur ausgewahlte Getrankeverpackungen aus Nachhaltigkeitssicht,* June 2011.

[24] Wolfgang Ringel (2008) *The German Deposit System on One Way Beverage Packaging*, Presentation to the first Global Deposit Summit, Berlin 2008.

[25] Data from the DPG (Deutsche Pfandsystem GmbH (System Operator)) in March 2010 puts the 2009/10 return rate for PET bottles at 98.5%.

Some have suggested that it is not the case that recycling rates are higher under deposit schemes. However, those who suggest this usually do so on the basis of reviewing recycling rates for *all* packaging. For example, the European Organisation for Packaging and the Environment (EUROPEN) argues:[26]

> *There are no compensating benefits with regard to an overall improvement in recycling performance. The Perchards report showed that overall recycling rates in Member States with deposit systems are not higher than those of comparable EU countries where there are no special arrangements for beverage containers.*

Deposits, however, do not apply to *all* packaging. The Perchards report itself states:[27]

> ***It is certainly true that deposit systems for non-refillable beverage containers can achieve higher recycling rates for the beverage containers affected than when these containers are handled through general recycling systems****. However European experience shows that* ***deposit systems do not achieve a higher recycling rate for all packaging of a given material, because beverage containers represent too small a proportion of the total tonnage of that packaging material.***
>
> *Drinks containers typically represent only about 10% of all packaging and the recycling rate for beverage containers in general recycling systems is likely to be higher than the recycling rate for all packaging of the same materials.*

The report then alludes to the performance of Belgium in respect of the recycling of *all* packaging even though this is clearly not a good comparator for reasons which the previous extract makes clear (the targeted materials – beverage containers – are a relatively small fraction of all packaging). In particular, the largest fraction of the packaging stream is *always* paper and card, which is also an easy, and relatively low cost, material to recycle. Consequently, in most countries, the packaging recycling rate will be heavily influenced by capture of a material that is irrelevant to any sensible discussion regarding DRSs.

This is not to deny the possibility that high rates of recycling of packaging can be achieved without DRSs. Other EU countries, such as Belgium as mentioned above, appear to have achieved impressive recycling performance without them. According to the Fost Plus managed packaging collection system, Belgium recycled 67% of plastic bottles in 2007 (comprising both Polyethylene terephthalate (PET) and High-density polyethylene (HDPE)) and 97.5% of metal packaging (steel and aluminium cans).[28] Belgium has a producer responsibility scheme in place which is fully funded by obligated industry, the system ensures that well-designed schemes for (usually) kerbside collection of packaging (sometimes with bring schemes for glass) are in place, and the use of pay-as-you-throw schemes is almost universal. One might still

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[26] EUROPEN (2007) Economic Instruments in Packaging and Packaging Waste Policy, Brussels: EUROPEN.

[27] G. Bevington (2008) *A Deposit and Refund Scheme in Ireland*, Report commissioned by Repak Ltd., September 2008.

[28] Fost Plus (2007) *Annual Report*, http://www.fostplus.be/files/EN/8/GB_AR.pdf

argue, even in this case however, that there might be room for improvement through use of a deposit scheme where plastic bottles are concerned.

With regard to recycling rates in Spain, in examining the current packaging recycling rates, for example for metal beverage cans (as shown in Figure 2-2), it appears likely that the implementation of a DRS in Spain would bring about a significant increase in recycling rates and in the quality of material collected.

## 2.2 Effects on Littering

There is evidence to suggest that deposit refund policies can reduce litter and even reduce the number of injuries to the public caused by glass in the environment.[29] Several one-way deposit systems were implemented with the clear objective of reducing littering (e.g. in Sweden, British Columbia, California, Michigan and Hawaii).

The potential for DRSs to be effective in reducing littering has an intuitively plausible rationale - if the deposit is significant and the consumer does decide to litter, the possibility exists that someone else will pick up the container to redeem the deposit. The Industry Council for Packaging and the Environment (INCPEN) suggests that this can worsen the litter situation in some cases and state that: "*There have been reports of homeless people emptying litter bins to obtain deposit containers, leaving other items on the street"*; there is however no evidence offered to support this view.[30]

The Container Recycling Institute suggested significant reductions in littering following the introduction of deposits in some US states (see Figure 2-3~~Figure 2-3~~). The effects on used beverage containers (UBCs) and on total litter are shown as being between 70-80% and 30-40%, respectively. It must be said, however, that all studies of this nature suffer in terms of the lack of clarity about the metric used to measure the contribution of beverage containers to total litter.

The Policy Exchange and CPRE report, Litterbugs,[31] cited a study suggesting litter in New York State declined by 30% in the wake of the use of a DRS.[32] Over the past 25 years, according to official figures, the New York State Returnable Container Act 1983

[29] M. Douglas Baker, MD, Sally E. Moore, and Paul H. Wise, MD, PhD, MPH, "The Impact of 'Bottle Bill' Legislation on the Incidence of Lacerations in Childhood", *American Journal of Public Health*, October 1986.

[30] Incpen (2008) Mandatory Deposits on Packaging, May 2008.

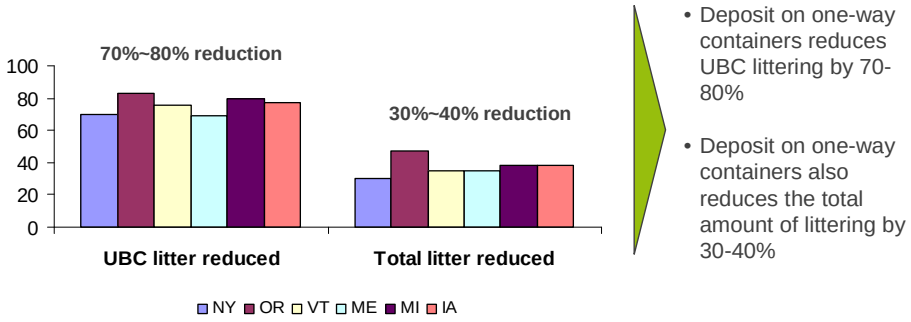
[31] Policy Exchange and CPRE (2009) *Litterbugs: How to Deal with the Problem of Littering*, London: Policy Exchange, 2009.

[32] New York Public Interest Research Group, www.nypirg.org/enviro/bottlebill/myths.html ; Bottle Bill Resource Guide, www.bottlebill.org/legislation/usa/newyork.html

achieved redemption rates between 65-80%;[33] and reduced container litter by 70-80% and roadside litter by 70%.[34]

Figure 2-3: Reduction in Littering in US States Linked to Deposit Schemes

Reduction of littering in 6 US states after the introduction of container deposit systems.




Source: Container Recycling Institute, USA

The significant matter of cost must also be considered as clearing litter costs an ever-increasing amount of public money. Cleaning up the beaches alone represents a significant cost for municipalities in Spain: according to data from 15 municipalities of the province of Girona (Catalonia), the expenditure associated with cleaning up beaches during the high season was 3 million euros in 2009.[35]

Where counter-arguments to the 'litter reduction' effect of DRSs are put forward, these very rarely challenge the likely reality of this effect. Generally, the argument tends to be that beverage containers are a small fraction of litter, and that therefore, eliminating this would not solve the litter problem. A limitation of this argument is that it assumes that the relevant indicator is 'counts' of litter rather than litter volumes. For example, a 2008 survey in the UK by ENCAMS for INCPEN highlighted that there were 44,040 counts of cigarette butts as compared with 582 counts of beverage containers.[36] However if these are considered by volume, the bottles and cans would occupy around 163 litres in their uncompacted form compared to approximately 22.02 litres occupied by the cigarette butts. That is to say that the beverage containers would occupy around seven times the volume in their uncompacted form

[33] New York State Department of Environmental Conservation Beverage Container Deposit And Redemption Statistics: October 2004 - September 2005, 2006.

[34] Kruman J, Bottle Bill at 25, New York State Conservationist, August 2007, New York State Department of Environmental Conservation, www.dec.ny.gov/chemical/8500.html

[35] Diari Avui (2009) Els municipis gasten tres milions d'euros en la neteja de platges de la Costa Brava, http://www.presencia.cat/noticia/article/2-societat/5-societat/54820-els-municipis-gasten-tres-milions-deuros-en-la-neteja-de-platges-de-la-costa-brava.html

[36] ENCAMS (2009) Litter Composition Survey of England, Aug-Oct 2008, report for Incpen, March 2009.

that the cigarette butts would fill. This highlights the fact that if count data is a poor proxy for perceived impact of litter, and if volume is a more appropriate one, then beverage packaging would be considered a significant contributor to litter.

In jurisdictions such as Hawaii, where the prevalence of beverage containers in litter has been a motivation for the introduction of a DRS, the problem also extends to pollution of the marine environment. One report from the State of Hawaii shows how the prevalence of beverage containers in litter (debris) has changed over time, for example plastic bottles have declined from 5,246 in 2003 to 2,965 in 2007.[37] The report notes:

> *While there appears to be a downward trend in the number of bottles and cans found at beaches, beverage containers, along with associated caps and lids, continue to be a large portion of beach litter. This is why it is important to continue to place a deposit on beverage containers to decrease the temptation to litter and increase the incentive to recycle.*

An interesting feature of the Hawaii data is that it shows the problem is not simply one of terrestrial litter. Indeed, beverage containers appear to be (relatively) more problematic in underwater cleanups.

Regarding plastics in particular, a UNEP report notes the prevalence of plastic bottles, caps and bags among the key forms of marine litter giving rise to increasingly serious problems at sea. Evidently, in the marine environment, it is the longevity and potential harm caused by plastics that makes them of particular concern.[38]

A study undertaken in Australia suggested that deposit schemes were likely to be the most effective policy option for reducing litter amongst those considered for improving recycling:[39]

> *A national CDS [container deposit scheme] is expected to provide the greatest reduction in overall litter levels, with the potential to provide a 6% reduction in the total national litter count and a 19% reduction in the total national litter volume.*

Also, given that beverage containers are relatively voluminous items, their removal from litter bins would leave more room for other waste.

Interesting evidence of the effects of deposits on littering comes from Denmark. In Denmark, there is a prominent cross-border trade in alcohol owing to the differences in excise duties between the countries. The Danish Society for Nature Conservation is

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[37] State Of Hawaii Department Of Health (2008) Pursuant To Sections 342g-102.5(H), 342g-114.5(B), And 342g-123, Hawaii Revised Statutes, Requiring The Department Of Health To Give A Report On The Activities Of The Deposit Beverage Container Program, Report To The Twenty-Fifth Legislature State Of Hawaii 2009, November 2008.

[38] Ljubomir Jeftic, Seba Sheavly, and Ellik Adler (2009) *Marine Litter: A Global Challenge*, Report for UNEP, April 2009, http://www.unep.org/regionalseas/marinelitter/publications/docs/Marine_Litter_A_Global_Challenge.pdf

[39] BDA Group (2009) *Beverage Container Investigation*, Report for the EPHC beverage Container Working Group, March 2009.

the largest nature conservation and environmental organisation in Denmark. With the support of 140,000 members, they work to protect nature and the environment, and each year conduct litter clean-up campaigns. What is most intriguing about these campaigns is the proportion of littered cans which do not carry a deposit, because they are imported from Germany from areas specifically exempted from the German deposit system. A short summary of the main results concerning beverage cans since 2008 from the "Clean Up Denmark" campaigns is given below:

- 2008: 154,400 cans, of this only 7,800 with a paid Danish deposit;
- 2009: 153,000 cans, of this only 10,000 with a paid Danish deposit; and
- 2010: 197,000 cans, of this only 7,800 with a paid Danish deposit.

The data indicates that the vast majority of cans which are found in litter are those which bear no deposit. The suggestion appears to be that the deposit system has a significant bearing upon whether cans are littered or not. The Danish EPA notes that the majority of the machines receiving containers bearing the Danish deposit are also equipped to receive those which do not. Hence, the only differences between the German and Danish containers is that the Danish ones bear a deposit, which seems to act as a significant incentive to motivate return to the appropriate system. The absence of incentive in the case of German containers (bearing no deposit) leads to greater littering.

## 2.3 Summary View

The evidence suggests that DRSs are likely to increase the capture of the targeted materials for recycling. This is unsurprising as the deposit gives the purchaser an incentive to take the material back to an appropriate location in order to generate a refund.

The schemes also appear to influence the prevalence of litter. It is true that deposit schemes do not affect littering of items such as cigarette butts or chewing gum, both of which are prevalent in terms of counts, but the contribution of beverage packaging to the volume of litter is significant. There are good reasons to believe that the volume of litter (not the 'count') is what gives rise to the associated disamenity.

## 2.4 Theoretical Studies on a DRS as an Effective Packaging Waste Policy

A number of theoretical studies have been undertaken regarding the financial impacts of implementing a DRS, with studies typically suggesting that the DRS is an effective environmental policy instrument. Several studies have, for example, argued that a DRS is the best policy in the presence of illegal disposal.[40] Indeed, Palmer *et*

[40] T. Dinan (1993) Economic Efficiency Effects of Alternative Policies for Reducing Waste Disposal, *Journal of Environmental Economics and Management* 25: 242–56; D. Fullerton and T. C. Kinnemann (1995), Garbage Recycling and Illicit Burning or Dumping, *Journal of Environmental Economics and Management*, 29 (1); Peter S. Menell (1990) Beyond the Throwaway Society: An Incentive Approach to Regulating Municipal Solid Waste, *Ecology Law Quarterly*, vol. 17, pp. 655-739; Hilary Sigman (1995) A

*al*. found that a $45/ton deposit /refund would reduce the disposal of paper, glass, plastic, aluminium and steel by 10%, whereas alternative policies such as an advanced disposal fee (ADF) of $85/ton or a recycling subsidy of $98/ton would be required to achieve the same diversion.[41]

Most theoretical studies recommend DRSs as economically efficient mechanisms to increase rates of recycling.[42] This includes a review undertaken by Turner *et al*. which found the deposit refund instrument to be:

> *An efficient mechanism and is equivalent to taxing disposal (for nonreturners) but without the attendant illegal disposal problems.* [43]

Given the theoretical support for DRSs as an effective environmental policy instrument one might expect there to be more DRSs in operation worldwide than currently exist. However, as noted by Turner *et al.* and by Palmer and Walls (1997), the theoretical calculation often falls short of reality, failing to account for the potential costs associated with administering such schemes which would reduce the efficiency of the approach.[44] This issue is discussed by Palmer *et al.* who calculated the impact of administrative costs on the overall efficiency of deposit refunds relative to product taxes and recycling subsidies.[45] Viewing their results alongside empirical evidence from Ackerman *et al.,* they suggest that administrative costs may be of the same order as the cost savings from using a deposit/refund.[46] Due to such

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Comparison of Public Policies for Lead Recycling, *RAND Journal of Economics*, vol. 26, no. 3 (Autumn), pp. 452-478.

[41] K. Palmer, H. Sigman and M. Walls (1997) The Cost of Reducing Municipal Solid Waste, *Journal of Environmental Economics and Management* 33, 128-50.

[42] See, for example, Dinan, T.M. (1993) Economic Efficiency Effects of Alternative Policies for Reducing Waste Disposal, *Journal of Environmental Economics and Management*, 25: 242-256.; Fullerton, D. and Kinnaman, T. (1995) Garbage, Recycling and Illicit Burning or Dumping, *Journal of Environment Economics and Management*, 29: 78-91; Pearce, D.W. and R.K. Turner (1993) Market-based approaches to solid waste management, *Resources, Conservation and Recycling* 8: 63-90. Porter, R.C. (1978) A Social Benefit Cost Analysis of Mandatory Deposits on Beverage Containers, *Journal of Environmental Economics and Management*, 5: 351-375. Sigman, H. (1995) A Comparison of Public Policies for Lead Recycling, *Rand Journal of Economics* 26: 452-478; Thomas Skinner and Don Fullerton (1999), The Economics of Residential Solid Waste Management, *NBER Working Paper 7326* http://www.nber.org/papers/w7326; K. Palmer and M. Walls (1999) Extended Product Responsibility: An Economic Assessment of Alternative Policies, *Discussion Paper 99-12*, January 1999, Washington DC: Resources for the Future; Don Fullerton and Amy Raub (2003) Economic Analysis of Solid Waste Management Policies, in OECD (2004) *Addressing the Economics of Waste*, Paris: OECD.

[43] R. Kerry Turner, J. Powell, A. Craighill (1996) Green Taxes, Waste Management And Political Economy, *CSERGE Working Paper WM 96-03.*

[44] Palmer and Walls (1997) Optimal Policies for Solid Waste Disposal Taxes, Subsidies and Standards. *Journal of Public Economics* 65(8): 193-205.

[45] K. Palmer, H. Sigman and M. Walls (1997) The Cost of Reducing Municipal Solid Waste, *Journal of Environmental Economics and Management* 33, 128-50.

considerations, Palmer *et al*., Fullerton and Kinnaman, and Palmer and Walls all argue that deposit refunds should be imposed upstream on producers rather than on final consumers to minimise administration and transaction costs.[47]

There have been few studies which have looked in detail at the potential costs of introducing a DRS. Work by Eunomia in the UK tried to shed light on the costs and benefits (both financial and environmental) of introducing a DRS in the UK.[48] The study found that, in a well-established DRS, the on-going financial and environmental benefits should outweigh the costs of operating a DRS in the UK (though this would depend on the value people place on having a litter-free environment). The additional fees payable by producers (net of unclaimed deposits) to fund the operation of the DRS was found to be roughly equivalent to the savings produced from a reduction in the costs associated with the existing collection of beverage containers by local authorities and commercial enterprises. Significant environmental benefits from the introduction of the DRS were modelled from additional recycling of beverage containers (above what could be achieved through kerbside collection systems alone). A potentially significant additional benefit was also identified from the reduction in litter in the environment and the value people might place on such a reduction.

## 2.5 Sismega Summary Report on the Introduction of a DRS in Spain

Alongside the more theoretical literature discussed above, a recent study undertaken by Sismega has sought to analyse the financial costs and associated impact on packaging recycling performance in Spain.[49] This study, funded by Ecoembes, takes into account the more practical cost aspects of the system, including the costs for logistics, administration and marketing of the DRS, as well as material revenues and revenues from unclaimed deposits which offset some of the DRS costs.

The details of the study have not been made publicly available. Where applicable, in this study, we have used a number of assumptions that are similar to the figures outlined in the Sismega summary report. For example, both reports use data provided by Nielsen (a global market research company) to determine the number of retailers that will form part of the DRS; these assumptions are detailed in the Appendices. There appear, however, to be several key points for further discussion within the

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[46] Frank Ackerman, Dmitri Cavander, John Stutz, and Brian Zuckerman (1995) *Preliminary Analysis: The Costs and Benefits of Bottle Bills*, Draft report to U.S. EPA/Office of Solid Waste and Emergency Response, Boston, Mass.: Tellus Institute.

[47] D. Fullerton and T. C. Kinnemann (1995) Garbage Recycling and Illicit Burning or Dumping, *Journal of Environmental Economics and Management*, 29 (1); Palmer et al (1997); Palmer and Walls (1997).

[48] Eunomia Research & Consulting (2010) *Have We Got the Bottle? Implementing a Deposit Refund System in the UK,* Report for the Campaign to Protect Rural England, September 2010.

[49] Sismega. S. L., (2011) *Untitled Document* looking at the analysis of the effects of introducing a DRS in Spain, accessed 15th July 2011, available at http://www.cecobi.es/images/prensa/Mon20110523154500SDDR.pdf

summary report that has been made public (though we note that some of these may be further clarified following the public release of the main report). Some of these are outlined below:

- The system proposed by Sismega does not cover glass or cartons. The lack of coverage of glass bottles, in particular, is unusual for deposit schemes and the reasoning for this is unclear (presumably, the focus reflects the interest of Ecoembes, the study sponsor);
- The authors state that a DRS will only cover 9% of household packaging. In part this reflects the exclusion of glass. However, according to our mass flow calculations, packaging comprises 17% of the total household waste stream, with DRS materials comprising 5% of the total household waste stream, and DRS materials thus comprising 31% (i.e. 5% divided by 17%) of the packaging waste stream. Even without glass, we calculate that packaging comprises 11% of the total household waste stream, and DRS materials constitute 2.4% of the household waste stream. DRS materials thus comprise 22% of the total packaging waste stream (i.e. 2.4% divided by 11%) Further details on the mass flow calculations can be found in Section 3.2.

  Having stated that the DRS would only cover 9% of total packaging, or 319,355 tonnes, the study then notes that:

  > *In a **very favourable scenario** of a **90% return rate** of this type of packaging through the DRS, the **actual contribution would be no more than 71,150 additional tonnes** of recycled containers out of a total of 2 million tonnes of lightweight packaging currently managed by Ecoembes.*

  It is very difficult to square the various figures, stating on the one hand that only 319,355 tonnes would be covered by the system, but that Ecoembes already manages 2 million tonnes of lightweight packaging. It is not clear what is, or is not, included in the various figures being cited. Similarly, the number of containers included in the system is estimated in the Sismega summary report to be 12.2 billion, whereas our industry data indicates that 14.5 billion non-refillable metal cans, PET bottles and cartons were placed on the market in 2010, alongside an additional 3.4 billion non-refillable glass bottles (excluding wine and spirits).[50]

  The above statement also implies that a 90% return rate would be 'very favourable'. The suggestion is that the rate might be difficult to achieve, but well-designed schemes do exceed these rates (as indicated above);
- No Horeca (hotels, restaurants and cafes) have been included as part of the DRS logistics in the Sismega modelling;
- From the summary report, it is difficult to tell whether or not the net cost of the system includes the savings that would be incurred in the existing collection systems as a result of a reduction in the amount of material being collected through them (including savings to the existing Green Dot schemes/producers

[50] : Canadean (2010) *Canadean's Wisdom Database*, http://www.canadean.com

and to municipalities) . In this study, we examine both the additional costs of the introduction of a DRS across Spain and the savings that would be incurred in existing systems;

- The country comparison table for performance uses Eurostat data, and is not, strictly speaking, valid since it covers all packaging and not just that which would be included in a DRS. The performance of schemes will be heavily influenced by performance in respect of paper and card packaging, which is largely irrelevant from the perspective of DRSs. In addition, the figures in the table do not indicate how much of the recycling rate is actually recovery via mixed waste dirty materials recovery facilities or recovery via incineration (which reduces closed loop recycling capability), compared to how much is through kerbside schemes and DRSs. Similarly, it is not clear whether the figures presented are inclusive or exclusive of contamination collected through the recycling systems which end up being rejected and sent for residual waste treatment or disposal;
- The two specific references to Germany are unreferenced, but the figure regarding deposits appears to be the oft-cited Roland Berger study, whilst the provenance of the first statement is unclear. The suggestion is that a tiny fraction of containers are returned through the DRS. If this were true, the system would cost producers an insignificant amount (or more likely under the suggested figures, generate substantial net revenue because unreturned deposits would generate a significant revenue in the DRS to offset some, or more than offset all of, the system costs).
- The report outlines that the consumers would face the following additional difficulties from the introduction of a DRS:
    - Increased waiting times/time in shops (queuing) for refunding;
    - Need for specific storage spaces for returnable containers at home;
    - Need to organise transport of containers to the establishment; and
    - Loss of deposit paid when container is not returned.

  Whilst we agree that the issue set out in the first bullet point might occur at peak times, if this was a continuing problem, the retailer might consider installing either their first, or an additional, machine to process the returns more quickly. Based on our modelling, we estimate that a maximum of 20 containers would be returned manually per hour at those stores that do not install automatic take-back machines. For those retailers using automated take-back, the numbers of containers returned are only greater than 20 containers per hour in hypermarkets and supermarkets. If we were to assume, for example, that the majority of containers would be likely to be returned during a daily two hour peak time (with all day Saturday also assumed to be peak hours), our modelling suggests that the busiest hypermarket and supermarket RVMs would need to process around 34 containers a minute during peak times, based on an average of 3 RVMs per hypermarket and 2 RVMs per large supermarket. This is within the operating capacity of RVMs, which is typically around 30 to 45 container per minute.

  With regards to the second bullet point, whether or not there is a need for additional space in the home depends largely on how frequently households

choose to return containers relative to the frequency with which they (currently) transport waste to residual waste containers and recycling points. There is no extra waste generated. Consequently, the issue simply reinforces the need to have a convenient system for returns in place. Thus the design of the system should provide a high density of return points to ensure householders can return their containers more frequently without needing to go too far out of their way to do so. The same applies in addressing bullet point three, though the majority of consumers will be likely to return their containers when shopping rather than making specific journeys. It seems highly unlikely, therefore, that consumers would make additional journeys solely dedicated to the return of containers.

The final bullet point is important – the deposit is the economic stimulus which generates high return rates, but there will be those who are not bothered about losing the deposit, who are effectively meeting the polluter pays principle, as well as a small minority that would find the system less accessible e.g. the elderly, less mobile (though it could be argued that the less mobile must have someone who does the shopping for them and that this person can therefore return any empty containers on the next shopping trip). It will again be important to ensure a sufficient network of return points to minimise accessibility problems, and give consumers as many opportunities as possible to return containers without having to go out of their way to do so. To the extent that it is clear that a deposit has been paid, however, those who choose to forego the deposit are essentially exercising their own choice in the face of the alternatives which confront them. This is not 'a problem' as long as the density of points for return is reasonable. Furthermore, although this is a 'cost' to consumers, it effectively provides revenue to the DRS, reducing the amount that producers would otherwise have to pay if the return rate was 100%.

- The summary report mentions an increase in recycling rates from the introduction of a DRS as a positive benefit of the system, but fails to mention a reduction in littering as another key benefit (as discussed in Section 2.2). This is partly a reflection of the quality of the data being used. It should be noted that it seems reasonable to assume that some litter in Spain would find its way into the marine environment. There are growing concerns around the effect of litter on the marine environment.[51]

In summary, based on the details that have so far been made available in the Sismega summary report, we note that the report seems to under-estimate the percentage of packaging that might be targeted in the DRS. Part of this under-estimate relates to the exclusion of glass or cartons from the system, but it is also very difficult to square the various figures stated in the Sismega summary report in order to understand why the figures quoted are different to the mass flows that are modelled in this report. It is also difficult to determine whether or not the Sismega

[51] GESAMP (Group of Experts on the Scientific Aspects of Marine Pollution) (1991) *The State of the Marine Environment*. London: Blackwell Scientific Publications; Allsopp, M., Walters, A., Santillo, D. and Johnston, P. (2006) *Plastic Debris in the World's Oceans*, available at http://www.unep.org/regionalseas/marinelitter/publications/docs/plastic_ocean_report.pdf

study includes the savings from existing collection systems and, if so, how these savings have been calculated. Finally, there appears to be a lack of balanced argument with regards to the difficulties that might be faced by residents, and the study neglects to mention a reduction in littering as a potential benefit from the introduction of a DRS in Spain.

# 3.0 Methodology for Financial Analysis

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

1) Formulation of a high-level design of a DRS to be modelled for Spain (including range of materials), based on our understanding of existing DRSs worldwide;
2) Establishment of the total number of packaging units placed on the market which would be included in the DRS, and the baseline tonnages of waste collected through the existing bring site system, larger household collection points, as commercial waste, via on-the-go recycling and from street sweepings. This is essentially a baseline 'mass flow' from which the changes associated with the DRS are measured;
3) Determination of tonnages that would be diverted from the existing waste flows into the DRS, and hence the development of a 'with DRS' mass flow;
4) Calculation of the initial investment costs that would be required to introduce a DRS in Spain;
5) Establishment of the ongoing costs and revenues for the DRS;
6) Determination of the change in costs relative to the baseline that results from changing the flow of deposit-bearing waste out of bring sites, the commercial waste stream, on-the-go recycling and street sweepings, and into the DRS; and
7) Pulling all the figures together to produce a financial analysis of the introduction of a DRS in Spain.

Further details of the approach taken are provided in the Technical Appendix.

## 3.1 System Scope

In modelling the introduction of a DRS in Spain, the following scope was considered:

- The DRS was modelled as being rolled out across the whole of Spain;
- The modelling examined only the financial costs and benefits associated with the system; it did not examine the environmental benefits and disbenefits, except to calculate the resultant increase in recycling that would be achieved by its implementation;
- The DRS was compared against the current baseline for beverage packaging collection in Spain, i.e. one which is predominantly based around bring site collections. It is worth noting that the European Commission is due to review the current targets for packaging recycling and recovery in the near future, and it might be that such changes would require a change in approach to the collection of packaging waste;
- It was decided that the following one-way (non-refillable) beverage containers materials were in scope for the DRS:

1) Plastic bottles predominantly made from PET (Polyethylene Terepthalate) and HDPE (High-Density Polyethylene), e.g. carbonated soft drinks, mineral water, squash bottles, but *excluding* milk;
2) Metal cans, both steel and aluminium, e.g. containers for fizzy soft drinks, alcoholic beverages, energy drinks, etc.;
3) Glass beverage containers, e.g. beer bottles, soft drink bottles etc, but *excluding* wine and spirits bottles; and
4) Beverage cartons, e.g., soft drinks, including brands such as Tetrapak©;[52]

- The level of the deposit was set at €0.20 per container irrespective of container size or material type.

Although there is, strictly speaking, no reason why, in theory, other containers or packaging could not be collected in these systems, the model has been designed around beverage containers for the following key reasons:

- More investment in technology would be required in order to enable recognition in reverse vending machines (RVMs)/counting centres for other types and, importantly, shapes of containers/packaging;
- Beverage containers are more likely than other types of food-based containers to be consumed away from home and thus end up as litter;[53] and
- Hygiene issues – particularly in association with plastic milk bottles, but also for other food-based containers; hygiene issues associated with milk bottles have been stated as a reason for not including these in existing DRSs.[54]

The modelled system targets non-refillable beverage containers, because the overall market for non-refillables in Spain is already greater than that for refillables, and the tendency has been for this market share to increase in recent years. Also, a well-established system already exists for those glass containers that are currently part of the refillables system. The DRS will encourage the capture of non-refillables which are purchased away from home, as well as those consumed in the household, exploiting the potential for increased recycling rates, a reduction in litter levels, and an increase in the quality of material that is collected for recycling through the deposit mechanism.

For the purposes of this modelling, we have thus considered refillables as 'exempt' from this deposit scheme. If the system we are proposing were to be implemented,

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[52] Note that further technological developments will be required in order for the current automated take back machines to accept the relatively small tonnage of beverage cartons alongside plastics, cans and glass. Manufacturers are currently developing machines to process all four materials, but such machines are not yet in wide circulation; we have thus factored additional cost into the financial modelling to account for the uncertainty around the likely change in cost of each automated machine.

[53] http://www.bottlebill.org/about/benefits/curbside.htm

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

then we would suggest that exemptions for refillables should be supported only where return rates exceed a minimum level (probably in excess of 75%). This minimum return rate would ensure that any producers seeking to switch to refillable beverage containers in order to circumvent the deposit scheme would still need to meet relatively high return rates for these containers, and would thus also contribute to the improvement in the management of beverage containers across Spain. It should be noted that, in reality, the majority of refillable deposit systems for beverage containers easily exceed this 75% return rate (except A.G.Barr in Scotland with a published return rate of 76%).

## 3.2 Mass Flows

In order to build a baseline mass flow for beverage containers across Spain, the first step was to consider the current packaging material flows in Spain, where the waste arises and how much of the waste is sent for recycling compared to how much is sent for treatment or disposal as residual waste. Consumers in Spain currently have the following recycling or disposal options for their packaging materials:

1) Household bring site collections - small communal bin areas consisting of separate containers for different packaging waste streams. For the majority of municipalities, a separate container is provided for plastics, cans and cartons, one for glass, one for paper and card, and one or more for residual waste;
2) Larger household waste collection points (*puntos limpios*), where residents can take their recycling waste, including waste streams which are not typically collected in bring sites, such as waste electrical and electronic equipment, textiles and cooking oil;
3) Commercial and industrial residual waste and recycling collections; assumed in this study to be all waste not from household sources; and
4) Placing containers in litter bins, in recycling-on-the-go bins, or discarding them as litter that may or may not subsequently be collected when cleaning the streets.

In this study, modelling was based on 2010 data wherever possible.

In order to ensure the impact of the introduction of the DRS was as directly comparable as possible to the baseline, both scenarios were modelled on the same year (i.e. 2010). This avoided the need to make assumptions regarding inflation and the uncertainty over future changes to factors such as disposal costs. Nonetheless, the results presented later in this report include the impact of several key factors which are likely to change over the coming years; for example, it is not clear to what extent landfill gate fees provide a true measure of the 'avoided costs' of disposal. With implementation of the EU waste hierarchy, and recognising that Spain needs to meet EU Landfill Directive targets, the future 'avoided costs' of disposal are likely to be those associated with incineration or other residual waste treatment processes (such as MBT).

Relevant data sources covering all of the current recycling and disposal options listed above were used to extract information relating to the containers for consideration as part of the DRS. Many of the data sources do not provide disaggregation down to the

level required, so some assumptions were required to break down material fractions into the following elements:

- Glass Bottles (Non-Refillable)
- Plastic Bottles (predominantly PET and HDPE)
- Cans (Ferrous)
- Cans (Aluminium)
- Beverage Cartons

The data sources and assumptions used in building up the baseline material flows are set out in Appendix A.1.2.

Importantly, as discussed in Section 2.0 there remains some discrepancy between the official reported figures for packaging recycling rates in Spain and findings from other studies on a smaller, but perhaps more detailed scale. Given the importance of understanding the baseline situation in determining the subsequent amount of additional recycling that we project would result from the introduction of a DRS, we used the figures presented in Table 3-1; the separately collected packaging (third column from the left) was divided by the total consumption (second column from the left) to derive the current material specific recycling rates for the existing bring site household waste collection system.

Only the separately collected/sorted tonnages were considered when calculating the bring site recycling tonnages in the mass flow baseline. These figures are based on detailed analysis of the European Commission packaging data submission, undertaken by the Fundació per a la Prevenció dels Residus i el Consum Responsible. The Fundació analysed the data based on the information provided in the data quality report provided alongside the submission, and by subsequently comparing the data submitted to other data sources, including from Cicloplast, Arpal, Ecoacero, Recipap and Aspapel.[55]

The subsequent changes in material flow that would occur if a DRS was introduced in Spain were then modelled. In our DRS scenario, it was assumed that the household bring site systems for containers would continue to operate in parallel to the deposit refund system, but that householders would no longer place the majority of their deposit-bearing beverage containers in the kerbside system, instead deciding to return these containers into the DRS and claim back their deposits.

The mass flows were adjusted so that the overall return rate for the DRS reflected the rate of return that could be expected from a €0.20 deposit. This rate was estimated to be 89% (see Section 3.3.1). It was assumed that, in introducing the DRS, 92.2% of DRS containers currently in the household bring site waste stream (including the residual waste stream) would be returned into the DRS, resulting in the overall DRS return rate of 89% when combined with the other sources of waste considered in the

[55] Fundació per a la Prevenció dels Residus i el Consum Responsible (2011) *Análisis de los Resultados de Recuperación de Residuos de Envases en 2008,* July 2011.

mass flow modelling. The remaining 7.8% of DRS containers in the bring site stream were assumed to be either recycled or disposed of in the current bring site system. For the remaining waste streams (*puntos limpios*, litter bins, street sweepings and commercial waste collections), the number of containers collected through each existing waste management route following the introduction of the DRS was reduced by the same proportion across each waste management route in order to achieve an overall return rate in the DRS of 89%.

Table 3-1: Packaging Waste Flow in Spain in tonnes (2008)

| | Consumption | Separate Collection/ Sorting Plants | Mixed Waste Sorting Plants | Incinerators | Traditional Recyclers | Total Recycled/ Recovered |
|---|---|---|---|---|---|---|
| Metals* | 366,138 | 62,769 | 92,873 | 39,976 | 50,333 | 245,951 |
| Steel | 317,701 | 59,957 | 90,999 | 37,643 | 43,958 | 232,557 |
| Aluminium | 48,437 | 2,812 | 1,874 | 2,333 | 6,375 | 13,394 |
| Plastic** | 1,109,000 | 254,823 | 35,000 | 0 | 0 | 289,823 |
| Glass | 1,392,000 | 716,204 | 36,424 | 0 | 0 | 752,628 |
| Cartons*** | 0 | 0 | 0 | 0 | 0 | 0 |
| Paper and Cardboard | 849,702 | 307,130 | 135,302 | 0 | 0 | 442,432 |
| Total | 3,716,840 | 1,340,926 | 299,599 | 39,976 | 50,333 | 1,730,834 |

Notes:

*It is not clear whether all metal coming from incineration and traditional recyclers is actually packaging waste.

**Gross recycling (net recycling would be 25% lower)

***Included in paper and cardboard figures.

*Source: Fundació per a la Prevenció dels Residus i el Consum Responsible (2011), based on 2008 data from Cicloplast, Arpal, Ecoacero, Recipap and Aspapel.*

Reflecting experience from other countries with a DRS, we also modelled a switch in the percentage of metal beverage cans that are sold in steel as compared to aluminium cans. The current ratio of steel to aluminium cans in Spain is around

80:20 in favour of steel.[56] Spain has a strong history of steel packaging manufacture, and is thus slightly unusual in its current split of steel to aluminium in the beverage container industry.[57] However, in introducing a DRS into a steel-dominated market, less of the system costs would be covered by the scrap value of steel than if the cans were, for example, predominantly made of aluminium. In most existing DRSs, by allowing the fee that producers pay to vary according to the balance of costs and revenues associated with each material, the systems tend to levy lower fees on aluminium than on steel, and this acts as an incentive to switch from steel and into aluminium. This can result in almost 100% of beverage cans being made of aluminium rather than steel. System operators, producers and retailers in Spain would, therefore, most likely start looking at options for changing their material mix in order to reduce the costs of the system which they experience. Following the introduction of the DRS, we thus modelled what we consider to be a relatively conservative ratio of beverage cans placed on the market at 80% aluminium, 20% steel.

Note that we have not considered any other changes in the market share of different materials, though this should not be ruled out if producers are faced with different fees reflecting the net costs of the specific materials in the context of the DRS.

## 3.3 Spanish DRS

The system developed for this study is based on similar principles to the systems which exist in the Nordic countries (Norsk Resirk, Returpack, Palpa and Dansk Retursystem), and in a number of provinces within Canada (ENCORP Atlantic Ltd, ENCORP Pacific Inc), although the details reflect Spain's structure of retailing. The operation of the system is illustrated in Figure 3-1 and is outlined in the following points:

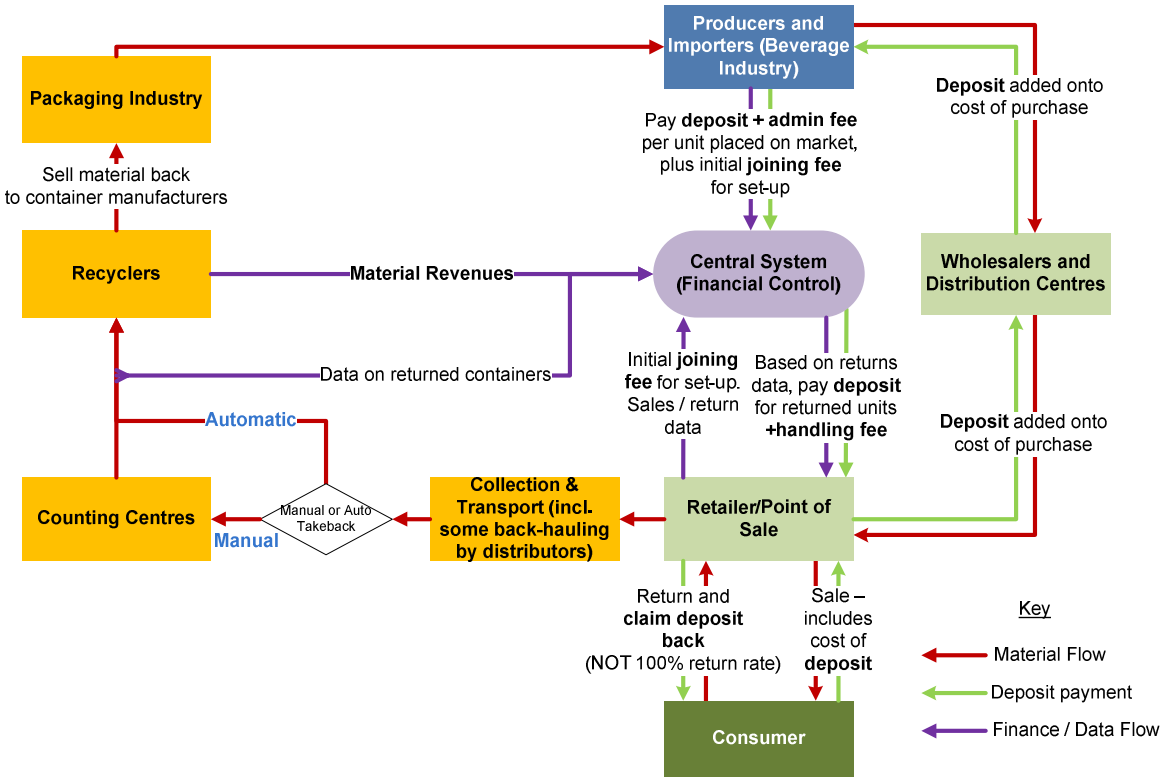
- As beverages are produced and sold to wholesalers, or directly to retailers, producers send sales data to a central system along with a payment matching the total value of the deposits on all items sold. In other words, the producers include the value of the deposit on 'the first sale' of the product. The central system effectively builds up a fund of 'deposits'. The cost of the deposit is paid by all of those in the supply chain including the final retailer;
- Producers also pay an administration fee to cover the remaining costs of the system. This is set periodically to reflect market prices of recyclate, amongst other factors, and is typically set at a different level for each type of packaging material in the system;
- When the consumer purchases a beverage, they also pay the deposit to the retailer, so the retailers are also reimbursed the total value of deposits;

[56] Anonymous European Industrial Source (2011)

[57] http://www.roeslein.com/laselva-spain.html, http://www.arcelormittalpackaging.com/pdf/Publi%20Canmaker.pdf, http://www.apeal.org/uploads/Library/Environmental%20Brochure.pdf

- As consumers return empty containers to stores or other take-back centres, the deposit is paid to them by the retailer. This effectively puts the retailer out of pocket, so the retailer then sends the returns data to the central system. The system then reimburses the retailer, from the 'deposit fund', an amount equal to the level of deposits that have been paid out to the consumer. Thus the circle of deposit payments is closed;
- As the return rate for containers is not 100%, the unclaimed deposits result in revenue being retained by the system, which can be used to fund its operation.

Figure 3-1: Deposit Refund System Model




- In addition to the deposit, the central system pays a handling fee to the retailer for each returned container, the intention being to compensate the retailer for loss of space (storage requirements) and time (in processing the deposit and taking back the containers). Handling fees are reviewed and adjusted periodically;
- Returned empty containers are collected in a number of ways. Automated systems of collection use reverse vending machines (RVMs). Manual collection is also possible. In this instance the retailer accepts the container, over the counter, and stores it in bags or crates within the store/outlet for transport.[58] These bags are

[58] This differs to the typical systems employed in countries such as Canada, where collections occur at a small number of redemption centres rather than at every retail outlet. We believe that in order to maximize return rates and to remove the need for consumers to travel individually make their way to redemption centres to return their containers, a denser network of collection points would be more

provided by the DRS operator and are standardised in order to minimize the time that is required for pickup and counting of the manually returned containers.

- Where the containers are collected via an automated machine, the sorted (and predominantly compacted) material can be transported directly to a recycler, with material revenues being paid back into the central system. Material revenues will also be paid on those containers that are collected manually, though this material will first have to be transported to a dedicated centre for counting, sorting and compacting, before it can be hauled on to a recycling facility. These costs are met by the central system;
- The central system is the focal point for the flow of information regarding container sales and finance for the whole DRS. A significant one-off cost is required to set up the DRS, including all the necessary administrative support, which we have modeled as being met by 'one-off' producer and retailer joining fees. There will also be ongoing costs associated with administering the system which are covered as part of the producer administration fee paid on each unit that is placed on the market. The overall administration fee payable by the producers/ importers is calculated as the balance of income from material revenues and unclaimed deposits against the costs of collection, transport, processing, admin and handling fees. In other words, the administration fee guarantees that the revenues accruing to the DRS match the overall level of expenditure (it is assumed that the system is a non-profit system).

It is worth noting that the system modeled here differs to that which exists in Germany, where the organisation which manages the deposit refund scheme, the DPG, only has an 'over-seeing' role. The system in Germany is much less centralised, with retailers able to set up their own systems of collection and processing, and payments moving directly between the producer and retailer (predominantly through one of six third-party clearing service providers) rather than going through a central system. In order to maintain as simplistic an approach as possible to setting up a DRS in Spain, we chose to model the Spanish system based on the central Nordic model, seeking to learn from experiences that have been highlighted in the operation of the German system, and indeed, others.[59] However, that is not to say that a more decentralised approach would not work, should the Spanish Government wish to opt for a more decentralised approach.

Some of the key elements forming part of the DRS cost model used in this study are summarized below; full details on the approach and assumptions used to model the costs of the DRS can be found in Appendix A.3.0.

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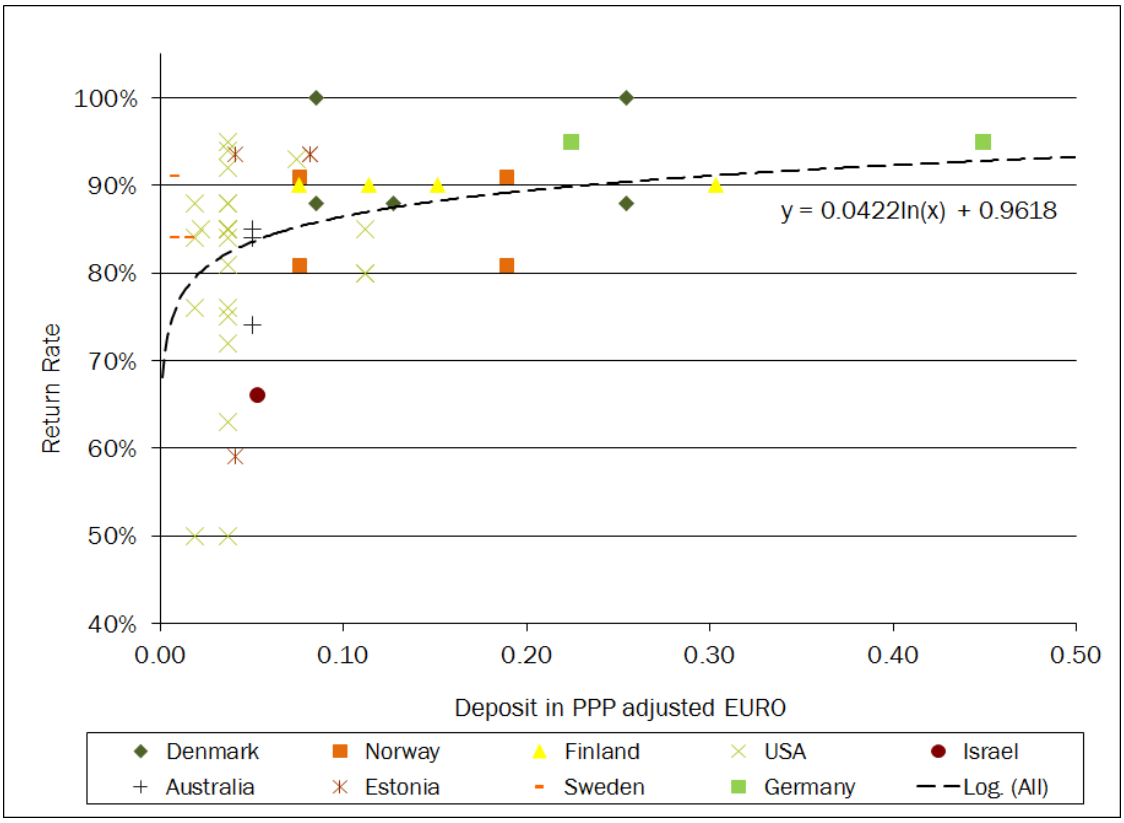
appropriate for Spain, and would eliminate additional environmental impacts which might arise from making 'dedicated journeys' to redemption centres. Thus we have modeled the system based on a higher number of collection points via both automated and manual methods of collection, similar to systems used in Norway, Denmark and Sweden.

[59] 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

### 3.3.1 The Deposit and Return Rates

One of the most crucial elements of the deposit model is the setting of the deposit itself. The value of the deposit for Spain was calculated based on deposits and return rates from other systems around the world. The return rate was plotted as a function of the deposit across existing schemes (see Figure 3-2~~Figure 3-2~~) in order to establish what return rate would be likely to be achieved under a €0.20 deposit in Spain. As illustrated in Figure 3-2~~Figure 3-2~~, an 85% to 95% return rate is currently achieved across a number of DRSs worldwide; if we assume that the principle motivation driving returns is an economic one, similar return rates should therefore be achievable across Spain.

Figure 3-2: Return Rates as a Function of Deposits in PPP-Adjusted Spanish Euros.




*Source: Eunomia*

We note, however, that other factors will also be involved in obtaining high return rates, including ensuring that there are sufficient return points for the DRS containers, and whether or not people in Spain are used to returning containers i.e. the 'habit of return'.[60,61] In respect of the former point, our modelling is designed with

[60] 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

a significant number of return points in order to make returns as easy as possible. Regarding the latter, we would argue that there appears to be no evidence to suggest that a habit could not be established anew, given an adequate financial incentive in support of the DRS.[62] Indeed, in the recent CECU study it was suggested that 89.6% of the people consulted would collaborate with a DRS.[63]

The deposits were converted from the local currency of the DRS to Spanish Euros using OECD Actual Individual Consumption Purchasing Power Parities from 2009 to give a better estimate of the value of the deposit than simply using the current exchange rate.[64] Figure 3-2~~Figure 3-2~~ illustrates that, in setting a deposit of €0.20 per container, the return rate for the system would be 89%. Sensitivity analysis is presented later in this report on the potential financial impacts of applying different deposit values and the resultant return rates that might be obtained from the system.

### 3.3.2 Handling, Collection, Logistics and Processing

In order to determine the overall costs of the DRS, detailed modelling was undertaken on the costs of handling the containers at retail outlets, and the costs of the subsequent collection and transport of containers to reprocessors. In order to understand both elements, it was important, firstly, to understand the retail landscape in Spain, to calculate both the number of collection points in the system and whether containers would be likely to be returned to retailers via automated reverse vending machines (RVMs) or manually over the counter.

In order to retain comparability with the recently published Sismega summary report, the types and total numbers of grocery store outlets in Spain which might accept returned containers were based predominantly on data from the same source (data from Nielsen, a global market research company).[65] To this was added data on the number of Horeca across Spain that might also sell beverage containers, but which were not considered as part of the Sismega study (namely food stores, gas stations/service areas/convenience stores and catering facilities in the workplace).[66,67,68] It should be noted that, in this model, it is assumed that retailers are only obliged to take back the container types that they sell.

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[61] Thomas Sterner (1999) Waste Management and Recycling, in T. Sterner (ed.) (1999) *The Market and the Environment: the Effectiveness of Market-based Policy Instruments for Environmental Reform*, Cheltenham: Edward Elgar

[62] Eunomia Research and Consulting (2010) *Have We Got the Bottle? Implementing a Deposit Refund System in the UK*, report for the Campaign to Protect Rural England, September 2010.

[63] CECU (2011) *Estudio Sobre la Acogida del Sistema SDDR en España. Investigación Cuantitativa.*

[64] OECD (2010) Purchasing Power Parities (PPP), Accessed May 2011, http://www.oecd.org/department/0,3355,en_2649_34357_1_1_1_1_1,00.html

[65] 2010 data provided by Nielsen, covering all hypermarkets and supermarkets, traditional stores, restaurants and hotels, clubs, bars, pubs and cafes.

[66] Fundación Hostelería de España (2010) *Los Sectores de la Hostelería en 2009.*

A significant number of the beverages sold in Horeca are in refillable rather than non-refillable containers. In reality, the Spanish system may consider Horeca outside the scope of a DRS, depending on the proportion of the beverages that they sell in refillable, compared to non-refillable, containers. However, given the current trend towards an increasing number of beverages being sold in non-refillables across Spain, the assumption that Horeca would be included in the DRS as locations at which consumers can return empty containers, and that a proportion of these Horeca would then register as a 'return point' in the DRS logistics system, is perhaps a more sensible and conservative (from a cost perspective, i.e. this reduces the likelihood that costs are underestimated) approach.[69] The proportion of Horeca assumed to be in the DRS was thus calculated based on the number of beverages sold across each retail type in non-refillable rather than refillable containers.

Table 3-2 summarises the number of outlets of each retailer type across Spain and the percentage of each retail type assumed to register as a return point as part of the DRS. Table 3-3 shows the proportions of each retail category that we assumed would use automated systems of take back, and would thus have an RVM in their store, and the average number of RVMs that would be required per store. The balance of return points in each retail category was assumed to operate a system of manual take back.

The total number of retail outlets requiring an RVM in Spain was calculated at 20,231, with the total number of RVM machines at 24,103. The number of businesses opting to register as a return point in the system but not requiring an RVM, was estimated at around 162,000. It should be noted that this is somewhat higher than the number assumed in the Sismega summary report.

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[67] La Caixa (2009) *Anuario Económico de España 2009,* available at http://www.anuarieco.lacaixa.comunicacions.com/java/X?cgi=caixa.anuari99.util.ChangeLanguage&lang=cat

[68] Alimarket (2010) *Informe anual Alimarket de Distribución 2010.*

[69] Where a retailer registers as a 'return point' they are choosing to be part of the logistics system of the DRS. Where a retailer chooses not to register, but still sells deposit-bearing containers, the retailer will still be obliged to take back any containers that are returned to it, but will then put those returned containers into another retailer system for collection.

Table 3-2: Total Number of Retail Outlets Selling Beverage Containers and the Percentage of each Retail Type Assumed to Register as Return Points in the DRS

| Type of Retailer | Number of Retail Outlets | Retailers Assumed to Register in the System (%) |
|---|---|---|
| Hypermarket ( >2,500 $m^2$) | 438 | 100% |
| Supermarket (1,000 - 2,499 $m^2$) | 2,996 | |
| Supermarket (400 - 999 $m^2$) | 4,891 | |
| Supermarket (100 - 399 $m^2$) | 8,890 | |
| Supermarket ( < 100 $m^2$) | 10,078 | |
| Traditional Store | 26,494 | |
| Food Stores | 29,844 | |
| Restaurants and Hotels | 57,640 | 25% |
| Clubs, Bars and Pubs | 23,483 | |
| Other Bars | 9,152 | |
| Cafes | 137,302 | 50% |
| Catering in the workplace | 12,223 | 10% |
| Gas Stations/Service Areas/Convenience Stores | 5,893 | 100% |
| Total | 329,324 | 55% |

Table 3-3: Retail Outlets Requiring RVMs and Number per Store

| Type of Retailer | % of Retailers Requiring an RVM | No. of RVMs per store |
|---|---|---|
| Hypermarket ( >2,500 $m^2$) | 100% | 3 |
| Supermarket (1,000 - 2,499 $m^2$) | 100% | 2 |
| Supermarket (400 - 999 $m^2$) | 100% | 1 |
| Supermarket (100 - 399 $m^2$) | 50% | 1 |
| Supermarket ( < 100 $m^2$) | 0% | |
| Traditional Store | 0% | |
| Food Stores | 25% | 1 |
| Restaurants and Hotels | 0% | |
| Clubs, Bars and Pubs | 0% | |
| Cafes | 0% | |
| Other Bars | 0% | |
| Catering in the workplace | 0% | |
| Gas Stations/Service Areas/Convenience Stores | 0% | |
| TOTAL | 20,231 | 24,103 |

*Source: Eunomia*

The combined analysis of retail outlets, market distribution, container material type and likely take back methods, culminates in the initial flow of containers shown in Table 3-4. From this analysis, it is thus assumed that 79% of container collection will be via automated take back, and 21% via manual take back.

Table 3-4: Number of Containers Requiring Collection via RVMs or through Manual Take Back, millions

| Product | RVMs | Manual |
|---|---|---|
| Glass ≤0.5 l | 2,134 | 475 |
| Glass >0.5 l | 374 | 83 |
| Plastic ≤0.5 l | 1,339 | 375 |
| Plastic >0.5 l | 2,652 | 742 |
| Cans (Fe.) | 3,899 | 938 |
| Cans (Al.) | 975 | 235 |
| Cartons ≤0.5 l | 1,067 | 343 |
| Cartons >0.5 l | 404 | 130 |
| Total | 12,844 | 3,321 |

*Source: Eunomia*

Other key elements that were costed in the DRS modelling were as follows:

- Automated take back RVM costs, including investment costs (annualised over seven years) and on-going operating costs;
- Retail space infringement costs;
- Retail labour costs (associated with emptying and cleaning machines where take back is automated, or with taking back containers over the counter and issuing receipts where manual);
- Containment for storage and transport of DRS containers;
- Backhauling of DRS containers to central retail depots using existing retail logistics networks. Key costs for the DRS operator in this instance related to onward transportation of material from the central depots to counting centres, as well as reimbursing retailers for the small increase in fuel usage due to the increased weight of returning vehicles;
- Dedicated collection round costs for all retail outlets where backhauling could not be assumed. This is organised by the DRS operator. Key costs included the vehicles and drivers needed to undertake the collection rounds (and associated fuel, maintenance, insurances etc.) and to deliver the containers to central collection/counting depots, the costs of the counting centres themselves which

are required to 'clear' the containers in the central system, and onward transport to reprocessors.[70]

Figure 3-3~~Figure 3 3~~ summarises the key components that were modelled in the DRS in Spain. Details of the step-by-step assumptions used in relation to the development of the DRS collection and transport logistics and in the calculation of the retailer handling fees are described in Appendix A.3.2.

### 3.3.3 Other DRS Costs

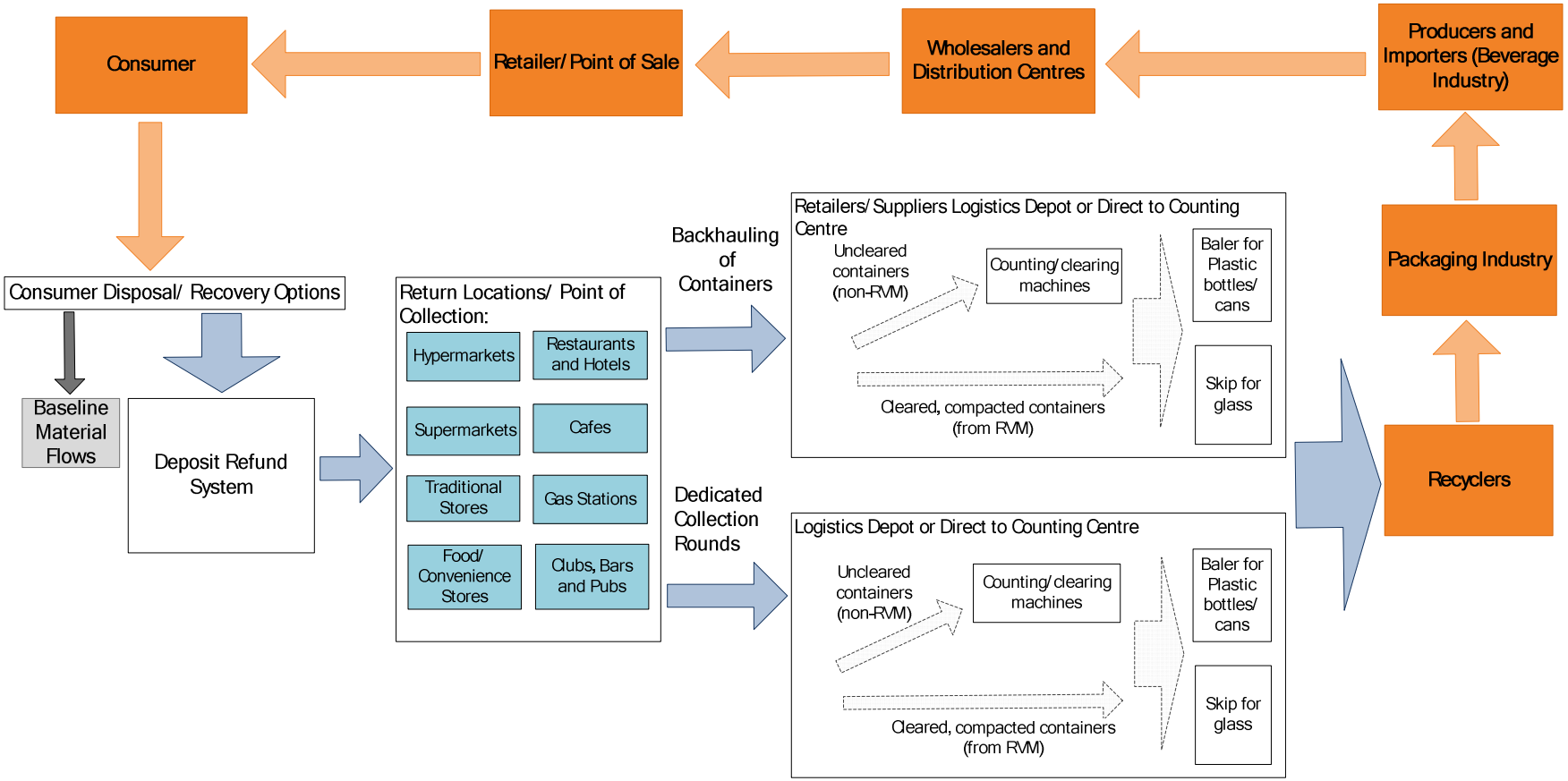
Other key elements modelled in determining the costs of implementing a DRS in Spain were as follows:

- The on-going costs associated with running the central administrative system; these costs were based on 65 staff being required to cover the administration, customer services functions and marketing activities of the Spanish system;
- Material revenues; in order to reflect the increase in quality that would be expected as a result of the introduction of a DRS, it was assumed that there would be an increase in the revenue received (per unit weight) for materials collected via the DRS compared to what was modelled for the current bring site system (reflecting the expected increase in quality);
- One-off set up costs for the system, including the costs required to:
  - Design the DRS;
  - Set up the central system;
  - Procure the necessary logistics and office/depot/counting centre space;
  - Communicate the system to the public;
  - Populate the product database from which deposit amounts, producer fees etc. are subsequently calculated; and
  - For producers to undertake any label changes required.

It should be noted that these one-off costs do not include the investment costs associated with purchasing items such as RVMs or counting centres; these costs have already been factored into the ongoing operating costs of the DRS, based on the assumption that they would be leased or depreciated over a certain number of years, rather than being considered as part of the one-off system costs.

[70] 'Cleared' means that the container has been processed and recorded as returned in the central system, and the subsequent handling fee and deposit can be paid out to the retailer.

Figure 3-3: Key Components Modelled in the Deposit Refund System in Spain



## 3.4 Cost Reduction in Existing Waste Collection Systems

One of the key elements missing in the majority of existing studies on DRSs is the reduction in costs associated with fewer containers having to be collected through existing collection routes. This oversight will result in an over-statement of the potential costs associated with the introduction of a DRS. Therefore, one of the key components of this study was the *inclusion* of all relevant costs, most importantly the change in costs from household bring site collection systems.

For the bring site modelling, the majority of assumptions used were based on the approach detailed in the Ecoembes report.[71] There were, however, several key assumptions which were changed in our modelling as follows:

- The mass flow modelling was not detailed in the Ecoembes report. Mass flows are required in order to determine how quickly the bring site containers are filled each week, and hence, the required frequency of collection. Given that the mass flow assumptions are not disclosed in the Ecoembes report, we have based our calculation on the mass flows using the approach outlined in Section 3.2 (with further details provided in Appendix A.1.2), in order to determine the collection frequencies required and hence the numbers of vehicles and staff;
- Vehicle costs were annualised over 8 years in our modelling rather than the 9 years used in the Ecoembes report;
- Contracted hours for staff were increased to 1,800 per year for all staff in our modelling compared to the 1,554 to 1,806 hours per year used for the different autonomous communities in the Ecoembes report. The working hours per day, on the other hand, were modelled at 7 hours, rather than the 7.5 hours in the Ecoembes report, to include a contingency for rest, breakdowns, queuing in traffic, etc;
- An absentee rate of 10% was used rather than 5%, this being considered more realistic; and
- Industrial profit was assumed to be 10% rather than 5%.

Further details on the assumptions used in modelling the bring site collection costs are given in Appendix A.2.0.

The change in cost resulting from the diversion of DRS containers away from the existing lightweight packaging, glass and residual waste collection systems was calculated by changing the mass flows running through the existing systems, with collections assumed to be reduced in frequency due to the slower fill rate in the existing bring site containers when the DRS is in operation.

For the lightweight packaging and glass collections, the resulting cost savings are assumed to result in a reduction in Green Dot fees payable to the municipality for

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[71] Ecoembes (2007) *Estudio para la Determinacion de la Formula de Pago de Aplicacion a la Recogida Selectiva de Envases Lig*eros, September 2007

these bring bank collections. The reduction in payment is assumed to be equal to the actual reduction in the costs of delivering these services by the municipality. Thus we assume no overall net change in costs to the municipality as a result of the reduction in DRS containers collected through the lightweight packaging and glass collection systems. In reality, the existing costs of packaging collection to the municipality could be higher than what is currently covered by the Green Dot fees paid by the PROs because, for example, the municipality may choose to empty the bring site collection bins more often than indicated by the Ecoembes modelling, or the productive/working hours for the collection crews may be less than specified in the Ecoembes modelling. In these cases there may be further savings available to the municipalities due to the reduction in the amount of waste flowing through the existing bring recycling system, but these are not modelled as they will vary from municipality to municipality and therefore are beyond the scope of our high-level, Spain-wide collection model.

The costs of residual waste collection and disposal are not covered by the Green Dot schemes; thus it is assumed that the municipality would receive any savings that result from a reduction in containers collected in the residual waste bring site system.

Approximate costs were also established for the cost of the collection and disposal of containers through larger household collection points, commercial waste recycling and residual waste collections, litter bin and on-the-go recycling bins, and street cleaning/sweeping.

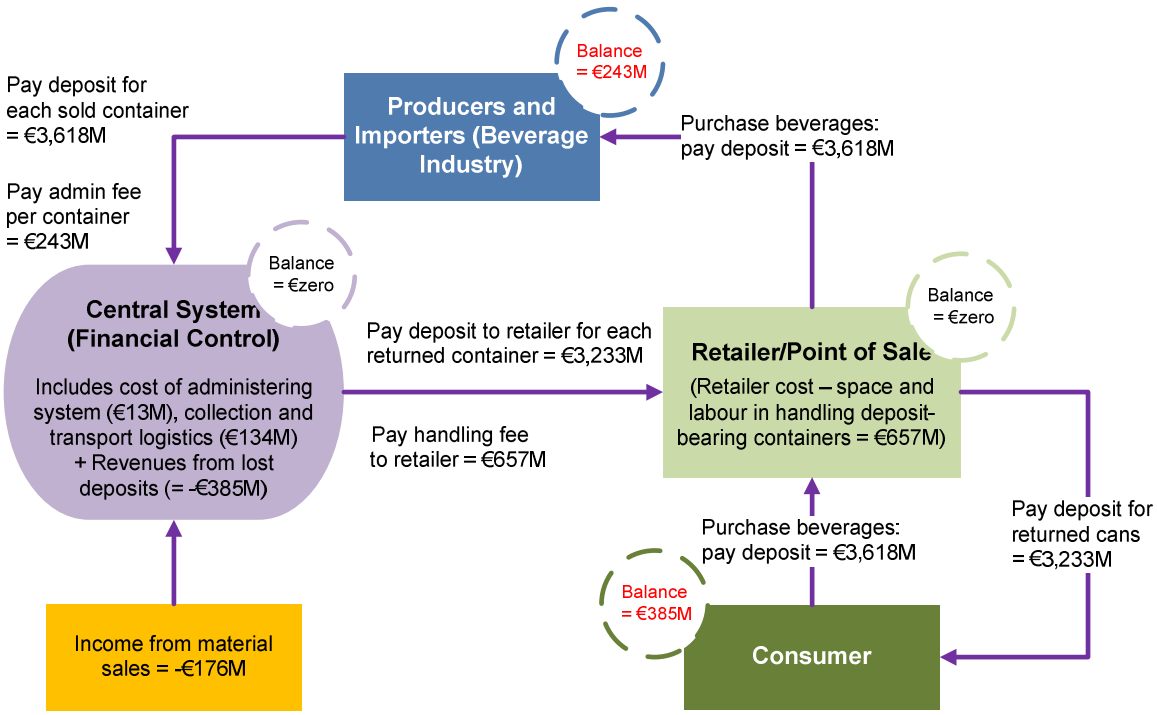
# 4.0 Results from Financial Analysis

Following the methodology described in the previous section, the financial implications associated with the introduction of a DRS in Spain have been estimated. The results are presented in this Section. Particular focus is given to:

- The net cost effect to producers from the costs they would bear in the DRS compared with the reduction in payments they would need to make for the existing producer responsibility system;
- The financial impacts on the retailers;
- The effect on local authority budgets of removing their need to collect deposit-bearing packaging (including street sweeping); and
- The potential cost to the consumer.

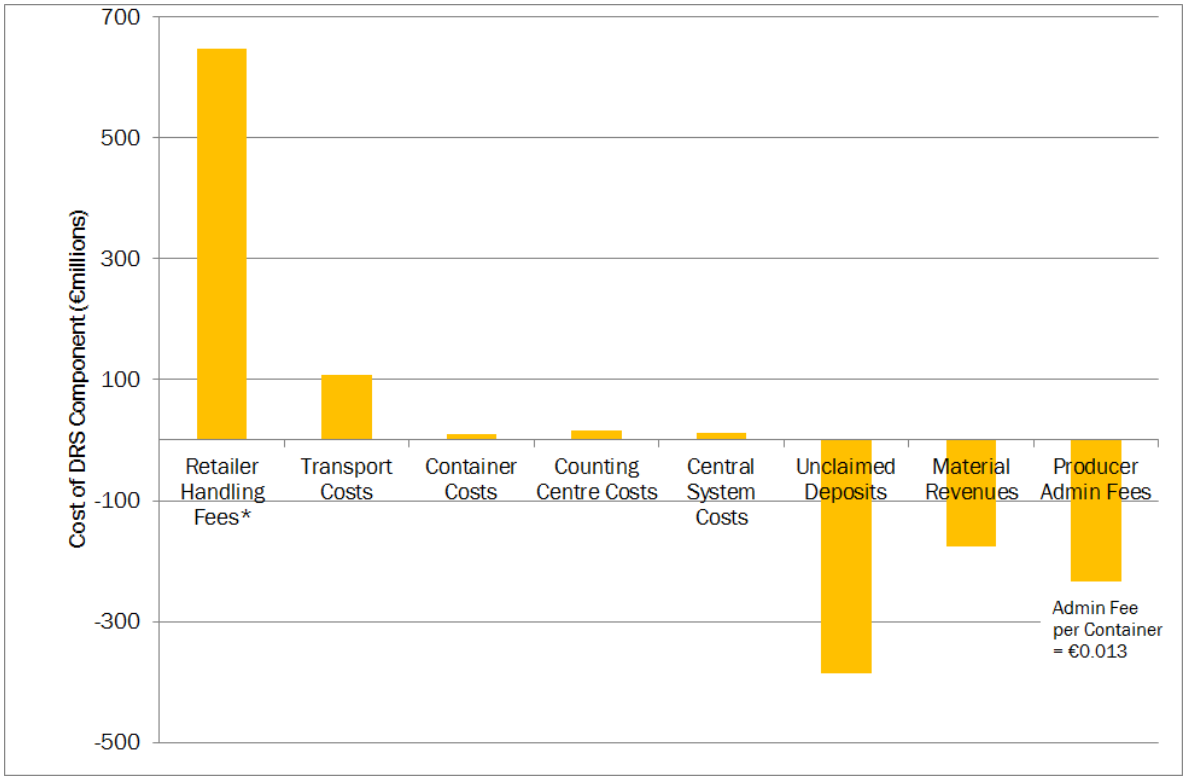
Figure 4-1 illustrates the annual flows of money throughout the DRS for each of the key stakeholders involved in the system. Figure 4-2~~Figure 4-2~~ shows a breakdown of the ongoing costs by the main components of the overall cost. It is important to note that throughout this cost benefit analysis, and in the sensitivity analysis that follows, a positive balance represents an overall 'cost' and a negative balance represents an overall 'saving' to the stakeholder in question or for the overall system. The overall net cost of the system (i.e. the amount of administrative fees that will need to be paid annually by the producer in order to bridge the outstanding imbalance between the costs and revenues in the central system) is calculated at €243 million, which equates to €0.013 per container placed on the Spanish market.

Figure 4-1: Cash Flows in the Spanish DRS, €millions




*Note negative figures indicate an income into the system, positive figures indicate a cost.*

Figure 4-2: Cost of Each DRS Component, €millions




**Handling fees include costs for the space and labour required for the DRS as well as, where applicable, the annualised costs of investing in and operating RVMs.*

The key points to draw from Figure 4-1 and Figure 4-2~~Figure 4-2~~ are as follows:

- Handling costs for the retailers are estimated to be around €657 million per annum. We have modelled that these costs would be fully compensated by the central system through the imposition of a 'handling fee' payable to the retailer for each container taken back. The average handling fee is calculated at €0.04 per container returned;
- Collection and counting costs, financed by the central system, are likely to be around €134 million per year;
- The materials income of €176 million derived from the sale of materials collected through the DRS goes towards paying for the running of the DRS;
- The ongoing running costs of the central system amount to €12.8 million per annum;
- The consumers who do not return the containers they purchase will lose the deposits they have paid. At an overall 89% return rate, consumers would forfeit a total of €385 million of unclaimed deposits. In our model, this revenue is used to fund the operation of the system (it reduces the level of the administration fee required from producers to support the costs of operating the system);

- The outstanding imbalance between the costs and revenues (including unclaimed deposits) in the central system is around €243 million. This is recovered through the administration fees paid by producers. The handling fee payments to the retailers and the administration costs of the central system are offset by the revenue generated from producer administration fees, income from material sales, and unclaimed deposits;
- The producer administration fee for the DRS equates to around €0.013 per container placed on the market. The system implies a net cost to the producers (in other words, producers are effectively paying for the collection and recycling of beverage containers that they place on the market).

The costs of the system are thus born by those who are responsible for the generation of the waste – the producer, and ultimately, to the extent that the costs can be passed on, the consumer.[72]

The calculated producer administration fee falls within the range of administration fees set by a number of existing deposit refund systems e.g. €0.01 to €0.05 per unit in Finland (dependent on material), and just over €0.02 per unit in Maine, USA.[73,74] It is important to note that the administration fee will be sensitive to both the return rate and the deposit, a fact which is explored in more depth in the sensitivity analyses undertaken later in this Section. The setting of the administration fee will thus need to be re-visited periodically following the introduction of a deposit scheme to ensure that the fee continues to cover the cost of the system, net of revenues received (in the form of revenues from material sales and unclaimed deposits).

The figures given above do not, however, tell the whole story with regards to the overall financial impact from the introduction of a DRS in Spain. Whilst additional cost would be incurred in setting up and delivering the collection logistics for the DRS, the majority of the deposit-bearing containers would no longer be collected through the existing household and non-household collection systems, thereby resulting in financial savings for those systems. The wider financial impacts of the introduction of the DRS on the key stakeholders involved in or directly impacted by the DRS are illustrated in Figure 4-3~~Figure 4-3~~ and are described henceforth.

A government body authorising the system and associated finances, and setting recycling targets for the various materials

The financial impact on the Spanish Government should be minimal, as Government already has to set recycling targets and associated policies. In terms of setting up the system, we have designed the DRS so that the stakeholders involved in implementing such a system would be tasked with designing it/setting it up rather than this being

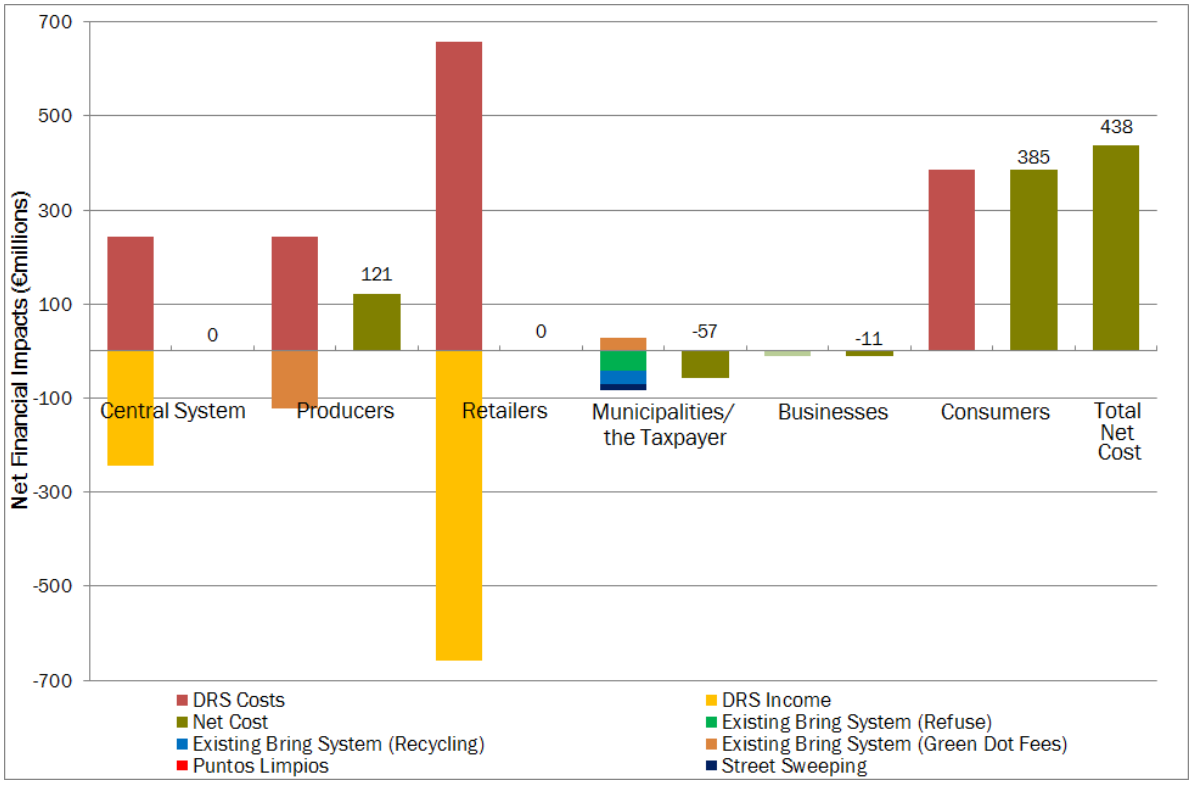
[72] The degree to which costs can be passed on from producers to consumers depends upon the elasticity of demand for the items being sold. For beverages, especially for off-sales, demand is relatively inelastic, so that the likelihood of most of the costs being passed through to consumers is quite high.

[73] http://www.palpa.fi/english

[74] http://yosemite.epa.gov/ee/epa/eerm.nsf/vwAN/EE-0216B-06.pdf/$file/EE-0216B-06.pdf

the responsibility of the Government, so again there would be minimal financial impact on the Government.

Figure 4-3: Wider Financial Costs and Benefits to each Key Stakeholder from the Introduction of the DRS, €millions




A central organisation owned and run by (within the constraints set by the authorising body), for example, non-governmental organisations, industry bodies, producers, breweries and retailers (i.e. the 'central system')

The costs of running the central system in the DRS amount to €12.8 million per annum (see Figure 4-2~~Figure 4-2~~). This cost is met in full as part of the producer administration fees that are paid into the system (see discussion on financial impacts to producers that follows).

The manufacturers of containers, producers of beverages and industries that 'fill' the containers (the 'producers')

The producers incur an annual cost from the introduction of the DRS of €243 million (equivalent to a €0.013 per container admin fee). We have also modelled an additional one-off investment cost for producers of €1.7million for the new labelling required for the DRS (in reality, this cost may be avoided by allowing a sufficient lead-in time for the introduction of the DRS so that producers can incorporate any changes as part of their periodical packaging/labelling re-design). It might also be argued that the producers will pay a significant portion if not all of the costs associated with setting up the DRS, the total cost of which is €31.3 million, which would be paid for through joining fees (though it is difficult to say exactly what percentage of the one-off set-up costs would be met by the producers, as it may be that other key stakeholders

such as retailers also contribute towards the set-up costs). One-off costs are discussed further in Section 4.4.

Although the producers incur a cost from the introduction of the DRS, in contributing to the DRS through admin fees, they will no longer be required to pay the existing Green Dot fees for that packaging which is considered in scope for the DRS. Based on the existing Green Dot fees payable for different material types in the Ecoembes and Ecovidrio systems (which averages at €0.007 per container placed on the market), multiplied by the numbers of containers that would be included in the DRS, the producers would save a total of €123 million per annum in existing Green Dot fees. Thus the net overall financial impact on producers of the introduction of a DRS is €120 million per annum, equivalent to an additional €0.007 per container on top of what they currently pay.

It is important to note that, based on our bring site modelling, we estimate the saving in the existing bring site packaging collection costs to be somewhat lower than the estimated reduction in Green Dot fees. From our modelling, we estimate that the collection costs for lightweight packaging and glass would only reduce by around €28 million per annum (though the actual reduction may be higher as the modelling assumptions used are mostly from the Ecoembes report where the collection services in all municipalities are assumed to be equally efficient).[75] If the reduction in Green Dot fees predicted here is in excess of the savings implied through reduced collection costs, this could leave a shortfall in funding the existing Green Dot schemes. In Germany, a similar effect was observed, and this shortfall was met by a combination of reduced overheads in the existing Green Dot schemes, tackling the issue of free-riders in the existing schemes and via improved efficiency of infrastructure. Another approach would be to raise the fees for the remaining packaging in the existing Green Dot schemes, but clearly this would be less preferable to producers.

Any retailer which sells beverages (non-refillables) in Spain

Based on the key cost components of the DRS, the costs to the retailer of the required space and resources for the DRS are by far the largest component of the total costs of the DRS (€657 million per annum). The cost to the retailer is fully reimbursed by the handling fees that are paid to the retailer by the central system on a per container returned basis. The average handling fee is calculated at €0.04 per returned container. The handling fees compensate the retailer for the following:

- RVM installation and operating costs;
- Shop floor space used to house RVMs and to store returned containers; and
- Labour costs associated with the emptying of RVMs, the manual take-back of containers by the cashier, and facilitating the pick-up of the returned containers by contracted logistics companies or the retailer's own haulage.

[75] Ecoembes (2007) *Estudio para la Determinacion de la Formula de Pago de Aplicacion a la Recogida Selectiva de Envases Lig*eros, September 2007

This includes a cost for additional labour for manual collections of €134 million; in reality, it could be argued that this is a somewhat conservative estimate, as staff employed by some retailers, particularly the smaller stores, will be likely to be able to absorb a significant amount of the time required for manual take back into their existing contracted hours without requiring additional payment. Nonetheless, this cost has been included here to ensure that the cost to the retailer is fully reimbursed by the handling fees that are paid to the retailer by the central system. Over time, as components such as the RVMs and any infrastructure alterations reach the end of their payback periods, the handling fees may effectively start to generate a net income for some retailers.

The retailers may, however, be required to contribute to the initial set-up costs of the system via retailer joining fees (as noted in the discussion regarding 'producers' costs above and discussed further in Section 4.4).

All consumers which purchase beverages in Spain

The consumers who do not return the containers they purchase will lose the deposits they have paid into the DRS. At an overall 89% return rate, consumers would forfeit a total of €385 million of unclaimed deposits. In our model, this revenue helps fund the operation of the system. For this reason, it is important to have complementary targets in place to ensure that the system is not designed so as to 'deliberately underperform', and thereby enable full funding through unclaimed deposits. With targets in place, the system would likely be designed with a deposit set at a rate designed to deliver the desired performance level, consistent with the level of infrastructure provision. The provision of many easily-reached return points should minimise the level of unclaimed deposits as long as the deposit it set at a reasonable level.

Through the implementation of the DRS, the costs of the system are met by those consumers that choose not to redeem their deposit (in combination with producer admin fees and material revenues obtained), rather than being paid for equally across all taxpayers i.e. the 'polluter pays' principle.

Municipality/taxpayer

The introduction of the DRS results in a reduction in the costs of collection and disposal associated with the following existing methods of packaging collection:

1) A reduction in residual waste bring site costs; a reduction in the amount of beverage container packaging being collected in the residual waste or 'grey bin' bring sites will result in a reduction in the frequency of collections that are required and in the disposal costs associated with the waste that is collected in these bins. The costs of the grey bin collections are currently met by the municipalities; hence any reduction in costs is considered a saving to the municipalities;
2) A reduction in street sweeping and litter bin costs; following similar logic to the bring site collections, a reduction in the amount of packaging waste being collected via street sweeping and litter bins will result in a reduction in collection and disposal costs to the municipalities, particularly in tourist areas; and

3) A small reduction in the costs to municipalities of running the *puntos limpios* associated with savings in handling and staff time.

The introduction of the DRS may also result in additional savings to the municipality if/where the Green Dot scheme payments made by the PROs to the municipalities do not cover the full costs of the separate collection of lightweight packaging and glass at bring sites. Given the lack of detailed financial data on a municipality by municipality basis in terms of the costs of running each element of the bring site service compared to the payments received by the PROs, in order to provide a conservative approach we have assumed that the Green Dot fees paid to municipalities cover the full costs of these separation collection services. Thus, although the municipality saves money through the reduction in collection costs of lightweight packaging and glass, this is matched by a reduction in fees paid by the existing PROs to the municipality for those collections. However, further savings may be available to those municipalities which currently have to meet the shortfall between PRO payments and running the separate collection schemes.

Current landfill disposal costs in Spain are relatively low compared to a number of other European countries, averaging €36.17 per tonne across the autonomous communities, with only Catalonia currently applying a landfill tax on top of landfill gate fees for municipal waste.[76] The current average cost of €36.17 per tonne was thus used in the central scenario in the modelling in order to calculate the avoided disposal savings derived from the introduction of the DRS.

However, given the need to meet the requirements of the Waste Framework Directive, including;

1) the need to enshrine the waste hierarchy in waste management policy and legislation; and

2) the need to comply with targets under Article 5 of the Landfill Directive,

it seems likely that the avoided cost of disposal will increase over the next few years in Spain.

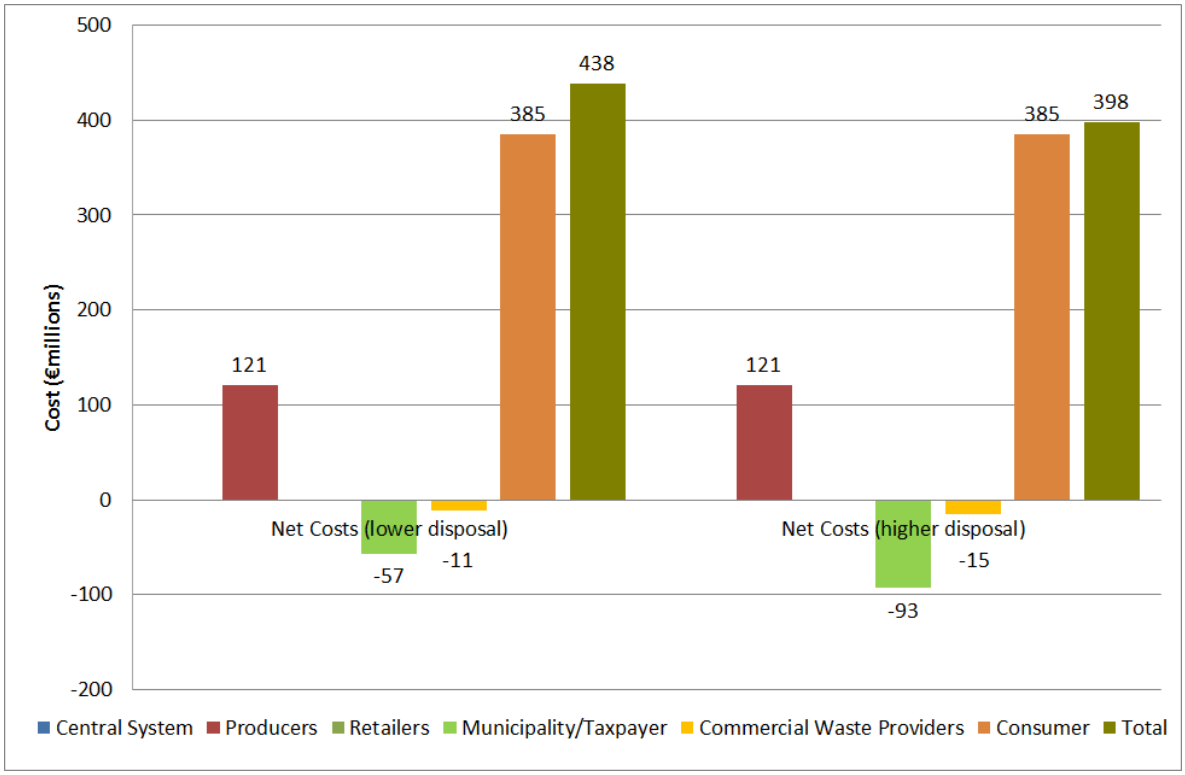
A more appropriate figure for the avoided cost of disposal in future, therefore, might be the likely cost of alternative residual waste management in Spain. The cost of MBT and incineration facilities in Spain are typically around €60 to €80 per tonne, this being for existing plants, some of whose construction will have been supported by European funding, potentially keeping the costs at the lower end of what might otherwise be expected. In order to explore the financial impact to municipalities of diverting waste away from existing collection systems and from disposal and into the DRS, we thus also modelled a 'higher disposal cost' scenario at €80 per tonne, i.e. at

[76] Eunomia Research & Consulting (2010) *An Appraisal of European Recycling Targets and Landfill Legislation,* report for the Welsh Assembly Government, March 2010. See also I. Puig Ventosa (2011) *Landfill and Waste Incineration Taxes: The Spanish Case*, Presentation to the European Commission Conference on Economic Instruments to Implement the Waste Hierarchy, Brussels, 25th October 2011, http://ec.europa.eu/environment/waste/pdf/strategy/5.%20Landfill%20and%20incineration%20taxes%20in%20Spain%20Ignasi%20Puig%20(2).pdf

the lower end of the typical range of costs for modern MBT/ incineration plants.[77] The results of this modelling are presented in Figure 4-4.

The total savings to the municipality/taxpayer therefore amount to between €57 million per annum (at the lower disposal cost of €36.17 per tonne) and €93 million per annum (at the higher disposal cost of €80 per tonne). The majority of the total savings (76% to 81% of the total savings for the lower and higher disposal scenarios respectively) is derived from the reduction in costs associated with the residual waste bring site service, with around 20% of the savings coming from street sweeping/litter bin emptying and less than 1% of the savings being derived from the *puntos limpios*.

Figure 4-4: Net Financial Impacts from the Introduction of the DRS based on a Lower Disposal Cost (€36.17 per tonne) compared to a Higher Disposal Cost (€80 per tonne), €millions




Businesses receiving Commercial Waste Collections

Following the introduction of the DRS in Spain, we also modelled a small reduction in the tonnages of residual waste, lightweight packaging and separate glass obtained through commercial waste collections. A saving of between €11 million and €15

[77] It can be the case, of course, in situations of over-capacity (relative to demand) that prices fall below this. The surplus incineration capacity in Central and Northern Europe is leading to downward pressure on prices, with gate fees frequently as low as €45 per tonne in the marketplace.

million per annum (depending on the assumed cost of disposal) was calculated to businesses for the reduction in collection and disposal costs associated with commercial waste collections.

It should be noted that the introduction of a DRS and the reduction in existing collection logistics will provide, in the first instance, opportunities, and in the second instance, reduced requirements for businesses that provide collection, sorting and disposal of waste. It is difficult to determine what the net effect on, for example, existing waste management companies might be; this will depend on, among other factors, the competition that comes into play for any new contracts created by the introduction of the DRS. In any case, to include the potential impacts on these companies as part of the financial analysis would be to introduce double-counting in calculating the net financial impacts of the introduction of the DRS (since the costs of funding the DRS logistics and the savings from not collecting beverage containers in the existing systems are already considered through impacts on producers, PROs, autonomous communities, etc.), and as such these are not considered further here.

Overall Net Impact across all Stakeholders

As indicated in Figure 4-4, the overall financial impact resulting from the introduction of a DRS in Spain is a net cost of between €398 million and €438 million per annum (depending on the cost of disposal). The highest costs are met by those consumers that choose not to return their containers to the DRS in order to redeem their deposit i.e. in accordance with the 'polluter pays' principle. The municipality receives the greatest financial benefit from the introduction of the DRS in the form of avoided costs for the existing bring site residual waste collections, as well as from avoided street sweeping and litter bin emptying costs.

In summary, the net overall financial impact is as follows:

1) There is a net annual cost to producers of €120 million (€0.007 per container placed on the market). This cost reflects the balance of producer admin fees payable into the DRS and the reduction in payments producers would need to make for the existing producer responsibility system;
2) The cost to the retailer of handling and processing the returned DRS containers is fully reimbursed by the handling fees that are paid to the retailer by the central system on a per container returned basis. Hence there is no net financial impact on the retailers;
3) The total savings to the municipality/taxpayer amount to between €57 million per annum and €93 million per annum (depending on the assumed cost of disposal);
4) Total savings to businesses that currently pay for commercial waste collections amounts to between €11 million per annum and €15 million per annum (depending on the assumed cost of disposal); and
5) At an overall 89% return rate, the cost to the consumer would be €385 million per annum, paid by those consumers that choose not to return their container to the DRS and who thus forfeit their deposit.

Table 4-1 illustrates the impact of the introduction of a DRS on the separately collected recycling performance in Spain (i.e. excluding recycling from RWS systems). The results are set into the context of the wider packaging recycling performance

required by law, with paper and card both excluded and included, to illustrate the overall impact of the DRS for only those materials that may or may not form part of the DRS, compared to across all packaging materials. The introduction of a DRS leads to an increase in the separately collected recycling of DRS-targeted packaging of 59 percentage points (from 33.7% to 92.5%), an increase of 18 percentage points (from 33.7% to 51.4%) in the overall separately collected recycling of metals, plastics and glass, and an increase of 14 percentage point (from 34.2% to 48.4%) in the overall separately collected recycling of all packaging materials across Spain.

Table 4-1: Impact of the Introduction of a DRS on Recycling Performance

| | Existing Separate Recycling Collections | Existing Separate Recycling Collections +DRS | Difference (percentage points) |
|---|---|---|---|
| DRS Packaging Only | 33.7% | 92.5% | +59 |
| Packaging, Excluding Paper | 33.7% | 51.4% | +18 |
| Packaging, Including Paper | 34.2% | 48.4% | +14 |

## 4.1 Sensitivity Analysis

In order to understand the robustness of the results presented above, this Section presents a series of sensitivity analyses around the financial costs of implementing the DRS.

The sensitivity analyses are first undertaken as discrete elements, in order to explore the relationship between individual key variables and the overall cost associated with introducing the DRS. Thus each sensitivity is run under the assumption that 'all other things remain equal'. Testing of the overall results, using multivariate analysis, is described towards the end of the section, in order to identify those variables that have the most significant influence on the results that have been obtained in this study.

### 4.1.1 Deposit Value and Return Rates Achieved

The central modelling scenario (hereafter referred to as the "Central Case") is based on a €0.20 deposit value for all beverage containers, with the DRS consequently predicted to achieve a return rate of 89%. As illustrated in Figure 4-1, the unclaimed deposits contribute a significant amount to the income required to operate the DRS. Other things being equal, a scheme with a higher return rate will lead to reduced revenues in the form of unclaimed deposits, with a corresponding increase in the revenue which must be raised from producers in the form of administrative fees. If the DRS were to achieve a 100% return rate, at a €0.20 deposit value, the revenue gap to be filled by administrative fees would increase from €234 million to €628 million, equivalent to an increase in producer DRS admin fees from €0.013 to €0.035

per container placed on the market. The overall net financial cost to the producers would increase from €0.007 to €0.028 per container placed on the market.

On the other hand, if one assumes that the same return rate (89%) is achieved using a higher deposit, then this would mean that the value of the unclaimed deposits would increase and the administrative fees could be reduced.

As suggested by Figure 3-2~~Figure 3 2~~, a higher deposit (in the absence of other improvements in the system) is likely to be needed in order to achieve a higher return rate, so these two factors (higher administrative fees due to higher returns and lower administrative fees due to higher deposit value) will play off against one another in determining the cost of the system. Table 4-2 illustrates the likely impact on the overall DRS cost from either applying a lower deposit value of €0.15, or a higher deposit value of €0.25, on containers, based on the relationship between the deposit value and return rate presented in Figure 3-2~~Figure 3 2~~. In this range of deposits/return rates, the administrative fee payable by the producer is higher at a lower deposit value and the financing gap falls as the value of the unclaimed deposit increases.

Table 4-2: Deposit Value Sensitivity Analysis

| Deposit value (€) | Estimated Return Rate (%) | Required DRS Admin Fee (€ per container) |
|---|---|---|
| €0.15 | 88.2% | €0.017 |
| €0.20 | 89.4% | €0.013 |
| €0.25 | 90.3% | €0.010 |

It is clear that the tendency of administrative fees to fall as the deposit increases is a reflection of the functional relationship which we have estimated. In the range of deposit values we have modelled, the elasticity of the rate of non-returned containers with respect to the level of deposit is quite low (around -0.34). Hence, the pot of revenue generated from unclaimed deposits increases as the deposit rises. If we were to have modelled at deposit rates in the more steeply sloping part of the curve in Figure 3-2~~Figure 3 2~~, the opposite would have been true since more elastic behaviour in respect of the return rate would have been modelled. Evidently, the shape of this curve will also depend on factors such as the convenience with which returns can be made. As long as the system is convenient, it might be presumed that at the deposit rates being assumed, we are likely to be moving along the less steeply sloping part of the curve. Even so, it would be prudent to retain the deposit at a reasonable level to ensure that the response rate is such as to deliver a high (around 90%) return rate, thus ensuring significant environmental benefits.

As we saw above, at a given deposit, the return rate is a particularly sensitive assumption. It will be important for Spain to ensure it has adequate container identification in place to prevent individuals from receiving deposits back on beverages purchased in countries where no deposit has been levied, as these would

otherwise contribute to taking the return rate nearer to or over 100%. Cross-border issues are discussed further in Section 4.5.

### 4.1.2 Number of Horeca Return Points in the DRS

The Sismega summary report on the introduction of a DRS in Spain did not include Horeca within the system.[78] In our modelling, we have taken a more conservative approach to calculating the costs of the DRS, including 25% of clubs, pubs, restaurants and hotels, and 50% of cafeterias within the deposit refund collection system (making the system more convenient to consumers than that modelled by Sismega). The remainder of the Horeca are assumed to be outside the system, choosing not to pay the registration fee, therefore not receiving any handling fees, and being required to return any containers they take back or use to an alternative DRS collection point.

Table 4-3 explores the potential financial impact of including either fewer or more Horeca in the DRS, the former bringing the numbers closer to the number of retailers upon which calculations were based in the Sismega approach. It is assumed that the system performance is invariant across these scenarios. As illustrated in Table 4-3, the total cost of the DRS either decreases by 41% or increases by 34%, depending on the assumptions applied, resulting in a range of producer DRS admin fees from €0.008 to €0.018 per container placed on the market. It will thus be important for the Spanish government to determine which stores are to be included within the DRS and, where retailers are considered outside the DRS, the rules that apply regarding whether or not they have to take back containers. It may be sensible to make provision for retailers to 'opt-out' of the DRS where they see no rationale for their involvement.

Table 4-3: Sensitivity Analysis - % of Horeca Requiring a Collection as Part of the DRS

| | % Horeca in DRS (Low) | % Horeca in DRS (Central Case) | % Horeca in DRS (High) |
|---|---|---|---|
| Restaurants and Hotels | 10% | **25%** | 50% |
| Clubs, Bars and Pubs | 10% | **25%** | 50% |
| Cafes | 10% | **50%** | 75% |
| Other Bars | 10% | **25%** | 50% |
| *Financial Impact* | | | |

[78] Sismega. S. L., (2011) *Untitled Document* looking at the analysis of the effects of introducing a DRS in Spain, accessed 15th July 2011, available at http://www.cecobi.es/images/prensa/Mon20110523154500SDDR.pdf

| | | | |
|---|---|---|---|
| Net Cost of DRS (€ million) | 144 | **243** | 326 |
| **Producer DRS Admin Fee (€ per container)** | **0.008** | **0.013** | **0.018** |

### 4.1.3 Change in the Amount of Backhauling

Under the Central Case, it has been assumed that most of the larger stores and a proportion of smaller stores and Horeca will be able to utilise backhauling.[79] If this is not the case, or conversely, if distribution companies are able to backhaul from much smaller premises as well, the costs of the collection logistics for the system will change significantly. In the Central Case, we have assumed that around 70% of retail outlets will be able to utilise backhauling.

It can be seen from Table 4-4 that shifting between low and high values for backhauling changes costs, relative to the baseline, by +€73/-€29million. Given the large number of supermarkets in the Spanish retail landscape, and their likely desire to want to backhaul where reverse vending machines are installed in their outlets, it seems unlikely that less than 40% of retail outlets would be engaged in backhauling (i.e. the 'low' scenario).

Table 4-4: Sensitivity Analysis - % of Retailers that Backhaul DRS Containers

| Type of Retailer | % Backhauling (Low) | % Backhauling (Central Case) | % Backhauling (High) |
|---|---|---|---|
| Hypermarket ( >2,500 m²) | 50% | 90% | 100% |
| Supermarket (1,000 - 2,499 m²) | 50% | 90% | 100% |
| Supermarket (400 - 999 m²) | 50% | 90% | 100% |
| Supermarket (100 - 399 m²) | 45% | 80% | 90% |
| Supermarket ( < 100 m²) | 25% | 50% | 75% |
| Traditional Store | 25% | 50% | 75% |
| Food Stores | 25% | 50% | 75% |
| Restaurants and Hotels | 45% | 80% | 90% |

[79] Note that backhauling refers to the return trip that is made by a truck after delivering a load to a specified destination. This return trip, on which the truck would otherwise be empty, is used, where possible, to transport items back to where the truck journey commenced from.

| Type of Retailer | % Backhauling (Low) | % Backhauling (Central Case) | % Backhauling (High) |
|---|---|---|---|
| Clubs, Bars and Pubs | 50% | 90% | 100% |
| Cafes | 45% | 80% | 90% |
| Other Bars | 45% | 80% | 90% |
| Catering in the workplace | 25% | 50% | 75% |
| Gas Stations/Service Areas/Convenience Stores | 50% | 90% | 100% |
| Kiosks | 0% | 0% | 0% |
| TOTAL | 38% | 70% | 86% |
| **Financial Impact** | | | |
| Net Cost of DRS (€ million) | 316 | **243** | 214 |
| **Producer DRS Admin Fee (€ per container)** | **0.017** | **0.013** | **0.012** |

### 4.1.4 Potential Switch in Manufacture Away from Deposit-Bearing Containers

Though not forming part of the scope of this study, it is perhaps worth briefly discussing the potential switch in choice of container material in order to avoid the DRS. In the recent study undertaken by ERM on DRSs, it was noted that the over-riding issue in the manufacturer's choice of which material to use to contain beverages was centred on consumer acceptance, rather than on avoidance of being in a deposit scheme.[80] However, the study did note one example where the manufacturer had changed their material choice specifically because of the DRS, with one producer in Sweden switching to a bottle made from plastic that was not part of the scheme. Subsequent adjustments to the legislation brought that particular product back into the DRS.

Policy makers should, therefore, be aware that some equivalent form of extended producer responsibility for those beverage containers falling outside the DRS might be necessary in order to avoid the shift to materials that are not so easy to include in DRSs for technical reasons. A clear issue with the existing producer responsibility

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

system is that the costs of complying with obligations do not fall fully upon the obligated companies. Part of the cost of dealing with packaging waste are still being met through local authority funding, so that there is little incentive for packaging waste producers to be mindful of the recyclability of the retail packaging they place on the market.

A range of instruments could be used to ensure that the incentives for product switching are reduced. Simply put, it would make sense for producers to be obliged to achieve high rates of recycling of packaging and to meet the costs of doing so (as under the DRS). Alternative mechanisms such as packaging levies could be used to influence the materials chosen by manufacturers. Denmark effectively discharges its packaging waste obligations through a combination of taxes and deposit refunds, with the tax rates varying depending upon whether the packaging falls within or outside a deposit scheme.[81]

## 4.2 Multivariate Analysis of the Financial Impacts of the DRS

A significant number of variables are included in the cost benefit model. To test all inputs and possible outcomes would require significant time, and would not necessarily provide any further understanding of the fundamental financial impacts associated with the introduction of a DRS in Spain. However, as discussed previously, to simply consider a range of discrete scenarios makes it difficult to obtain an overall idea of the 'worst' or 'best' case outcomes.

A simulation tool called Crystal Ball® was thus used to perform Monte Carlo analysis on the key inputs to the model and to determine the likely impact on the overall ongoing costs associated with introducing a DRS. The goal of Monte Carlo analysis is to determine how random variation, lack of knowledge, or error affects specified outputs, in this case, the cost of operating the DRS. 'Monte Carlo' simulation is categorised as a sampling method, because the inputs are randomly generated from probability distributions to simulate the process of sampling from an actual population. The key variables tested in the model are given below (larger variations have been given to assumptions which are less certain).[82] Note that where values relate to system costs, negative values denote an income and positive values indicate a cost.

- Deposit Refund System Costs:
  - Material Revenues[83]:
    - Glass: -€9 to -€26 income received per tonne
    - PET: -€250 to -€416 net income received per tonne

[81] Eunomia (2009), *International Review of Waste Management Policy: Annexes to Main Report,* Report for the Department of the Environment, Heritage and Local Government, Ireland, p.316-321

[82] All inputs are varied linearly between the limits given.

[83] Note negative values indicate an income, positive values a cost

        - HDPE: -€245 to -€410 net income received per tonne
        - Steel Cans : -€155 to -€265 income received per tonne
        - Aluminium Cans:  -€720 to -€1080 income received per tonne
        - Cartons: -€15 income to €15 net cost charged per tonne
    - Total Transport Cost:
        - Number of trips from logistics centres to the counting centre +/- 25%
        - Fuel Consumption Costs for Backhauling +/- 20%
        - Total Volume Containers Requiring Collection +/- 50%
        - Daily Fuel Cost +/- 5%
    - Total Container Costs +/- 25%
    - Total Counting Centre Costs +/- 20%
    - Labour Costs (RVM) +/- 20%
    - Labour Costs (manual) +/- 50%
    - Retail Floorspace Rateable Value +/- 25%
    - Central System Administration Cost + 200%/ - 50%
- Existing Waste Collection Costs
    - Bring Site Collection Costs +/- 80%
    - HWRC Costs +/- 80%
    - Litter Collection Costs +/- 80%
    - Commercial Collection Costs +/- 80%

Figure 4-5~~Figure 4-5~~ and Figure 4-6~~Figure 4-6~~ show the outputs from the simulation in terms of the producer administrative fees associated with introducing a DRS in Spain and the net overall financial impact of the introduction of the DRS respectively. The Figures represent a probability distribution based upon the inputs described above. The certainty of the result falling between the upper and lower bounds (the blue area) is shown at the bottom of the charts.

Figure 4-5: Monte Carlo Analysis – Producer Administrative Fees associated with Introducing a DRS in Spain

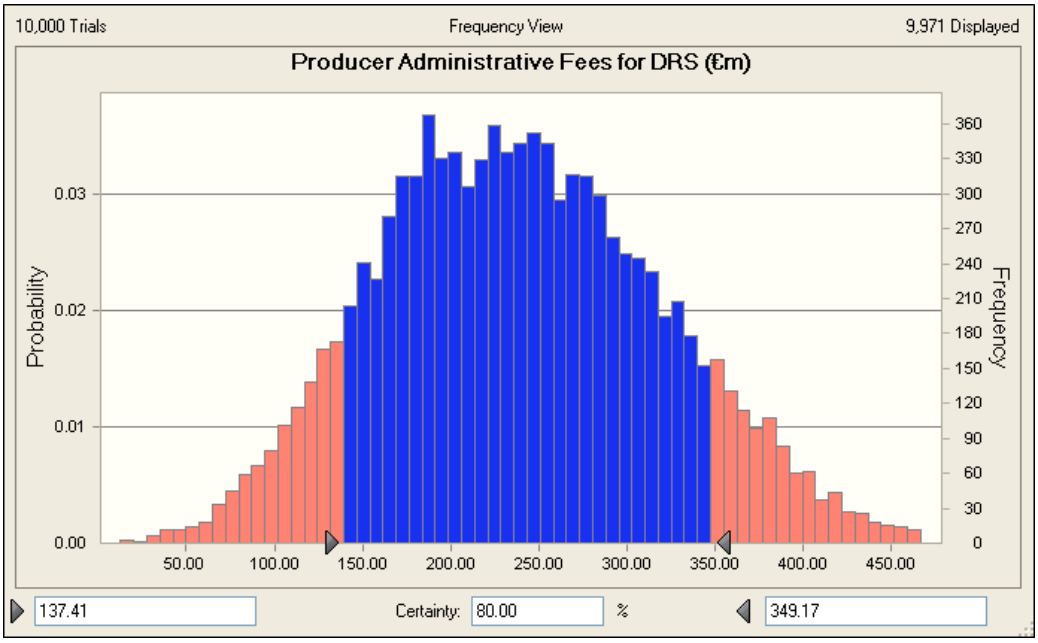
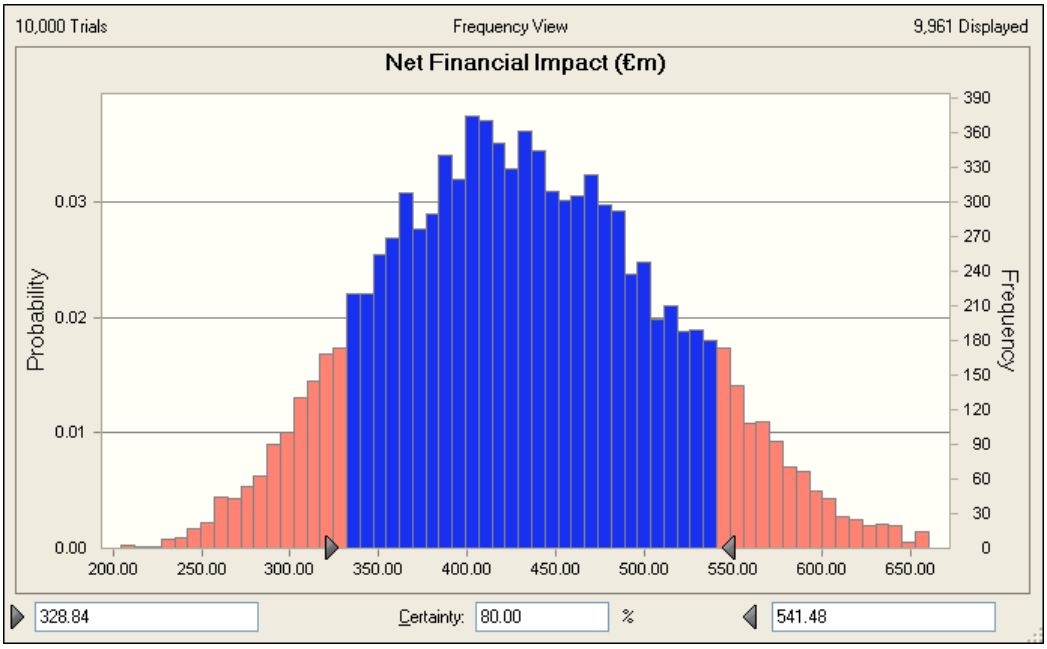



Figure 4-6: Monte Carlo Analysis – Net Financial Costs Resulting from the Implementation of a DRS (based on a disposal cost saving of €36.17 per tonne)




*Source: Eunomia*

Figure 4-5~~Figure 4-5~~ shows that that the producer admin fees associated with running a DRS in Spain have an 80% likelihood of lying between €137 and €349 million annually. Figure 4-6~~Figure 4-6~~ illustrates that the net financial cost

resulting from the introduction of a DRS in Spain has an 80% likelihood of lying between €329 and €541 million annually (based on the lower assumed disposal cost saving of €36.17 per tonne).

The key sensitivities in the model can also be extracted from within the simulation software. In examining the implementation of a DRS in Spain, it is important to note that the four most influential variables affecting both the producer administrative fees payable for the DRS and the overall net cost of implementing a DRS in Spain are:

1) The additional fuel consumption associated with backhauling containers (accounts for around 75% of the variance in both cases);
2) The compensation cost of the retailer floor-space that is lost to enable container take back (accounts for around 13% of the variance in both cases);
3) The costs of labour in manual take back; and
4) The assumed material revenue obtained for aluminium cans.

## 4.3 Variable Producer Admin Fees

The calculation of the admin fees payable by producers for every container placed on the market varies from DRS to DRS. Whilst it might be argued that the collection costs for the different materials are unlikely to vary substantially, the material revenues subsequently obtained will vary quite significantly. The central system might, therefore, decide to vary the admin fees payable (through discussions with stakeholders and the shareholders of the DRS), with the fees adjusted periodically according to the material revenues generated from different beverage container material types. Based purely on the income that would be obtained for each material stream, Table 4-5 illustrates the resultant admin fees that would be payable according to material type.

Table 4-5: Varying Producer Admin Fees According to Material Revenue Generated from Different Materials

| | Aluminium | Steel | Plastic | Carton | Glass |
|---|---|---|---|---|---|
| Cost per Container (€) | €0.023 | €0.023 | €0.023 | €0.023 | €0.023 |
| Total Material Income (€m) | -€105.7 | -€6.2 | -€53.5 | €0 | -€10.9 |
| Number of Containers (millions) | 5,405 | 1,351 | 5,719 | 2,183 | 3,433 |
| Income Per Container (€) | -€0.020 | -€0.005 | -€0.009 | €0.000 | -€0.003 |
| **Adjusted Admin Fee (€** | **€0.004** | **€0.019** | **€0.014** | **€0.023** | **€0.020** |

| | | | | | |
|---|---|---|---|---|---|
| per container) | | | | | |

However, in reality, the Spanish government would need to be careful in how they structure their pricing mechanisms; lower admin fees for, for example, aluminium compared to steel may lead to beverage can manufacturers switching from steel to aluminium, and the government would need to take a view as to whether the resulting environmental impacts would be in keeping with the DRS as an environmental policy. It is beyond the scope of this study to examine the environmental impacts of potential switches in the materials used to contain beverages. One might argue that the high material revenues generated for aluminium reflect the high costs associated with obtaining this raw material, which in part reflects the energy used in acquiring it, so that encouraging a switch from steel to aluminium as the preferred container material would incur a more negative environmental impact. On the other hand, the environmental impact will depend on whether the aluminium used in place of steel is from primary or recycled sources. Clearly, using recycled aluminium is preferable to using the primary material.

## 4.4 One-Off Costs

In constructing the costs that we believe would be associated with setting up this type of system, one-off investment costs were calculated at €32 million to set up the central DRS and an additional €1.7 million for the producers to change their labelling. It should be noted that the one-off costs presented here do not include the investment costs associated with purchasing items such as RVMs or counting centres; these costs have already been factored into the ongoing operating costs of the DRS, based on the assumption that they will be leased, or depreciated over a certain number of years (so that costs have been annualised at an appropriate discount rate).

It is worth noting that although some producers may need to change their printing procedures in order to ensure that the correct barcode is applied to containers destined for the Spanish market, the actual changing over of labels will more than likely coincide with the periodical changes that the producers already have to make in their printing process; hence, as long as sufficient lead-in time is given to producers, then the cost of changes to labelling should be able to be kept to a minimum.

As stated previously, no literature has been unearthed which provides a detailed calculation of joining fees for either producers or retailers associated with these one-off costs. Joining fees vary across existing deposit schemes; for example, in Finland, the producer can opt to pay either a one-off lifetime joining fee of €7,500, or an annual joining fee of €1,700 over a 5 year period, and must also pay a per registered barcode additional fee of around €350 in both circumstances.[84] In Denmark, the joining fee for producers is €2,000 per annum, and retailers also pay an annual fee of

[84] http://www.palpa.fi/english

€550 to make them eligible to receive handling fee payments.[85] In Germany, an annual fee is paid which varies according to the number of containers a particular producer sells, plus a one-off registration fee for every new barcode entered into the system that also varies according to the volume of a particular product/barcode that is placed onto the market.

For the purposes of this high level modelling, we have not attempted to split the one-off costs into joining fees per producer or per retailer. A number of key decisions would require further consideration beyond this study in order to determine how the one-off costs of the system would be covered, including the following:

- Should both the producer and the retailer be charged a joining fee?
- If so, how should the one-off costs of the central system be split between the producer and the retailer?
- Should the fee be a one-off membership, or an ongoing annual fee?
- Should a per product fee be charged on top of a more general fee in order to reflect the size of producer/ retail outlet?

Arguably, the system should adopt an approach that most closely reflects the way in which costs are actually incurred.

## 4.5 Cross Border Issues – Private Trade in Alcohol bringing Non-Deposit Containers into Spain

We note this issue because a) the scale of cross border trade is potentially significant and b) it could be claimed by opponents of deposit systems to be a critical issue.

The key driver of cross-border purchases of beverages is the relative price of beverages. This price may fluctuate from region to region based upon local conditions, but the three most significant factors affecting relative pricing between countries are 1) exchange rate movements (affecting differentials over the short-term); 2) excise duty on alcohol; and 3) differing VAT rates on beverages.

It is clearly possible that, notwithstanding the fact that the deposit is a temporary payment (and is returned when the can is returned) that some consumers might perceive it as more beneficial to shop in other countries, such as Portugal or France to obtain cheaper beverages. PRO-Europe claims:

> *"Consumers tend to try to avoid paying deposits by shifting to deposit free products. This includes shopping in stores across borders where mandatory deposits are not applied. Consequently, retailers in the border region are faced with tremendous loses due to 'customer migration'."*
>
> *Source: PRO-EUROPE Position Paper Mandatory Deposit Systems.*[86]

[85] http://www.dansk-retursystem.dk/content/

[86] Pro-Europe (n/a) *PRO EUROPE Comments on: Mandatory Deposit Systems for One-Way Packaging*, http://www.pro-e.org/files/08-11_Position_Paper_Mandatory_Deposit_RBV01.pdf

There is no strong evidence to support this, other than the case of the border shopping areas at the German / Danish border. Here, a specific exemption from applying German deposits was given to some companies to allow a long-standing border shopping trade to continue, which reflected the differing levels of excise duty applied to alcohol in Germany (low duty) and in Denmark (high duty). Hence, even though both Germany and Denmark operate DRSs, Danes (and Swedes) cross over to Germany to take advantage of the much lower excise duties on alcohol which prevail in Germany.

If consumers know that they have a convenient means to return their containers, it seems unlikely that they would inconvenience themselves so much as to drive across borders to avoid paying a one-off deposit which they know they can be refunded. What drives border trade is the differentials in duties that are reflected in genuine (i.e. excluding deposit) price differentials across borders. Although it might appear that Danes shop in Germany because there is no deposit at border shops, the reality is that the cross border shopping is driven by large excise duty differentials, not the existence (or otherwise) of a deposit. Indeed, the exemption from the deposit in the German border shops was agreed precisely so as to allow an already existing border trade to continue.

Table 4-6~~Table 4-6~~ illustrates that the price differential for alcohol beverages between Spain, Portugal and France is much lower than that experienced across the German-Danish border. As discussed above, given that excise duty differentials appear to drive the majority of cross-border trade, it would therefore seem unlikely that a major cross-border trade exists, still less, that one would be generated by the introduction of a DRS in Spain. Indeed, given the price differentials below, it seems more likely that the flow of beverages is from Spain to Portugal and France rather than the other way round. It is possible that if some consumers make trips to Spain to purchase beverages, the payment of a deposit which cannot be refunded in the country of consumption may discourage some existing buyers from purchasing beverages in Spain. This effect is likely to be extremely small, however, reflecting the likely limited extent of cross-border purchases at present.

Table 4-6: Alcohol Price Index Values across 6 EU Member States

| Country | Alcohol Price Index |
|---|---|
| Spain | 81 |
| France | 91 |
| Portugal | 99 |
| Germany | 82 |
| Denmark | 128 |
| Sweden | 145 |

*Source: Borchert, E. and Reinecke, S. (2007) Eating, drinking, smoking - comparative price levels in 37 European countries for 2006, Report for Eurostat, 12 July 2007,*

*http://epp.eurostat.ec.europa.eu/cache/ITY_OFFPUB/KS-SF-07-090/EN/KS-SF-07-090-EN.PDF; Karlson T. and Osterberg E. (2009) ibid.; Brewers of Europe (2011) ibid*.

Regarding beverages from other countries, automated counting machines can be made to accept containers from outside the DRS, without returning the deposit, to ensure that consumers can still return and recycle their containers.[87] In addition, consumers could also place these containers in the existing bring site collection system, which we have assumed will continue to be used alongside the DRS. Clearly no deposit would be paid back to the consumer, and no admin fee would be paid by, for example, the Portguese producer, but the central system would benefit from the sale of the material. This would be especially beneficial in the case of aluminium cans (which appears to be the material which is most often used to package beverages which are traded across borders).

[87] This already occurs in the Finnish DRS (Palpa), which has been designed to accept Estonian cans without issuing the deposit back to the consumer.

# 5.0 Summary and Conclusions

In this report we have investigated the financial consequences of the introduction of a deposit refund system (DRS) across Spain. The report has detailed the net costs associated with the introduction of the DRS, as well as the reduction in costs associated with fewer containers having to be collected through existing collection routes. The report comes at a time when Spain is reviewing its current waste policy, with the new Law on Waste and Contaminated Land, approved by Parliament on 14th July 2011, explicitly including the possibility of the introduction of a DRS for one-way (non-refillable) beverage containers.

In particular, this study has examined:

1) The net cost effect to producers from the costs they would bear in the DRS compared with the reduction in payments they would need to make for the existing producer responsibility system;
2) The financial impacts on the retailers;
3) The economic benefits to local authority budgets of removing their need to collect deposit-bearing packaging; and
4) The potential cost to the consumer.

In modelling a potential deposit refund model for Spain, we were able to examine closely the costs and revenues that might be involved in the implementation of a DRS. Based on existing examples, we calculated that a deposit of €0.20 would achieve a return rate in the region of 89% for the glass bottles, cans, PET bottles and cartons that we included in the DRS.

The majority of the cost calculations for the system centred firstly on how retailers would take back the returned containers (automatic machine or manual) and the associated compensation that they would thus require, and secondly on the subsequent collection, counting and transport of those containers to re-processors. Hence a significant part of the modelling was based on building up a picture of the retail landscape across Spain. Ongoing administration costs for the system were also factored into the modelling.

The costs of the DRS (the handling fee payments to the retailers, the costs of the DRS logistics and the administration costs of the central system) are partially offset by the materials income received for the material collected through the DRS and partially by the unclaimed deposits that are forfeited by the consumers that choose not to return their containers into the DRS. The remaining balance of costs for the DRS is met by producers in the form of an administration fee per container placed on the market. The ongoing cost to the producers for the running of the DRS was calculated at €243 million per annum, which equates to €0.013 per container placed on the Spanish market.

The figures given above do not, however, tell the whole story with regards to the overall financial impact from the introduction of a DRS in Spain. Whilst additional cost would be incurred in setting up and delivering the collection logistics for the DRS, the

majority of the deposit-bearing containers would no longer be collected through the existing household and non-household collection systems, thereby resulting in financial savings for those systems. Therefore, one of the key components of this study was the *inclusion* of all relevant costs, most importantly the change in costs (and associated savings) from household bring site collection systems.

The net overall financial impact of the introduction of a DRS was determined as follows:

1) There is a net annual cost to producers of €120 million (€0.007 per container placed on the market). This cost reflects the balance of producer admin fees payable into the DRS and the reduction in payments producers would need to make for the existing producer responsibility system;
2) The cost to the retailer of handling and processing the returned DRS containers is fully reimbursed by the handling fees that are paid to the retailer by the central system on a per container returned basis (the average handling fee was calculated at €0.04 per container returned). Hence there is no net financial impact on the retailers;
3) The total savings to the municipality/taxpayer amount to between €57 million per annum and €93 million per annum (depending on the assumed cost of disposal). The savings result from a reduction in collection and disposal costs associated with existing residual waste bring site systems, street sweeping and litter bin emptying and from puntos limpios. No savings were attributed to the municipality/taxpayer for the existing packaging bring site collection systems, as it was assumed that any reduction in packaging bring site collection costs for the municipality would be counterbalanced by a matching reduction in Green Dot scheme payments to the municipality. In reality, if the payments currently made by the Green Dot schemes do not fully cover the collection costs (for example, if the municipality chooses to collect the bins more frequency that was assumed in the calculations undertaken by the PROs to determine the fees payable to the municipalities), further savings may be available to those shown here;
4) Total savings to businesses that currently pay for commercial waste collections amounts to between €11 million per annum and €15 million per annum (depending on the assumed cost of disposal); and
5) At an overall 89% return rate, the cost to the consumer would be €385 million per annum, paid by those consumers that choose not to return their container to the DRS and who thus forfeit their deposit.

The overall financial impact resulting from the introduction of a DRS in Spain is a net cost of between €398 million and €438 million per annum (depending on the cost of disposal). The overall cost of collecting packaging is shifted specifically onto producers and consumers rather than being paid for by the population as a whole through municipality collection and disposal.

In terms of improved recycling performance, the introduction of a DRS is projected to lead to an increase in the separately collected recycling of DRS-targeted packaging of 59 percentage points (from 33.7% to 92.5%), an increase of 18 percentage points (from 33.7% to 51.4%) in the overall separately collected recycling of metals, plastics

and glass, and an increase of 14 percentage points (from 34.2% to 48.4%) in the overall separately collected recycling of all packaging materials across Spain.

A number of sensitivity analyses were undertaken in order to understand the robustness of the results presented. The return rate was found to have a particularly significant impact on the overall costs of the DRS. Since DRS costs to producers are lower with lower return rates, it would appear sensible to introduce target recycling rates for these materials to encourage higher return rates from the system, and reduce the incentive for poor system design / inadequate infrastructure. The effect of this is to lower the revenue generated from unclaimed deposits, thus leading to slightly higher administrative fees, but with the ultimate outcome that greater environmental benefits are delivered, and the losses to consumers are reduced.

We also attempted to construct the one-off costs that would be associated with the set-up of a DRS in Spain. Based on the modelling, a total cost of €32 million would be required to set up the central DRS, plus potentially an additional €1.7 million for the producers to change their labelling (though in reality, this cost may be avoided by allowing a sufficient lead-in time for the introduction of the DRS so that producers can incorporate any changes as part of their periodical packaging/labelling re-design). These one-off costs are certainly not insignificant amounts; however, given the large number of producers and retailers involved in the Spanish market, it should be possible to split the costs sensibly in order to ensure that the subsequent joining fees are both reasonable and manageable for both producers and retailers.