

<b>Title:</b> Proposal to introduce packaging recovery and recycling targets for 2013 to 2017 <b>IA No:</b> 1368  <b>Lead department or agency:</b> DEFRA  <b>Other departments or agencies:</b> Scottish Government, Welsh Assembly Government, Dept of the Environment Northern Ireland	<b>Impact Assessment (IA)</b>		
	<b>Date:</b> 10/10/2011		
	<b>Stage:</b> Consultation		
	<b>Source of intervention:</b> EU		
	<b>Type of measure:</b> Secondary legislation		
<b>Contact for enquiries:</b> Ian Atkinson, 020 7238 4345			

<b>Summary: Intervention and Options</b>	<b>RPC Opinion:</b> RPC Opinion Status
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Cost of Preferred (or more likely) Option			
Total Net Present Value	Business Net Present Value	Net cost to business per year (EANCB on 2009 prices)	In scope of One-In, Measure qualifies as One-Out?
£256.8m	£0m	£0m	No
			NA

**What is the problem under consideration? Why is government intervention necessary?**

The externalities of having to deal with packaging efficiently at the end of its life are currently internalised through Producer Responsibility Regulations, which implement the EU Packaging Directive. The targets for packaging waste recycling in these Regulations only run until 2012. New mandatory targets are needed beyond then to ensure that EU targets on packaging waste recycling and recovery continue to be met, and maintain the gains achieved by packaging recycling in terms of GHG savings and resource efficiency. This IA reviews the impact of targets and other delivery mechanisms, with a view to delivering the policy objectives below.

**What are the policy objectives and the intended effects?**

To increase resource efficiency and GHG savings through higher recycling and recovery of packaging waste. This will ensure that the minimum packaging recycling and recovery targets included in the Packaging Directive continue to be met. In addition to this, the policy will contribute to meeting landfill diversion targets, increasing the diversion of commercial and industrial waste from landfill. The direct intended effects are to ensure that businesses which produce or handle packaging recover/recycle more of their packaging waste.

**What policy options have been considered, including any alternatives to regulation? Please justify preferred option (further details in Evidence Base)**

Option 1 - Keep all packaging recycling and recovery targets to the EU minimum until 2017  
 Option 2 –Higher recycling rates aluminium & plastic (respectively 1% and 2% increase/yr from 2013), through: a. Statutory targets; b. Statutory targets to EU min plus voluntary responsibility deals  
 Option 3 – Higher recycling rates for aluminium, plastic and steel, with glass recycling rate split by end use. (respectively 3%, 5%, 1% increase/yr, 1% change/yr from 2013), through:  
 a. Statutory targets; b. Statutory targets to EU min plus voluntary responsibility deals; c. Statutory targets to EU min plus deposit refund system

Preferred option is Option 3a. This delivers the highest net present value and has significant benefits above the EU minimum. This option is a tax-and-spend measure and is therefore out of scope of OIOO.

**Will the policy be reviewed? It will/will not be reviewed. If applicable, set review date: Month/Year**

Does implementation go beyond minimum EU requirements?		Yes			
Are any of these organisations in scope? If Micros not exempted set out reason in Evidence Base.	<b>Micro</b> No	<b>&lt; 20</b> No	<b>Small</b> No	<b>Medium</b> Yes	<b>Large</b> Yes
What is the CO <sub>2</sub> equivalent change in greenhouse gas emissions? (Million tonnes CO <sub>2</sub> equivalent)		<b>Traded:</b> -2.0		<b>Non-traded:</b> 0.0	

*I have read the Impact Assessment and I am satisfied that, given the available evidence, it represents a reasonable view of the likely costs, benefits and impact of the leading options.*

Signed by the responsible SELECT SIGNATORY: \_\_\_\_\_ Date: \_\_\_\_\_

# Summary: Analysis & Evidence

# Policy Option 1

Description: Targets set to EU minimum

## FULL ECONOMIC ASSESSMENT

Price Base Year 2011	PV Base Year 2011	Time Period Years 5	Net Benefit (Present Value (PV)) (£m)		
			Low: 0	High: 0	Best Estimate:0

COSTS (£m)	Total Transition (Constant Price) Years	Average Annual (excl. Transition) (Constant Price)	Total Cost (Present Value)
Low	0	0	0
High	0	0	0
Best Estimate	0	0	0

### Description and scale of key monetised costs by 'main affected groups'

Figures compared to EU min, since assumption that current EU targets will continue in the absence of new targets. If taking a 'notional' baseline, in the absence of targets, costs are: additional collection/sorting costs of £70.6m-£385.7m over 5 years. Less waste to landfill creates savings in resource costs of £52.5m-£233.7m. The balance of additional costs of recycling (including material revenues, below) will be paid for indirectly by packaging producers via the PRN system, or directly, through responsibility deals.

### Other key non-monetised costs by 'main affected groups'

Impacts of waste treatment options on local environment quality, such as litter abatement, air quality, etc, have not been included. The net impact would depend on the balance of local impacts of different treatment options.

BENEFITS (£m)	Total Transition (Constant Price) Years	Average Annual (excl. Transition) (Constant Price)	Total Benefit (Present Value)
Low	0	0	0
High	0	0	0
Best Estimate	0	0	0

### Description and scale of key monetised benefits by 'main affected groups'

Figures above show costs compared to current EU min. If taking a 'notional baseline', in the absence of EU targets, benefits are: revenue from materials of £88.2m to £266.1m. This will lessen the 'additional costs of recycling' paid for by packaging producers via the PRN system.

Carbon Benefits of £106.8m to £188.7m

Savings in disposal costs are included as a reduction in costs, above.

### Other key non-monetised benefits by 'main affected groups'

Increased collection and recycling of packaging waste could have wider benefits by acting as a driver for long term investment in waste collection and treatment technologies, and in reprocessing.

Key assumptions/sensitivities/risks

Discount rate (%)

3.5

Headline assumptions are set out in detail in Annex 4. Costs are compared to EU minimum since there is an assumption that the current EU targets will 'roll on' in the absence of new targets.

Further analysis models a range of estimated benefits relative to a baseline scenario which models recycling and recovery rates in the absence of targets.

This baseline is modelled to i) assess the need for intervention for the UK to achieve these EU targets, and ii) to estimate the costs and benefits of compliance with EU minimum targets.

## BUSINESS ASSESSMENT (Option 1)

Direct impact on business (Equivalent Annual) £m:			In scope of OIOO?	Measure qualifies as
Costs: 0	Benefits: 0	Net: 0	No	NA

# Summary: Analysis & Evidence

# Policy Option 2a

**Description:** Higher statutory targets for aluminium and plastic (1% and 2% annual increases)

## FULL ECONOMIC ASSESSMENT

Price Base Year 2011	PV Base Year 2011	Time Period Years 5	Net Benefit (Present Value (PV)) (£m)		
			Low: -14.6	High: 95.8	Best Estimate: 78.0

COSTS (£m)	Total Transition (Constant Price) Years	Average Annual (excl. Transition) (Constant Price)	Total Cost (Present Value)
Low	0	17.9	75.9
High	0	23.3	99.1
Best Estimate	0	20.7	87.5

### Description and scale of key monetised costs by 'main affected groups'

The additional costs relative to the baseline of EU minimum are: additional collection/sorting costs of aluminium and plastic over 5 years, minus reduction in collection of 'general recycling' with a PV of £96.9m (+/- 10%). Less waste to landfill creates savings in resource costs of £9.4m. The balance of additional costs of recycling (including material revenues, below) should be paid for indirectly by packaging producers via the PRN system, or directly, through responsibility deals.

### Other key non-monetised costs by 'main affected groups'

Impacts of waste treatment options on local environment quality have not been included. The net impact would depend on the balance of local impacts of different treatment options.

BENEFITS (£m)	Total Transition (Constant Price) Years	Average Annual (excl. Transition) (Constant Price)	Total Benefit (Present Value)
Low	0	19.6	84.5
High	0	40.6	171.7
Best Estimate	0	38.7	165.5

### Description and scale of key monetised benefits by 'main affected groups'

Benefits assessed relative to EU min.  
Revenue from materials of £163.6m. This will lessen the 'additional costs of recycling' paid for by packaging producers via the PRN system (see costs). Low material prices and current prices +5% assessed as sensitivity. Carbon benefits of £1.9m.  
Savings in disposal costs are included as a reduction in costs, above.

### Other key non-monetised benefits by 'main affected groups'

Impacts of waste treatment options on local environmental quality have not been included. The net impact would depend on the balance of local impacts of different treatment options.  
Increased collection and recycling of packaging waste could have wider benefits by acting as a driver for collection and recycling of other waste streams.

Key assumptions/sensitivities/risks	Discount rate (%)	3.5
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Headline assumptions are set out in detail in Annex 4. For the full NPV of this option (tonnages up to and over EU minimum, compared to the notional baseline of no intervention), the PV of option 1 should be added to the PV above.

Best estimate takes current prices for material revenues and best estimate of costs, rather than a mid-way point between low and high.

## BUSINESS ASSESSMENT (Option 2a, additional to EU min) PRN transfer from obligated business to reproprocessors:

Direct impact on business (Equivalent Annual) £m:			In scope of OIOO?	Measure qualifies as
Costs: -11.7	Benefits: 11.7	Net: 0	No	NA

# Summary: Analysis & Evidence

# Policy Option 2b

**Description:** Statutory targets set to EU minimum, plus voluntary responsibility deal for aluminium and plastic

## FULL ECONOMIC ASSESSMENT

Price Base Year 2011	PV Base Year 2011	Time Period Years 5	Net Benefit (Present Value (PV)) (£m)		
			Low: 13.9	High: 43.3	Best Estimate: 28.5

COSTS (£m)	Total Transition (Constant Price) Years	Average Annual (excl. Transition) (Constant Price)	Total Cost (Present Value)
Low	0	4.7	18.0
High	0	5.3	20.7
Best Estimate	0	5	19.4

### Description and scale of key monetised costs by 'main affected groups'

Costs assessed relative to EU min. Low/High show 5/10% levels of voluntary agreement. Additional collection/sorting costs of £6.8 to £13.6m over 5 years. Less waste to landfill creates savings in resource costs of £4.1m to £8.2m. Balance of these costs (including revenue) would be paid for by the producers of packaging signed up to the responsibility deal. Ongoing administration of scheme has a PV of £15.3.

### Other key non-monetised costs by 'main affected groups'

Impacts of waste treatment options on local environment quality have not been included. The net impact would depend on the balance of local impacts of different treatment options.

BENEFITS (£m)	Total Transition (Constant Price) Years	Average Annual (excl. Transition) (Constant Price)	Total Benefit (Present Value)
Low	0	7.3	31.8
High	0	14.7	63.9
Best Estimate	0	11	47.9

### Description and scale of key monetised benefits by 'main affected groups'

Benefits assessed relative to EU min. Low and high show figures for 5% and 10% level of agreement. Revenue from materials of £28.1m-£56.2, which will contribute to the balance of the additional costs of recycling covered by packaging producers (see costs).

Carbon Benefits of £3.7-£7.7m

Savings in disposal costs are included as a reduction in costs, above.

### Other key non-monetised benefits by 'main affected groups'

Impacts of waste treatment options on local environmental quality have not been included. The net impact would depend on the balance of local impacts of different treatment options.

Increased collection and recycling of packaging waste could have wider benefits by acting as a driver for collection and recycling of other waste streams.

Key assumptions/sensitivities/risks

Discount rate (%) 3.5

Headline assumptions detailed in Annex 4. As previous option, this measures costs and benefits above the EU minimum.

Since low represents a 5% agreement and high represents a 10% agreement, the low benefits are netted against the low costs and the high benefits are netted against the high costs.

## BUSINESS ASSESSMENT (Option 2b, additional to EU min)

Direct impact on business (Equivalent Annual) £m:			In scope of OIOO?	Measure qualifies as
Costs: -0.8	Benefits: 0.8	Net: 0	No	NA

# Summary: Analysis & Evidence

# Policy Option 3a

**Description:** Higher statutory targets for aluminium, steel and plastic (3%, 1% and 5% annual increases) with split target for glass

## FULL ECONOMIC ASSESSMENT

Price Base Year	PV Base Year	Time Period Years	Net Benefit (Present Value (PV)) (£m)		
			Low: 0.3	High: 298.4	Best Estimate: 256.8

COSTS (£m)	Total Transition (Constant Price) Years	Average Annual (excl. Transition) (Constant Price)	Total Cost (Present Value)
Low	0.05	58.5	209.2
High	0.07	44.8	268.2
Best Estimate	0.075	51.7	219.1

### Description and scale of key monetised costs by 'main affected groups'

Costs assessed relative to EU min. IT costs of £0.075m to include split glass target. Additional collection/sorting costs of £271.9m over 5 years. Less waste to landfill creates savings in resource costs of £52.8m. The balance of additional costs of recycling (including material revenues, below) will be paid for indirectly by packaging producers via the PRN system, or directly, through responsibility deals.

### Other key non-monetised costs by 'main affected groups'

Impacts of waste treatment options on local environment quality have not been included. The net impact would depend on the balance of local impacts of different treatment options.

BENEFITS (£m)	Total Transition (Constant Price) Years	Average Annual (excl. Transition) (Constant Price)	Total Benefit (Present Value)
Low	0	62.9	268.5
High	0	117.0	498.6
Best Estimate	0	111.7	476.3

### Description and scale of key monetised benefits by 'main affected groups'

Benefits assessed relative to EU min. Revenue from materials of £445.8m - a reduction in the 'additional costs of recycling' paid for by packaging producers. (Low benefit models material revenues with lower prices). Carbon Benefits of £30.5m Savings in disposal costs are included as a reduction in costs, above.

### Other key non-monetised benefits by 'main affected groups'

Impacts of waste treatment options on local environmental quality have not been included. The net impact would depend on the balance of local impacts of different treatment options. Increased collection and recycling of packaging waste could have wider benefits by acting as a driver for collection and recycling of other waste streams.

Key assumptions/sensitivities/risks	Discount rate (%)	3.5
Headline assumptions detailed in Annex 4. As previous option, this measures costs and benefits above the EU minimum.		
Best estimate takes current prices for material revenues and best estimate of costs, rather than a mid-way point between low and high.		

## BUSINESS ASSESSMENT (Option 3a, additional to EU min) PRN transfer from obligated business to reprocessors:

Direct impact on business (Equivalent Annual) £m:			In scope of OIOO?	Measure qualifies as
Costs: -35.4	Benefits: 35.4	Net: 0	No	NA

# Summary: Analysis & Evidence

# Policy Option 3b

**Description:** Statutory targets set to EU levels, plus voluntary responsibility deal for aluminium, plastic and steel.

## FULL ECONOMIC ASSESSMENT

Price Base Year	PV Base Year	Time Period Years	Net Benefit (Present Value (PV)) (£m)		
			Low: 21.8	High: 59.0	Best Estimate: 40.4

COSTS (£m)	Total Transition (Constant Price) Years	Average Annual (excl. Transition) (Constant Price)	Total Cost (Present Value)
Low	0	4.5	19.7
High	0	5.5	24.0
Best Estimate	0	5.0	21.9

### Description and scale of key monetised costs by 'main affected groups'

Costs assessed relative to the EU min. Range represents a 5%/10% achievement of voluntary deal, (which means that low costs are netted against low benefits and high against high). Additional collection/sorting costs of £11.1 to £22.1m over 5 years. Less waste to landfill creates resource savings of £6.7m to £13.4m. The balance of additional costs of recycling (including material revenues, below) will fall to packaging producers taking part in a voluntary responsibility deal. Administration of scheme PV costs of £15.3.

### Other key non-monetised costs by 'main affected groups'

Impacts of waste treatment options on local environment quality have not been included. The net impact would depend on the balance of local impacts of different treatment options.

BENEFITS (£m)	Total Transition (Constant Price) Years	Average Annual (excl. Transition) (Constant Price)	Total Benefit (Present Value)
Low	0	9.5	41.5
High	0	18.8	83.0
Best Estimate	0	14.1	62.3

### Description and scale of key monetised benefits by 'main affected groups'

Benefits assessed relative to the EU min. High / Low represents 5/10% voluntary agreement. Revenue from materials of £35.9m to £71.8m - a reduction in the 'additional costs of recycling' paid for by packaging producers. Carbon Benefits of £5.6m to £11.2m. Range represents a 5% or 10% voluntary deal and range of baseline. Savings in disposal costs are included as a reduction in costs, above.

### Other key non-monetised benefits by 'main affected groups'

Impacts of waste treatment options on local environmental quality have not been included. The net impact would depend on the balance of local impacts of different treatment options.

Key assumptions/sensitivities/risks

Discount rate (%)

3.5

Headline assumptions detailed in Annex 4. As previous option, this measures costs and benefits above the EU minimum i.e. above the NPV displayed for option 1.

Since low represents a 5% agreement and high represents a 10% agreement, the low benefits are netted against the low costs and the high benefits are netted against the high costs.

## BUSINESS ASSESSMENT (Option 3b, additional to EU min)

Direct impact on business (Equivalent Annual) £m:			In scope of OIOO?	Measure qualifies as
Costs: -1.3	Benefits: 1.3	Net: 0	No	NA

# Summary: Analysis & Evidence

# Policy Option 3c

**Description:** Statutory EU targets, plus DRS to encourage additional recycling of metals and plastic

## FULL ECONOMIC ASSESSMENT

Price Base Year 2011	PV Base Year 2011	Time Period Years 5	Net Benefit (Present Value (PV)) (£m)		
			Low: -1,877	High: -1,476	Best Estimate: -1,677

COSTS (£m)	Total Transition (Constant Price) Years	Average Annual (excl. Transition) (Constant Price)	Total Cost (Present Value)
Low	1	503.2	2,267.7
High		589.8	2,645.6
Best Estimate		73	546.6

### Description and scale of key monetised costs by 'main affected groups'

Above the costs of option 1 (EU min), there are:

Deposit Refund System (to Producers): £1,050m, Collection and Treatment/Disposal cost savings (to Local Authorities): £603m, Change in Cost of PRNS (conservative estimate): £126m, Collection and Treatment/Disposal (to Commerce): £63m, Consumers (Unclaimed Deposits): £-3979m, one off fixed costs of £73m.

### Other key non-monetised costs by 'main affected groups'

Impacts of waste treatment options on local environment quality have not been included. The net impact would depend on the balance of local impacts of different treatment options.

BENEFITS (£m)	Total Transition (Constant Price) Years	Average Annual (excl. Transition) (Constant Price)	Total Benefit (Present Value)
Low	0	89.9	390.8
High	0	268.2	1,169.3
Best Estimate	0	179	1,560

### Description and scale of key monetised benefits by 'main affected groups'

Above the benefits of option 1, there are environmental benefits of recycling of £274m over 5 years.

### Other key non-monetised benefits by 'main affected groups'

Reducing environmental impact or disamenity of litter. Research from Australia indicated households are willing to pay AU\$4.15/£48 per 1% reduction. Across 26m households, this equates to £1,248m. However given that these estimates are not fully robust and disamenity impacts for all options have not been appraised, this has not been included in the final NPV.

Key assumptions/sensitivities/risks

Discount rate (%) 3.5

For recycling targets, the analysis models a range of estimated benefits relative to a baseline scenario which models recycling and recovery rates in the absence of targets.

For deposits, we have used figures provided by Eunomia in the report they have done for CPRE to provide an estimation of the net costs for this option. This option is at scoping stage and thus for further consideration, more analysis would be required.

## BUSINESS ASSESSMENT (Option 3c, additional to EU min)

Direct impact on business (Equivalent Annual) £m:			In scope of OIOO?	Measure qualifies as
Costs: 127.4	Benefits: 473.0	Net: 345.6	No	NA

# **Evidence Base (for summary sheets)**

## **CONTENTS**

### **Introduction**

#### **Baseline**

Do nothing – No regulation. This is not a feasible option, since the UK would not meet statutory EU targets.

#### **Description of options considered**

##### **Costs and Benefits**

Costs, Benefits and Cost to Business of each option described above  
Sensitivity tests

#### **Wider impacts**

#### **Annexes**

Annex 1: Post Implementation Review Plan

Annex 2: PRN/PERNs Mechanism and Cash Flows

Annex 3: Choice of levels of recycling: summary of evidence

Annex 4: Headline Assumptions

Annex 5: Tables and breakdown for each option

Annex 6: Key principles of Depository Refund Scheme

Annex 7: Breakdown in costs of Deposit Refund System to Producers



# Introduction

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This Impact Assessment (IA) applies to the options under consideration for packaging recycling policy from 2013 to 2017. The options reflect, among other things, thinking done as part of the review of waste policy in England.

## Problem under consideration

The UK has had since 1997 a statutory producer responsibility scheme for packaging recycling, which implements the EU Packaging Directive. This scheme internalises some of the externalities of dealing with packaging at the end of its life in a way that is better for the environment and natural resources than landfill. It does so by setting minimum recycling and recovery targets on UK businesses in the packaging supply chain. Current targets run until 2012. The targets have been flat for the past 2 years. The targets included in this IA are intended to run from 1 January 2013 for five years.

Despite recent successes in increasing the amount of packaging that is recycled, there is still a perception amongst both householders and businesses that more packaging should be recycled. It is a very visible presence in our bins.

Statutory recycling targets on packaging producers are required to ensure that the UK continues to meet the minimum recovery and recycling levels set down in the Packaging Directive. Following the announcement of a review of waste policy in England, Ministers decided to set targets for 2011 and 2012 only, and to set future targets in line with the outcome of the review. The Advisory Committee on Packaging, an expert committee advising government on packaging policy, has previously recommended that future targets should be set for a minimum of at least 5 years in order to provide industry with greater certainty for planning and future investment purposes. Similarly, an incremental increase year on year is preferable – a delay and then a sudden large jump in targets could result in lack of certainty for industry in terms of longer-term planning on funding for e.g. infrastructure.

This IA reviews the impact of targets and other delivery mechanisms, with a view to delivering the policy objectives set out in the ‘rationale for intervention’ section below. There are different implementation options, including statutory targets and voluntary responsibility deals.

## Background – the Packaging Directive and producer responsibility in the UK

The EC Directive on Packaging and Packaging Waste (94/62/EC, as amended by Directive 2004/12/EC, and hereafter referred to as ‘the Packaging Directive’) aims to harmonise the management of packaging waste by minimising the impact of packaging and packaging waste on the environment and by avoiding obstacles to trade and distortion and restriction of competition within the Community.

It is implemented in the UK by (i) the Packaging (Essential Requirements) Regulations 2003 (as amended); and (ii) the **Producer Responsibility Obligations (Packaging Waste) Regulations 2007** (as amended). This IA assesses options relating to the statutory targets contained in the latter set of Regulations, which are thereafter referred to as ‘the Packaging Regulations’.

The Directive sets a minimum overall recovery target of 60% (of which a minimum of 55% must be recycling), as well as material-specific recycling targets. These are 60% for glass, 60% for paper and board, 50% for metals, 22.5% for plastics, and 15% for wood.

These targets are to be met by Member States by 31 December 2008. After that date, Member States must continue to meet these minimum targets, but they have the freedom to set higher targets. The Commission has noted that the 60% recovery rate in the Directive is a minimum and has indicated that Member States will be encouraged to go beyond this level.

The UK has met and in some cases exceeded the Directive’s minimum targets since 2008. In 2010 the UK recovered 66% of packaging placed on the market, compared with 30% in 1998.

Table 1: UK achievement against the packaging recycling and recovery targets, 2010

	Total Waste (tonnes)	Amount recycled/recovered (tonnes)	Directive Target	Achievement
Paper	3,787,560	3,099,941	<b>60%</b>	81.9%
Glass	2,712,860	1,647,917	<b>60%</b>	60.7%
Aluminium	147,500	60,304		40.9%
Steel	652,000	386,621		59.3%
<i>Metal</i>	799,500	446,925	<b>50%</b>	55.9%
Plastic	2,478,630	598,252	<b>22.5%</b>	24.1%
Wood	1,023,939	771,224	<b>15%</b>	75.4%
<b>Total recycling</b>		<b>6,568,370</b>	<b>55%</b>	60.7%
EFW		721,505		
<b>Total Recovery</b>		<b>7,289,875</b>	<b>60%</b>	67.3%

A "packaging producer" includes any business involved in the packaging supply chain, i.e. that manufactures raw materials for packaging, converts raw materials into packaging, uses packaging to wrap goods, or sells packaged products. The 'responsibility' for the packaging is split between these actors in the supply chain.

Under the Packaging Regulations, to show they have discharged this legal obligation, businesses must obtain evidence in the form of Packaging Waste Recovery Notes (PRNs) or Packaging Waste Export Recovery Notes (PERNs). These evidence notes are issued by accredited packaging waste reprocessors and exporters, respectively and are bought by businesses. An accredited reprocessor/exporter can issue PRNs/PERNs to the amount of waste reprocessed (e.g. 100 tonnes of steel reprocessed allows the reprocessor to 'sell' 100 PRNs in steel).

The evidence notes have two functions. Firstly, they are a 'counting tool' for the amount of recovery/recycling undertaken on the behalf of producers. Secondly, they are a way to channel producer funding to recycling/recovery operations, since businesses pay for these PRNs / PERNs.

Businesses obligated under the Regulations have a choice as to how they comply. They can undertake the recycling/recovery themselves in order to obtain the required PRNs; they can contract directly with reprocessors/exporters and acquire evidence of compliance in the form of PRNs and PERNs (known as individual registration) or they can pay to join one of several registered compliance schemes, who takes on the regulatory reporting and contractual duties, with greater market clout than individual producers. The majority of packaging producers have chosen to join a compliance scheme.

Their price varies depending on the availability of evidence. The Regulations do not mandate the use to which the proceeds from the sale of PRNs/PERNs to producers is put, though accredited reprocessor and exporters are required to report on the use of the funds as they are intended to finance improvements in the collection and reprocessing infrastructure across the UK.

Annex 2 fully explains the PRN mechanism and cash flows.

## **Rationale for intervention**

### Achieving targets set by EU packaging legislation

In the absence of intervention, the market prices for recyclates **do not** ensure UK recycling levels meet EU packaging targets. The costs of collecting and reprocessing a material may be greater than the value which can be earned from selling the material, resulting in no incentives to recycle. To ensure the EU packaging targets are met, Government intervention is required.

### Externalities and reaching efficient level of recycling

All environmental costs and benefits of waste disposal decisions are not reflected in the relative costs of each disposal option. (Environmental benefits are detailed in the policy objectives section.)

In the absence of intervention in recycling, there are monetary incentives to move waste away from landfill, due to pre-existing regulation (the Landfill Tax). However, there are no incentives which reflect the *additional* benefits of recycling compared to other non-landfill options. Under the landfill tax, all materials are equally incentivised away from landfill, despite the benefits of different waste types moving up the hierarchy to recycling being very different.

### **Box 1: Why do we need additional recycling intervention, when we have the landfill tax and the EU ETS?**

#### **1. Environmental externalities:**

The existing key intervention, the landfill tax rises only to £80/tonne which does not fully take into account the externalities for all the materials in the packaging targets. For example, the environmental benefit of moving each tonne of aluminium from landfill to recycling is £202 per tonne so the landfill tax, therefore does not account for the environmental externality of sending aluminium to landfill rather than recycling.

For glass, there is a carbon benefit of moving glass from end-use of aggregates to re-melt. Although the externality relative to landfill is covered, the difference between different treatment routes for glass is not reflected anywhere, (in fact the aggregates levy incentivises glass to be used for aggregates rather than mining new materials and therefore doesn't reflect the carbon benefit of this glass being sent to and end use of remelt). A split target would move the proportions of end-use from aggregates to re-melt, to reflect this carbon benefit. (see text and Annex 3 for more information on this).

*EU ETS:* The carbon emissions associated with recycling and with raw material production in Europe are included in the EU Emissions Trading Scheme. However, carbon emissions not covered by existing intervention include international transport emissions, emissions involved in extraction and production outside the EU (or outside similar electricity schemes).

#### **2. Market Imperfections:**

Interventions such as the landfill tax are insufficient to deliver an efficient level of recycling for each material due to market imperfections that occur through the complex chain of waste disposal. The price signal does not impact on activity through the chain of agents in waste disposal due to rigidities and pricing in waste disposal contracts, issues where the individual contract negotiator may not benefit in full from any changes to increase recycling activity (principal agent issues) and general misaligned incentives. Householders are not directly incentivised through pricing signals to increase recycling, although piloted reward and recognition schemes aim to incentivise recycling. Local authorities are subject to the landfill tax, but incentives Annex 3 details the requirement for additional intervention and considers the efficient levels of recycling for each material.

Both these points mean that, in the absence of Government intervention in recycling, levels of recycling will not reach the efficient level for each material.

Intervention is required to move towards a more efficient level of recycling. This intervention may be statutory targets, voluntary producer responsibility deals or other alternatives. Where the intervention is statutory (mandating a higher recycling rate and resulting in a higher tonnage of PRNs required), the cost of the PRN to the producer as a tax (and resulting revenue to the recycling sector as a spend) addresses the environmental externalities to a certain extent. (However, since the PRN price fluctuates, the PRN price does not always match the level of the carbon externality – at current levels, the PRN price is below the carbon externality for most materials).

## **Policy objectives**

Packaging waste constitutes about 10% of the commercial and industrial (C&I) waste stream and about 20% of the household waste stream in the UK. Packaging recycling and recovery rates therefore have an important role to play in meeting municipal landfill diversion targets, increasing the diversion of commercial waste from landfill, meeting overall recycling targets, and recovering energy from waste. All of which contributes to reducing greenhouse gas emissions, and more efficient use of natural resources.

Appropriate recycling and recovery targets for packaging support the shift from landfill to recycling and recovery. Landfill is not a sustainable way of disposing of waste. In addition to the space additional landfilling would require, there are a number of other adverse environmental effects:

- climate change, primarily through the release of methane gas from biodegradable material;
- possible damage to soil and water quality through leaching from landfill sites;

- disamenities such as noise and odour.

By contrast, recycling packaging results in reductions in emissions of CO<sub>2</sub> because less energy is used to produce recycled raw materials than in the production of virgin raw materials. It also avoid the extraction of raw materials, which can have a negative impact on the environment and biodiversity. Increased collection of packaging waste could also have additional social benefits by acting as a driver for collection of other waste streams for recycling (e.g. other plastics; non-packaging paper). Finally, increased recovery and recycling of packaging waste could have amenity benefits by contributing to a decrease in packaging litter.

The final objective is to ensure that the minimum packaging recycling and recovery targets included in the Packaging Directive continue to be met. This will avoid potentially costly infraction proceedings.

## The options

Option 1 - Keep all packaging recycling and recovery targets to the EU minimum until 2017.

Option 2 –EU min PLUS:

Higher recycling rates for key materials: Increase recycling for aluminium & plastic. Aluminium recycling rate increased by 1% per year from 2013; plastic rate increased by 2% per year from 2013

- Higher targets achieved through statutory recycling %s
- Higher targets achieved through setting targets to EU min plus negotiated voluntary responsibility deals with industry to recycle more plastic and aluminium packaging.

Option 3 – EU min PLUS:

Higher recycling rates for aluminium, plastic and steel, with glass recycling rate split by end use. Aluminium increased by 3% per year from 2013; plastic rate increased by 5% per year from 2013; steel increased by 1% per year from 2013. Glass recycling rate split by end use.

- Higher targets achieved through statutory recycling %s
- Higher targets achieved through setting targets to EU min plus negotiated voluntary responsibility deals with industry to recycle more plastic, aluminium and steel packaging and encourage more glass available for remelt.
- Achieved through setting targets as in Option 1 plus a mandated DRS for drinks containers.

Outcomes of the EU minimum is assessed against a *notional “do nothing” baseline* which models a scenario without any statutory targets. High and low scenarios are proposed for this baseline, demonstrating a scenario with a large and smaller drop in recycling in the absence of any statutory targets.

Options 2 and 3 are assessed against the EU minimum baseline, to assess the additional costs and benefits (above EU minimum) which could be achieved through higher targets for key materials.

## The ‘notional’ Baseline – scenario without packaging recycling targets

Note this is not a feasible option, since this option would result in a breach of EU legislation. This is a notional scenario, in order to:

- estimate the costs and benefits of compliance with EU minimum targets, and
- assess the need for Government intervention in order to achieve EU targets.

Paragraph 5.14 of the Impact Assessment Toolkit states that:

*“The baseline, or counterfactual, for estimating the incremental costs and benefits of transposing EU legislation is a ‘notional do nothing’ scenario, in which no action is taken, though that is not a feasible option.”*

This is required in order to assess the additional net costs all relevant parties face to comply with both the minimum and other regulatory options.

The baseline in this IA estimates what levels of packaging recycling and recovery businesses and local authorities would achieve without any form of statutory targets on packaging producers, given the current policy landscape with the landfill tax escalator, landfill diversion targets and investment in infrastructure. It then assesses the costs and benefits of any additional levels of recycling and recovery required to meet the targets.

**We have modelled two scenarios** for the change likely to occur to packaging recycling rates if there were no targets after 2012 (Table 2 below) – ‘high’ and ‘low’. The percentages in the table below illustrate the drop in recycling levels compared to the 2010 achievement in Table 1 above. The high scenario represents a “high” drop in recycling rates and thus the need for intervention; the low scenario is the opposite. Taking the example of paper, a 0% drop indicates that in the absence of targets, the market is likely to deliver recycling and recovery rates similar to what is being achieved now, and sufficient to meet EU requirements. However in the case of wood, an estimated drop of up to 80% signals a market preference to divert the packaging waste to alternative treatments, such as energy from waste(EfW).

Table 2: % Drop in recycling rates from 2010 actual recycling levels

Material	RR rate achieved 2010 (%)	2013		2014		2015		2016		2017	
		Low	High	Low	High	Low	High	Low	High	Low	High
Paper	81.90%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Glass	60.70%	-2%	-20%	-2%	-20%	-2%	-20%	-2%	-20%	-2%	-20%
Aluminium	40.90%	0%	-20%	0%	-20%	0%	-15%	0%	-15%	0%	-15%
Steel	59.30%	-5%	-30%	-5%	-25%	-5%	-20%	-5%	-20%	-5%	-20%
Plastic	24.10%	-10%	-20%	-10%	-15%	-10%	-15%	-10%	-15%	-10%	-15%
Wood	75.40%	-50%	-80%	-40%	-80%	-40%	-80%	-40%	-80%	-40%	-80%

The estimated drop in recycling and recovery rates is based on economic factors and industry and policy assessment. The rationale for each material is as follows:

**Paper:** The global market for waste packaging paper and board is a mature one, and reflected in a relatively low PRN price of £1-2 (the PRN price reflects the additional cost per tonne of waste to make reprocessing it economically viable, with a low PRN price indicating that reprocessing is close to being economically viable based on market conditions). Demand for paper for recycling has been consistently high over the years. In addition, weight-based landfill diversion targets and the landfill tax act as a strong incentive for collecting and recycling heavy materials such as paper. Therefore we have assumed a 0% drop in both scenarios.

**Glass:** Though in theory weight-based landfill diversion targets and the landfill tax should also incentivise the recycling of glass, achievement of the glass recycling targets has historically been tight. Without producer funding, the costs of collection may not be offset by the value of the material. Therefore removing targets is assumed to lead to drops of between 2% and 20%. There may also be a further shift, with more material going to open-loop applications (aggregates) due to lower collection quality.

**Aluminium:** Aluminium is highly valuable. For that reason, in the low scenario we have assumed that without targets, established collections would not stop, leading to a 0% drop in current recycling rates. However, as a light and relatively bulky material it is more expensive to collect than denser materials, and offers less benefit in terms of avoiding landfill costs. Therefore the high scenario assumes that collections rates could be affected by decisions on the economics of collection, leading to a potential drop of 20%.

**Steel:** We have assumed drops of between 5% and 30% to account for the fact that packaging steel tends to be of lower quality than waste steel from other sources, and it is therefore relatively vulnerable to trading conditions. When targets are in place, this is normally compensated by producer funding topping up the value of the material or incentivising its trading.

**Plastic:** The main plastic fractions collected in the UK (bottles from households and film from commercial and industrial sources) are valuable, so the low scenario assumes that established collections would continue unchanged. However, as a light and bulky material, waste plastic packaging is relatively costly to collect and does not offer much saving in landfill costs. It is therefore vulnerable to decisions on the economics of collection. To reflect this, the high scenario assumes a reduction of 15% in recycling rates.

**Wood:** The demand for waste wood as a feedstock for energy from waste has been increasing over time. Responses to previous consultations indicated that significantly more waste wood packaging would go into energy from waste if it was not for the packaging recycling targets because of the financial incentive offered by ROCs. We have therefore assumed drops in recycling rates between 50% and 80%.

In addition to the assumed drop in tonnages recycled in the absence of packaging targets, it is assumed that any tonnage which would otherwise have been recycled will be sent 80% to landfill and 20% to energy recovery (excluding wood, which we assumed 80% to energy recovery).

Annex 5 (tables and breakdowns) sets out the actual tonnages associated with each of these scenarios.

In the low scenario (where the reduction in the level of recycling is lowest), the UK would continue to achieve close to the required minimum to meet the EU Directive targets.

In the high scenario, where the reduction in recycling is predicted to be greater, the UK would not meet the EU Directive targets and risk infraction. Therefore, to ensure ongoing compliance, an intervention is required; in this case, national targets. **For this reason, removal of all packaging specific targets is not considered as a potential option.**

### **The base data used to set targets (common to all options)**

All the options below start with the same set of data:

- i. the amount of packaging flowing into the UK waste stream, by material (Annex 5, Table A11);
- ii. the level of packaging that is 'obligated' on the UK market (Annex5, Table 13).

The Packaging Regulations include a *de minimis* threshold, exempting businesses which have a turnover below £2m and who handle under 50 tonnes of packaging a year; they are 'not obligated'. However, the packaging that is handled by those exempt businesses still counts when calculating the UK's recycling performance. This is because the Packaging Directive targets are set as a percentage of the total packaging waste arising in each Member State.

The 'obligated tonnage' is the total tonnage handled in a calendar year by the companies who are covered by the Regulations. The recycling and recovery targets which apply to this 'obligated tonnage'

are higher than those set by the Packaging Directive in order to cover the *de minimis* tonnage. This ensures that the UK complies with the provisions of the Directive. These higher targets are known as 'UK business targets'.

Estimating the 'obligated tonnage' requires assumptions to be made about the amount of packaging businesses will handle in future years. This does not, and cannot take account of future unknown economic or market events at a national or international level, nor of commercial developments at company level.

The current targets in the Packaging Regulations are based on the assumption that obligated tonnage would grow in line with the tonnage placed on the market and therefore arising as waste. These forward estimates have proved reasonably sound. Historically, the level of obligation has grown approximately in line with the growth in packaging arising (around 1.5-2% per year) and major changes in the level of obligated tonnage have been the result of regulatory changes (to bring more packaging into scope of the Regulations), rather than changes in the market. Therefore, we expect the obligated tonnage to continue to track packaging waste arisings, and so have used the same growth rates for both, using the 2009 actual obligated tonnage data as a baseline.

The estimates used for the obligated tonnage (i.e. the tonnage to which the statutory recycling targets under the Packaging Regulations apply, excluding tonnage from businesses which fall under the *de minimis*) are in annex 5, table A13.

## Description of the options considered

### OPTION 1: UK packaging recycling targets set to meet the EU minimum targets

Since the UK is legally bound to maintain minimum recycling targets under the Packaging Directive, the minimum option is to set targets which achieve this level, but no more. As discussed above, no targets is *not* a feasible option, since these EU minimum targets would not be achieved in the absence of intervention. Under the scenario of a 'low' drop in recycling, the EU targets would not be met for glass and plastic. Under the 'high' scenario, the EU targets would not be met *for all materials*. (The high scenario is considered to be equally as likely as the 'low' scenario.)

Note that this EU minimum level is **likely to be below the efficient level of recycling for the UK**, since there are net benefits from additional recycling above this level.

The proposed business targets for 2013-2017 in Table 3 below apply to the tonnage captured under the Packaging Regulations, above the *de minimis* threshold. These business targets are higher than EU minimum targets to compensate for the *de minimis* tonnage, as this still counts towards the UK packaging waste stream as a whole.

There are minor adjustments (in red) in the business targets for plastic and overall recovery to take account of changes in the underlying data. In both cases, the amount of waste arising and the amount of obligated tonnage are predicted to diverge, therefore a higher target is required to ensure the same achievement against the total waste stream.

Table 3: Business Packaging Targets (%)

%	2012 (in place)		2013		2014		2015		2016		2017	
	Business targets	To achieve	Business targets	To achieve	Business targets	To achieve	Business targets	To achieve	Business targets	To achieve	Business targets	To achieve
Paper	69.5	63.8	69.5	63.8	69.5	63.8	69.5	63.8	69.5	63.8	69.5	63.8
Glass	81.0	62.4	81.0	62.4	81.0	62.4	81.0	62.4	81.0	62.4	81.0	62.4
Aluminium	40.0	39.8	40.0	39.8	40.0	39.8	40.0	39.8	40.0	39.8	40.0	39.8
Steel	71.0	53.5	71.0	53.5	71.0	53.5	71.0	53.5	71.0	53.5	71.0	53.5
Plastic	32.0	23.8	32.0	23.5	32.0	23.3	32.0	23.1	33.0	23.6	33.0	23.3
Wood	22.0	19.2	22.0	19.2	22.0	19.2	22.0	19.2	22.0	19.2	22.0	19.2
Total recovery	74.0	61.2	74.0	61.2	74.0	61.2	75.0	62.0	75.0	61.9	75.0	61.9
Of which recycling	68.1	56.3	68.1	56.2	68.1	56.1	69	55.9	69	55.8	69	55.6

The gap between a producer's material specific target and overall recycling target is filled by 'general recycling'. This recycling can come from any material and therefore tends to focus on the materials with the lowest PRN costs (i.e. paper and wood).

Annex 5 illustrates the recycled tonnages that would be delivered by adopting these minimum targets and the incremental tonnage compared to each notional baseline (Tables A14 and A15a and A15b). As described above, the baseline scenarios are not necessarily sufficient to meet EU requirements, so these incremental tonnages ensure that the EU minimum targets are met.

**The higher costs of recycling this material will either be indirectly paid for by producers through the PRN system, or directly paid for through arrangements with local authorities, which has taken part in the past. See box 3 in the costs and benefits section.**



## OPTIONS 2 and 3: Higher levels of recycling for key materials

### *Rationale for choice of recycling rate*

Annex 3 (summarised below) considers where the efficient level of recycling for each of these materials is likely to lie, i.e. whether it is above or below the EU level. Once above the EU minimum, the rationale for intervention is to address the environmental externality and misaligned incentives (in collection and disposal) which mean that the 'optimal' level of recycling is not achieved.

Options 2 and 3 aim move recycling rates towards a level considered to be optimal.

The proposal to increase targets post-2012 for specific materials is aligned with:

- In England, the Government's intention to achieve higher of recovery and recycling and its ambition to be the greenest government ever. The government's review of waste policy, published in June 2011, announced recognised the importance of recycling packaging, particularly plastic and aluminium as they are the two most energy-intensive materials to manufacture, and there are big environmental gains to recycling more. In addition, the waste review announced the intention to consult on establishing a sub-target for recycling of glass into re-melt applications (as re-melt is much better in greenhouse gas terms).
- In Wales, In Wales, Towards Zero Waste, Wales' overarching waste strategy document was launched in June 2010. The strategy document outlines the actions necessary to reach Wales' ambition of becoming a high recycling nation by 2025 and a zero waste one planet nation by 2050. Waste in Wales needs to reduce by 1.5 per cent every year until 2050 and recycling needs to achieve a rate of 70% by 2025. The waste strategy has been based on the ecological footprint tool and priority materials for reduction and recycling have been identified. These include packaging materials. Where waste is produced the best way to reduce the ecological footprint of waste is via closed loop recycling. In some cases, for example glass and plastic, open loop recycling can be more damaging to the environment such as glass to aggregate.
- Scotland's waste policy is set out in its innovative Zero Waste Plan, published in June 2010. The Plan highlights our ambition to:
  - Treat waste as a resource that should not be discarded carelessly;
  - Tackle all waste, not just municipal waste;
  - Achieve total recycling targets of 70% by 2025, with no more than 5% of all waste going to landfill.
  - One of the Plan's commitments was for the Scottish Government to look at statutory producer responsibility measures to see if they can be made to drive recycling and waste prevention in Scotland.
  - Most recently, through its Zero Waste Regulations, the Scottish Government has set a timetable for the separate collection of recyclables and progressive landfill bans on various materials
- The Northern Ireland Waste Management Strategy 2006-2020 provides the policy basis for waste management in Northern Ireland. It contains actions and targets designed to move away from simply managing the waste produced towards recognition of this waste as a valuable resource.
  - The strategy identifies packaging as a priority waste stream that should be addressed through producer responsibility legislation, and initiatives such as the 'Courtauld Commitment' which aims to design out packaging waste growth and deliver absolute reductions.
  - The Department of the Environment for Northern Ireland is undertaking a scoping exercise that could lead to a review of the current Waste Management Strategy.
  - The scoping exercise commenced in August 2011 and is considering all relevant drivers, including EU Directives and Regulations, and recent strategic statements in the UK and Ireland. The output from this exercise will set out the options for a review based on the identified policy and legislative interventions.

The table below summarises where the efficient levels of recycling may lie, considering the marginal benefits of additional tonnes, marginal costs of additional tonnes and where there are likely to be 'jumps' in the cost curve for dealing with additional tonnes of recycled material. This table below is only a very brief summary – annex 3 details the evidence of marginal costs and benefits which was considered, the

uncertainties as well as more explanation behind the ‘requirement for specific recycling intervention’.

## Summary Table 4

	<b>Value of GHG externality*</b>	<b>Marginal benefits compared to costs for tonnages above EU min</b>	<b>Feasibility of increases**</b>	<b>Requirement for specific recycling intervention***</b>	<b>Proposed options</b>
<b>Alum'</b>	Around £200 <i>(Higher than landfill tax)</i>	Marginal benefits >> marginal costs Higher than EU min	ACP recommendation of year-on year increases of initially 1%, up to 3% per year. View from industry that 3% per year is feasible without large jumps in costs.	Landfill tax only incentivises waste away from landfill rather than into recycling.	Option 2: 1% yearly increase Option 3: 3% yearly increase
<b>Steel</b>	Around £38	Marginal benefits > marginal costs	ACP recommendation of around 2% every year.	EU <i>packaging</i> targets unlikely to be met in absence of intervention.	Option 2: No increase Option 3: 1% yearly increase
<b>Plastic</b>	Around £27 (average plastic closed loop recycling), slightly lower for film plastic	Marginal benefits > marginal costs; <i>however uncertainty in costs and volatility in material price (benefit)</i>	ACP recommend 2.3% yearly increases. Beyond a certain point, marginal costs of additional collection will be much more costly than marginal benefits of additional tonnes of plastic. However, 5% increases are unlikely to pass this point: it should be possible to achieve the targets by increasing the participation and yields from existing bottle and mixed plastics household collections and the levels from C&I source. Benefits > costs even when assuming new infrastructure in plastics collection is required.	Low density material, relatively less incentive to divert from landfill with weight-based tax compared to denser material. Without targets in place, volatility of material price disincentive to long term investment in plastic recycling.	Option 2: 2% yearly increase Option 3: 5% yearly increase
<b>Glass</b>	Around £8 / tonne for glass recycled into re-melt, much lower for recycled into aggregates <i>(difference not reflected in landfill tax).</i>	Marginal costs may be greater than marginal benefits. Likely to be gain from marginal tonnes diverted from aggregate to re-melt.	1% yearly change in proportion with end use of remelt vs aggregates is feasible. Future changes in technology may enable glass collected as mixed to be colour sorted for remelt. (letsrecycle.com)	EU targets unlikely to be met in the absence of intervention.	Option 2: No yearly increase Option 3: no overall increase in tonnage, change split of end-use

\*Benefit of recycling compared to landfill, from initial Zerowaste Scotland calculations of traded and untraded split

\*\* Based on advice from advisory committee on packaging, discussions with industry and evidence of costs of additional infrastructure

\*\*\* As discussed in Box 1, existing interventions in the carbon market internalise a subset of the carbon emissions associated with electricity in recycling and production in the EU.

Based on this evidence for each material, Option 2 and 3 outline two different choices for levels of recycling. Option 3 is the preferred levels of recycling rates, representing significant economic and environmental benefits.

The alternatives for achieving these levels of recycling are: i) through setting statutory targets up to these

levels, or ii) through keeping statutory targets at the EU minimum and negotiating voluntary responsibility deals with industry for tonnages above this level. For option 3, this IA also presents an alternative: iii) through a 'deposit refund system' to encourage recycling above EU levels.

There is a clear rationale for increasing recycling levels through *statutory* targets rather than voluntary agreements. Firstly, as described below, voluntary targets are unlikely to achieve the tonnages of recycling described in the options, due to the externalities and misaligned incentives. Secondly, the PRN system is a low cost compliance scheme for business, putting all businesses on a level field (rather than voluntary targets, where only certain businesses cover the costs, with others 'free-riding'.)

As described above, the PRN system is necessary to ensure that the UK achieves EU minimum targets. The administration of the scheme (and associated costs) mean that the PRN price has to be higher than this cost in order to provide an actual benefit for each tonne of recycled material. If the reprocessors are faced with admin costs higher than the value of the PRN revenue, there is no incentive provided by the PRN system. Stagnant targets have resulted in low PRN prices over the past 2 years. Government can influence PRN prices through increasing *statutory* targets (but are unlikely to influence prices through voluntary targets). Higher PRN prices would mean there is an actual benefit received by the reprocessor, resulting in a real flow of revenue to the collection and reprocessing of recyclates.

## OPTION 2: Higher levels of recycling for aluminium & plastic

This option rolls forward the 2012 EU material specific targets for paper, glass, steel, wood. The aluminium target increases by 1 percentage point per year from 2013, rising to 45% by 2017. The plastic targets increases by 2 percentage points per year from 2013, rising to 42% by 2017

*Note that these levels are targeting key materials where there is a strong rationale for further recycling intervention. These levels may be less than the rates of recycling considered to be 'optimal', and below the tonnages considered (as industry) as feasible to collect and reprocess.*

The options for achieving these options are: i) through setting statutory targets up to these levels, or ii) through keeping statutory targets at the EU minimum and negotiating voluntary responsibility deals with industry for tonnages above this level.

### OPTION 2a: Higher levels of recycling for aluminium & plastic, achieved by setting statutory targets.

The above levels of recycling can be achieved through setting statutory targets, implemented through the PRN system.

Table 5: Proposed targets on individual UK obligated businesses

%	2012 (as set in current Regulations)		2013		2014		2015		2016		2017	
	Business targets	To achieve	Business targets	To achieve	Business targets	To achieve	Business targets	To achieve	Business targets	To achieve	Business targets	To achieve
Paper	69.5	63.8	69.5	63.8	69.5	63.8	69.5	63.8	69.5	63.8	69.5	63.8
Glass	81.0	62.4	81.0	62.4	81.0	62.4	81.0	62.4	81.0	62.4	81.0	62.4
Aluminium	40.0	39.8	41.0	42.8	42.0	45.8	43.0	48.8	44.0	51.8	45.0	54.8
Steel	71.0	53.5	71.0	53.5	71.0	53.5	71.0	53.5	71.0	53.5	71.0	53.5
Plastic	32.0	23.8	34.0	27.2	36.0	30.6	38.0	33.9	40.0	37.1	42.0	40.3
Wood	22.0	19.2	22.0	19.2	22.0	19.2	22.0	19.2	22.0	19.2	22.0	19.2
<b>Recovery</b>	<b>74.0</b>	<b>61.2</b>	<b>75.0</b>	<b>61.9</b>	<b>75.0</b>	<b>61.7</b>	<b>75.0</b>	<b>61.6</b>	<b>76.0</b>	<b>62.2</b>	<b>76.0</b>	<b>62.1</b>
<b>Of which Recycling</b>	<b>68.0</b>	<b>56.3</b>	<b>69.0</b>	<b>57.1</b>	<b>69.0</b>	<b>57.0</b>	<b>69.0</b>	<b>57.0</b>	<b>69.9</b>	<b>57.7</b>	<b>69.9</b>	<b>57.7</b>

Setting these targets through the PRN system means that **producers of packaging would cover the costs of the additional collection and sorting costs. See box 3 in the costs and benefits section.**

The gap between a producer's material specific target and overall recycling target is filled by 'general recycling'. This recycling can come from any material and therefore tends to focus on the materials with the lowest PRN costs (i.e. paper and wood). Even though 'general recycling' may decrease, the higher targets for total recovery and recycling will pull up the *overall* amount of recycling and the material specific targets ensure higher levels of recycling for 'key materials'.

### OPTION 2b: Higher levels of recycling for aluminium & plastic.

**Statutory targets to meet the EU minimum, with negotiated responsibility deals to recycle more plastic and metals packaging.**

This option would see the implementation of statutory targets as shown in option 1, via the PRN system, supplemented only with responsibility deals for key materials/packaging formats. The responsibility deal would aim to achieve the higher targets set out above, in 2a.

For option 2b, the expected responsibility deals would cover:

- Metals: Aluminium
- Plastic (bottles, carrier bags, non-bottle plastics)

In this scenario, the responsibility deal could involve the key stakeholders (those with the largest obligation in aluminium) committing to recycle a proportion beyond their minimum legal requirements. This would mean that as well as ensuring the recovery/recycling of the minimum required to meet their obligation under the Regulations, companies would seek to support other activities which would lead to increased recycling of the specific material.

### **Box 2: Example of a Responsibility Deal**

In 2010 Marks and Spencer established a partnership programme with specific local authorities to significantly improve kerbside recycling, enabling councils to collect an additional 60,000 tonnes of recyclable material from six million people every year by 2015.

As part of the programme M&S committed to invest £1.25 million over five years in the first partnership with Somerset County Council's Waste Partnership enabling the council to add plastics and cardboard to the materials it collects from homes across its five district councils. This is intended to increase the amount collected for recycling by 60kt.

The benefits for householder from the partnerships are more materials, such as plastic food and drink packaging and metal trays will be collected as part of the kerbside system. The Local Authority will benefit as recycling capacity will be increased and Marks and Spencer will benefit from direct access to recycled material to increase the level of recycled content in packaging

Three other similar partnerships are set to be announced later in the year, including Kent Waste Partnership which is in advanced talks with M&S.

The precise mechanism by which each individual company might choose to achieve this would be a matter for each company to decide, though they may choose to act through an overarching trade body or through a compliance scheme.

### How much would Voluntary Responsibility Deals Need to Achieve to Match Higher Targets?

The initial analysis models the **top 30 companies** with the largest obligation participating in a responsibility deal. For aluminium, the top companies deliver 75% of the total obligated tonnage, therefore recycling anything above this would have a significant impact on the overall recycling rate. For plastics however, the top companies only deliver 42% share of the overall obligated tonnage and thus the change brought about by these top 30 companies would be less substantial overall. The tables in the annex show the tonnages recycled by the top 30 companies.

To achieve levels comparable to what is being delivered by higher targets set out under Option 2, the top 30 businesses would need to recycle beyond their statutory requirement and beyond the tonnage otherwise estimated to be recycled by these companies. For aluminium, these 30 companies would be required to recycle 17% more than they are otherwise anticipated to recycle (an increase of 23% on 2010 levels by 2017). For plastic, these companies would need to display an increase of 71% relative to 2010 levels by 2017 (23% more than estimates of recycling estimates for these companies).

This means that, with a voluntary initiative, an achievement close to that which matches higher targets may be possible for aluminium. For the top 30 companies, levels of recycling in 2017 would only need to increase by 23% relative to 2010 levels to achieve the rates of recycling laid out under option 2. However, the rates of recycling for plastics **would not be expected** because in order to achieve the same level of recycling the companies would need to undertake **significantly more recycling** than their legal obligation. This would mean greatly increased costs for those signatory companies (see costs section), which may put them at a commercial disadvantage, and which may be difficult to secure.

### Voluntary Responsibility Deal modelled for the analysis

To model voluntary responsibility deals, the analysis considers the net social benefit of the top 30 companies partaking in a scheme which commits each business to increase their recycled tonnage by either 5% or 10% each year. These % levels have been chosen as realistic annual increases which may be proposed for a voluntary responsibility deal. The additional tonnage and overall impact on the recycling rate is as follows.

Table 6a: Additional tonnage recycled over and above legal obligation (tonnes)

ALUMINIUM	2013	2014	2015	2016	2017
5% per annum PRD	2,236	2,258	2,281	2,303	2,326
Overall Recycling achievement	34.6%	34.6%	34.6%	34.6%	34.6%
10% per annum PRD	4,471	4,516	4,561	4,607	4,653
Overall Recycling achievement	35.9%	35.9%	35.9%	35.9%	35.9%
Overall recycling achieved under suggested rate (option 2)	35.7%	36.5%	37.4%	38.3%	39.1%

Table 6b: Additional tonnage recycled over and above legal obligation (tonnes)

PLASTICS	2013	2014	2015	2016	2017
5% per annum PRD	13,180	13,509	13,847	14,637	15,002
Overall Recycling achievement	24.3%	24.3%	24.3%	25.0%	25.0%
10% per annum PRD	26,359	27,018	27,694	29,273	30,005
Overall Recycling achievement	24.8%	24.8%	24.8%	25.5%	25.5%
Overall recycling achieved under suggested rate (option 2)	25.1%	26.6%	28.1%	29.6%	31.1%

The “overall recycling achievement” percentage figure is the total tonnages recycled per annum (including what is required for the EU minimum) as a proportion of the overall packaging waste arisings.

For comparison, the overall recycling rates achieved with the targets suggested under option 2 (above) are presented as a row below. Note that this comparison rate is lower than the statutory level stated above for these obligated producers, since the targets for option 2a fall only on obligated producers and the overall recycling rate achieved is therefore lower.

It is clear that even a PRD of 10% per annum increase would fall short of the recycling achievement under option 2.

## Option 2: Comparison of total additional tonnages over 5 years

Table 7

Material	Option 2a: statutory targets	Option 2b: voluntary responsibility deal (average of 5% and 10%, as shown on summary sheet)
Aluminium	24,065	11,404
Plastic	620,432	70,175

### OPTION 3: Higher levels of recycling for aluminium, plastic & steel & split rate of recycling for glass

This option rolls forward the 2012 EU material specific targets for paper and wood.

The **aluminium** target increases by 3 percentage points per year from 2013, rising to 55% by 2017.

The **plastic** targets increases by 5 percentage points per year from 2013, rising to 57% by 2017.

The **steel** target increases by 1 percentage point per year from 2013, rising to 76% by 2017.

**Glass** is held on the assumption that the target will be split by end use.

The overall recovery rate increases by 1 percentage point per year, rising to 79% by 2017.

These rates of recycling are considered to be levels where the additional environmental benefits are balanced with additional costs. Incremental increases in tonnages are considered feasible, without imposing dramatically higher costs. **This option is the preferred option.**

Considering the evidence presented above, it should be noted that recycling rates *higher* than presented in option 3 may go above the efficient level of recycling, i.e. the additional costs may be greater than the additional benefits associated with further tonnages.

The options for achieving these options are: i) through setting statutory targets up to these levels, or ii) through keeping statutory targets at the EU minimum and negotiating voluntary responsibility deals with industry for tonnages above this level and iii) keeping statutory targets at the EU minimum and implementing a deposit refund system.

As described above, **there is a clear rationale for increasing recycling levels through statutory targets.** Higher targets will increase the PRN price, resulting in revenue flows to reprocessors above the transaction costs and a real flow of revenue to the collection and reprocessing of recyclates.

### OPTION 3a: Higher levels of recycling for aluminium, plastic & steel & split rate of recycling for glass, achieved by setting statutory targets.

The levels of recycling discussed above, can be achieved through setting statutory targets, implemented through the PRN system. The split glass target would be achieved by splitting the PRN market for re-melt and aggregates. Evidence for aggregates would be separate from evidence for re-melt.

This may not be best method for achieving this split of glass end-use: as part of the consultation response we would appreciate feedback on potential distortions / administrative difficulties and any alternatives.

Table 8: Proposed targets on individual UK obligated businesses

%	2012 (as set in current Regulations)		2013		2014		2015		2016		2017	
	Business targets	To achieve	Business targets	To achieve	Business targets	To achieve	Business targets	To achieve	Business targets	To achieve	Business targets	To achieve
Paper	69.5	65.7	69.5	65.7	69.5	65.7	69.5	65.7	69.5	65.7	69.5	65.7
Glass	81.0	61.7	81.0	61.7	81.0	61.7	81.0	61.7	81.0	61.7	81.0	61.7
Aluminium	40.0	41.0	43.0	44.0	46.0	47.1	49.0	50.2	52.0	53.2	55.0	56.3
Steel	71.0	53.2	72.0	53.9	73.0	54.7	74.0	55.4	75.0	56.2	76.0	56.9
Plastic	32.0	23.7	37.0	27.4	42.0	31.1	47.0	34.8	52.0	38.5	57.0	42.1
Wood	22.0	21.5	22.0	21.5	22.0	21.5	22.0	21.5	22.0	21.5	22.0	21.5
<b>Recovery</b>	<b>74.0</b>	<b>62.4</b>	<b>75.0</b>	<b>63.2</b>	<b>76.0</b>	<b>64.0</b>	<b>77.0</b>	<b>64.8</b>	<b>78.0</b>	<b>65.6</b>	<b>79.0</b>	<b>66.4</b>
<b>Of which Recycling</b>	<b>68.10</b>	<b>57.5</b>	<b>69.0</b>	<b>58.2</b>	<b>69.9</b>	<b>58.9</b>	<b>70.8</b>	<b>59.6</b>	<b>71.8</b>	<b>60.4</b>	<b>72.7</b>	<b>61.1</b>

The gap between a producer's material specific target and overall recycling target is filled by 'general recycling'. This recycling can come from any material and therefore tends to focus on the materials with

the lowest PRN costs (i.e. paper and wood). Even though 'general recycling' may decrease, the higher targets for total recovery and recycling will pull up the *overall* amount of recycling and the material specific targets ensure higher levels of recycling for 'key materials'. The higher recovery target also leads to tonnages moving from landfill to energy from waste.

Setting these targets through the PRN system means that **producers and handlers of packaging would cover the costs of the additional collection and sorting costs. See Box 3 in the costs and benefits section.** Delivering the targets proposed under this option will present a greater degree of challenge to producers than targets set to meet EU minimum requirements.

Within this option, producers will choose the most efficient way to discharge their legal requirement. In the past, groups of packaging producers have made arrangements with selected local authorities to fund schemes to improve recycling rates, in return for ownership of the material thus collected (and the PRN). We are aware that some producers have started or are considering direct intervention (eg direct work with local authorities to deliver higher recycling rates for packaging), either on their own or as part of a group. This option would keep compliance costs down for businesses who are not taking part in a responsibility deal, though there would be costs for signatories.

PRN revenues are a tax and spend measure (flowing directly from obligated companies to reprocessors), therefore they are not accounted for in the resource costs and benefits (see box 3) and there is no net cost to business. However, even if the PRN financial flow was considered in the analysis and *only* the costs were accounted for, this would still result in a high positive net present value for society.

### **OPTION 3b: Higher levels of recycling, as outlined above. Statutory targets to meet the EU minimum, with negotiated responsibility deals to recycle more plastic and metals packaging.**

This option would see the implementation of statutory targets as shown in option 1, via the PRN system, supplemented only with responsibility deals for key materials/packaging formats. The responsibility deal would aim to achieve the higher targets set out above, in 3a. This voluntary responsibility deal would follow the format as laid out in option 2b, with the addition of steel cans, aerosols, foils.

The only differences between 2b and 3b are:

- i) The outcomes and costs and benefits of a voluntary responsibility deal are compared to regulatory and other options **for achieving different targets** (2b is compared to 2a targets; 3b responsibility deal is compared to meeting targets under 3a).
- ii) This means that option 3b includes steel (compared to an option including steel) and 2b does not include steel in the responsibility deal.

Note this responsibility deal does *not* include the split target for glass: the above analysis has been shown with and without the split glass target to allow comparison.

Again, this analysis models the participation of the top 30 companies by obligated tonnage.

This section includes steel as part of the responsibility deal. For steel, the top 30 obligated companies currently recycle 60% of obligated tonnage. To achieve levels comparable to what is being delivered by higher targets set out under Option 3, tables 18 in annexes shows the additional tonnage that the top 30 businesses would need to recycle, beyond their statutory requirement. The table also reports the percentage increase in recycling that would need to be delivered each year over and above the legal obligation as well as the increase relative to 2010 levels.

For **aluminium**, the top 30 obligated businesses would need to achieve a **68%** increase in aluminium recycling levels, compared to 2010 tonnages. For **plastic**, this increase would be a **322%** increase on 2010 tonnages, to match the levels of recycling laid out in option 3a. For **steel**, the top 30 companies would require a **14%** increase in recycling tonnages from 2010.

The increases required under a voluntary agreement for steel seem a realistic target, however this is not the case for aluminium and plastic. With a voluntary initiative, particularly plastics, an achievement close to that which matches higher targets **would not be expected** because in order to achieve the same



level of recycling the companies would need to undertake **significantly more recycling** than their legal obligation. This would mean greatly increased costs for those signatory companies (see Table 47), which may put them at a commercial disadvantage, and which may be difficult to secure.

This means that the levels of recycling which will pull the UK closer to the 'optimal' level will not be reached.

#### Voluntary Responsibility Deal modelled for the analysis

As under option 2b, the analysis considers the net social benefit of the top 30 companies partaking in a scheme which commits each business to increase their recycled tonnage by either 5% or 10%. Again, these % levels have been chosen as realistic annual increases which could be proposed for a voluntary responsibility deal. The additional tonnage and overall impact on the recycling rate are shown below, compared to the suggested rates of recycling under option 3.

Table 9a: Additional tonnage recycled over and above legal obligation (tonnes)

<b>ALUMINIUM</b>	<b>2013</b>	<b>2014</b>	<b>2015</b>	<b>2016</b>	<b>2017</b>
5% per annum PRD	2,236	2,258	2,281	2,303	2,326
Overall Recycling achievement	<b>34.6%</b>	<b>34.6%</b>	<b>34.6%</b>	<b>34.6%</b>	<b>34.6%</b>
10% per annum PRD	4,471	4,516	4,561	4,607	4,653
Overall Recycling achievement	<b>35.9%</b>	<b>35.9%</b>	<b>35.9%</b>	<b>35.9%</b>	<b>35.9%</b>
<b>Overall recycling achieved under suggested rate (option 3)</b>	<b>36.5%</b>	<b>38.3%</b>	<b>40.0%</b>	<b>41.7%</b>	<b>43.5%</b>

Table 9b: Additional tonnage recycled over and above legal obligation (tonnes)

<b>PLASTICS</b>	<b>2013</b>	<b>2014</b>	<b>2015</b>	<b>2016</b>	<b>2017</b>
5% per annum PRD	13,180	13,509	13,847	14,637	15,002
Overall Recycling achievement	<b>24.3%</b>	<b>24.3%</b>	<b>24.3%</b>	<b>25.0%</b>	<b>25.0%</b>
10% per annum PRD	26,359	27,018	27,694	29,273	30,005
Overall Recycling achievement	<b>24.8%</b>	<b>24.8%</b>	<b>24.8%</b>	<b>25.5%</b>	<b>25.5%</b>
<b>Overall recycling achieved under suggested rate (option 3)</b>	<b>27.4%</b>	<b>31.1%</b>	<b>34.8%</b>	<b>38.5%</b>	<b>42.1%</b>

With the inclusion of steel:

Table 9c: Additional tonnage recycled over and above legal obligation (tonnes)

<b>STEEL</b>	<b>2013</b>	<b>2014</b>	<b>2015</b>	<b>2016</b>	<b>2017</b>
5% per annum PRD	10,314	10,262	10,211	10,160	10,109
Overall Recycling achievement	<b>55.1%</b>	<b>55.1%</b>	<b>55.1%</b>	<b>55.1%</b>	<b>55.1%</b>
10% per annum PRD	20,628	20,525	20,422	20,320	20,218
Overall Recycling achievement	<b>56.7%</b>	<b>56.7%</b>	<b>56.7%</b>	<b>56.7%</b>	<b>56.7%</b>
<b>Suggested rate (option 3)</b>	<b>53.2%</b>	<b>53.9%</b>	<b>54.7%</b>	<b>55.4%</b>	<b>56.2%</b>

The "overall recycling achievement" percentage figure is the total tonnages recycled per annum (including what is required for the EU minimum) as a proportion of the overall packaging waste arisings. Note that the voluntary responsibility deal for steel would achieve the same or higher tonnages than under option 3a however, the recycling rates for plastic and aluminium are significantly lower than the tonnages laid out under 3a.

**OPTION 3c: Higher levels of recycling, as outlined above.  
Achieved through statutory targets set to meet the EU minimum, plus introduction of a deposit refund system**

This option would see the implementation of statutory targets on packaging producers to the EU level (as per in Option 1), supplemented with a deposit refund system (DRS) for beverage containers which would aim to deliver higher levels of recycling.

The OECD’s Glossary of Statistical Terms defines DRSs as follows:

*“A deposit-refund system is the surcharge on the price of potentially polluting products. When pollution is avoided by returning the products or their residuals, a refund of the surcharge is granted.”*

The DRS is compared as an alternative method for achieving the higher levels for option 3, i.e. higher recycling rates of aluminium, plastic, steel and a change in the split of glass end-use. (The DRS would increase the tonnages of glass collected separately. As mentioned above, an end-use of re-melt may be easier to achieve where glass is colour-sorted.)

A DRS encourages the return of target materials into an organised reuse, recycling or disposal process. Producers typically finance the process through the payment of an administration fee on each item covered by a deposit. DRSs can encourage recycling and / or reuse of items that are otherwise easy to dispose of with the residual waste or discard as litter.

For the purposes of this IA, we have assessed the DRS scheme developed by Eunomia for CPRE’s report *Have we got the bottle* [<http://www.cpre.org.uk/resources/energy-and-waste/litter-and-fly-tipping/item/1917->]. This scheme uses principles similar to systems which exist in Denmark and other Scandinavian countries. *For key principles please see Annex 5.* The scheme would cover glass bottles, PET bottles, aluminium and steel beverage cans. This focuses on the materials highlighted for increased recycling levels in the above assessment. All other packaging formats and materials would continue to be collected through existing collection systems.

If this option was pursued, further analysis would be needed on the scope and coverage of a DRS, to include a greater range of drinks containers and materials, such as liquid carton board, pouches and HDPE milk bottles. Potentially, packaging items which are sufficiently similar to drinks containers (eg glass and plastic jars) could also be considered.

Because a DRS would only cover drink containers, it would run as a parallel system with kerbside collection, which would continue to be needed for wastes (including other types of packaging) not covered by the DRS.

The modelling done by Eunomia calculates the additional recycling “that will occur as a result of higher return rates from the parallel deposit refund system.” Please note that their analysis only covers the first year of implementation, which they assumed to be 2014/15. For a comparative assessment of all the proposed options, we have had to estimate the cost and benefit of a DRS over a full 5 year period and therefore the results for all other years are assumed the same.

Annex 5, Table A41 shows the additional tonnage recycled over above a baseline of existing regulations therefore, as with all options beyond option 1, the analysis considers this tonnage additional to EU minimum.

It should be noted that the additional tonnages achieved by the DRS scheme are higher than those proposed for targets in option 3a. A comparison of the additional tonnages achieved for each option are below. The DRS scheme only captures additional tonnages of *drinks containers*, rather than all packaging.

### Option 3: Comparison of total additional tonnages over 5 years

Table 10: Additional tonnages achieved under each option (tonnages additional to EU minimum)

Material	Option 3a: statutory targets – estimated as a move	Option 3b: voluntary responsibility deal (average of 5% and	Option 3c: Deposit Refund Scheme (tonnages from Eunomia

	towards a more efficient level	10%, as shown on summary sheet)	modelling)
Glass	0 (Only change from aggregate to remelt)	n/a	2,100,000 (method of collection would allow re-melt)
Aluminium	72,197	11,404	320,000
Steel	71,231	51,056	490,000
Plastic	1,551,080	70,175	960,000

## COSTS AND BENEFITS

This cost-benefit analysis attempts to identify and quantify the range of social, environmental and economic impacts of increasing the recovery and recycling of packaging waste above the baseline. Note that the summary sheet shows the NPV of each option relative to the notional baseline ('high' and 'low' scenario), however the costs below detail the costs and benefits *additional* to the EU minimum (option 1). The figures on the summary sheets are therefore option 1 plus the costs and benefits calculated below.

No quantifiable social impacts have been identified (disamenity of litter); however the environmental and economic impacts identified are discussed below.

The benefits of increasing diversion of packaging waste away from landfill relate predominantly to greenhouse gas emissions savings, as well as resource savings for products throughout their life-cycle and therefore economic efficiency. Savings are accrued both directly through reductions in methane emissions from biodegradable waste being landfilled, and indirectly through avoided (fossil fuel) energy use in primary material or electricity production.

The disamenity costs associated with avoided landfill have not been quantified in this impact assessment as there is no equivalent data for the disamenity impacts associated with other waste treatments. However, given the lower land requirements of non-landfill treatments it seems likely that there will be a net benefit resulting from landfill diversion.

See annex 3 for headline assumptions.

### Costs and Benefits

All costs and benefits are reported in net present values unless stated otherwise.

#### **Box 3: PRN prices and the costs and benefits of recycling: Methodology of Impact Assessment (including costs to business)**

The Impact Assessment uses a bottom-up approach to calculate the costs and benefits associated with packaging targets. The various components include the additional collection and sorting costs of recycling, the cost savings from avoided landfill disposal costs (excluding the landfill tax), and revenues from recycled materials. This is, theoretically, the additional costs of recycling in a perfect market. PRN costs are not included in the assessment of costs and benefits because PRNs are a tax-and-spend measure (i.e. a transfer payment) – they are a direct cost to obligated businesses and a direct benefit of exactly the same amount to reprocessors.

In theory, for options involving statutory targets, an alternative approach is to use PRN revenues that are passed directly from obligated businesses to reprocessor. The PRN price is essentially the additional cost of incentivising an additional tonne of recycling that is not driven by the market or the landfill tax. For a typical producer, the PRN price is influenced by the cost of recycling that particular packaging waste (collection and sorting and the delivery of segregated packaging to reprocessors) minus revenues in the form of avoided landfilling and revenue from recycled materials. When the cost of recycling is less than revenues from avoided landfilling and from the sale of recycled materials, the PRN price is likely to be close to 0. Cases where the PRN price is high, reflects either high recycling costs or a low value of the recycled material.

However, these two approaches are not equivalent and the most appropriate indication of the resource costs and benefits of recycling is provided by the bottom-up costs. The calculated PRN costs will not accurately match the balance of the bottom-up recycling costs for a number of reasons. First, the PRN price reflects the cost of landfilling including the landfill tax. As taxes are treated as transfers, the landfill tax is not included in social cost-benefit calculations. In addition, PRN prices are driven by a number of market-based factors, such as commodity prices and institutional and market structures in the waste management market. Similarly, the market price of the materials also fluctuates and the figures used to derive the PRN price may have been significantly different from those assumed in the IA. One final point to emphasise is the imperfect market for waste management: there is a long 'chain' of waste

management, with rigidities in contracts. The PRN price only reflects on the incentive required at the end of the chain but we can't account for other costs/benefits which are held by business throughout the chain. See Annex 3 for a description of the imperfections in the recycling market.

It should be noted that there *is* existing intervention to address these imperfections, in the form of 'joint working' schemes and recycling credits. However, even with these interventions, the benefits of recycling at the end of the chain are not reflected in the incentives provided at the beginning of and throughout the chain, hence the need for further intervention.

## Option 1: EU Minimum

Option 1 assesses the costs and benefits businesses face from complying with the EU Directive Targets relative to a baseline of no targets (the 'notional' baseline, with a high or low drop in recycling).

### Box 4: Who pays the additional costs of recycling?

In theory, the balance of the costs and benefits of additional recycling will **fall to packaging producers**, since the obligation is on them to pay for the evidence of additional recycling (see Box 2).

#### **Packaging producers pay indirectly:**

Where it is more costly to achieve recycling (if, for example, additional collection is required), this is likely to lead to a raised PRN price paid to reprocessors. If collection is the limiting factor for additional recycling, this should lead reprocessors to pay higher prices for the collection of materials, which will incentive additional collection by business or Local Authorities (indirectly covering these additional costs). Even though the costs of additional collection may seem to initially fall on local authorities, and the benefits of revenue may flow directly to local authorities (via e.g. reduced gate fees), the *balance* of additional costs compared to landfill should be covered by the packaging producers. Reprocessors may also choose to spend the PRN revenues on collection e.g. infrastructure such as bring-banks, bins/containers, trucks and collection vehicles.

#### **Packaging producers pay directly**

Alternatively, packaging producers may directly pay for the collection of recyclates. Packaging producers can choose to meet their statutory requirements through responsibility deals, i.e. by a group of packaging producers striking a funding arrangement to improve recycling rates with selected local authorities, in return for ownership of the material thus collected (and the PRN). This has taken part in the past, for meeting previous statutory targets.

Either way, producers in theory should cover these additional costs of meeting higher targets. As described in box 2, the relevant costs and benefits which contribute towards the 'additional costs of recycling', is labelled as such. Box 2 also describes why the bottom up calculations here will not match the actual PRN revenues paid for by producers.

Costs and benefits are calculated relative to the EU minimum (Option 1). For the benefits, the unit values are taken from annex 3: "headline assumptions".

## Benefits of Option 1

The monetised benefits of option 1 include the benefits of additional material revenues as well as benefits of avoided GHG emissions. The incidence of these benefits is described in box 3.

### Benefits from recycling materials ('Additional costs of recycling' calculation)

Additional revenue would be generated under the proposed targets by the sale of the recovered material. This material revenue will be subtracted from recycling costs, (i.e. the gate fees for Materials Recycling Facilities are lower since they take these revenues into account). In practice, this funding flow may be seen by disposal authorities and business who deal with the waste, however, these material revenues should be considered as one part of the calculation above (the additional costs of recycling, financed by packaging producers).

Tables A16a and A16b in Annex 5 are the product of current material price and additional tonnage recycled. They show this calculation broken down by material and year. It should be noted that the price for wood is negative in the market place, i.e. owners of this material pay for it to be taken. General recycling is assumed to consist of 50% paper and 50% wood, since these have the lowest PRN prices.

Compared to the low scenario (a baseline which assumes low drops in recycling in the absence of any Government regulation) this material revenue for all materials provides a present value of **£88.2m**, and

compared to the high scenario (a baseline which assumes higher drops in recycling), the material revenue is has a present value of **£266.1m**.

#### Greenhouse Gas (GHG) Emissions (Societal benefit)

The carbon value includes carbon saved and carbon produced throughout the chain, i.e. avoided carbon from production of a raw material, and avoided carbon associated with landfill gas, minus carbon associated with the recycling process and transport of recyclates. Carbon values have taken the central 2011 traded and untraded price.

The GHG emissions associated with the additional recovery/recycling activity have been calculated as **£103.1m** compared to the low scenario and **£174.7m** compared to the high scenario (both net present value of the 5 year period). See Annex 4 for the detail of the embedded and process emissions of carbon, as well as Annex 5, table A17 for the breakdown by material and year.

#### Other Non-monetised Benefits

Producer responsibility targets contribute to meeting landfill directive targets. Without the recycling targets and PRN system, there would be an increased risk that the landfill diversion targets are not met, which might mean that we face infraction proceedings from the European Commission.

### **Costs of Option 1 – EU Minimum**

The monetised costs of option 1 include the additional collection costs which will fall to local authorities (collection authorities) as well as businesses. There will be an offsetting reduction in the costs associated with collection and disposal to landfill. This *reduction* in costs to business as well as local disposal and collection authorities are monetised and included under this section.

#### Collection costs of recyclates ('Additional costs of recycling' calculation)

The costs of the incremental change in recycling under the proposed targets comprises of the variable cost of collection and sorting, either from households or from businesses. A ratio of 45:55 for tonnages collected from household: business is assumed.

Household costs draw on work from WRAP<sup>1</sup> and modelling work from Eunomia: the average cost for collecting and sorting household waste co-mingled is around £102 per tonne; the figure for kerbside sort is £128 per tonne. Both of these figures assume an equal share of 'urban' and 'rural' waste. In order to obtain both kerbside and co-mingled costs as gross figures (rather than net of material sales), the Eunomia figures have been taken for co-mingled collections and the WRAP figures have been taken for kerbside sort. (WRAP figures include the co-mingled figure is net of material sales). This may make the comingled and kerbside sort comparison inconsistent, but provides an indication of the different resource costs. For commercial and industrial waste collections, the figure varies between around £50 per tonne and £110 per tonne depending on the volumes and locations of the collected waste. In some cases, the cost may be above this range.

The marginal costs are assumed flat for the additional tonnage given that this there is sufficient capacity in the system to capture the recyclables both from households and commercial businesses. The level of recycling required under the EU minimum currently takes place, therefore no additional capacity would be required.

Compared to low scenario, these additional costs are £70.6m PV for the 5 years. Compared to the scenario with a high drop in recycling, the additional costs are £385.7m present value. See annex 4 for breakdown of materials and years.

#### Offsetting reduction in the disposal cost of refuse to landfill ('Additional costs of recycling' calculation)

Additional recycling will lead to a reduction in collection and disposal costs associated with mixed waste to landfill. The savings in disposal costs for each material from avoided landfill are £52.3m compared to the low scenario and £233.7m compared to high scenario. Annex 5, table A19 shows the yearly breakdown and the contribution of each material.

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<sup>1</sup> "Kerbside Recycling: Indicative Costs and Performance. Technical Annex.", Tables 14 and 15.

As mentioned above, these costs are resource costs only, i.e. including collection of mixed waste and *only* the landfill gate fee, since the landfill tax is a transfer payment and does not feature in a social cost benefit analysis. It should therefore be noted that the offsetting reduction in financial costs to business and local authorities will be higher than this figure, by a total of £48 up to £80/tonne as the landfill tax escalates.

### Summary – costs and benefits

The summary of costs and benefits are as set out in Table 31, indicating a net present value from the proposed targets of between £74.6m and £162.9m.

*Table 11a: Summary – Option 1: Present Value of Costs and Benefits (£m) – Low Scenario*

Cost / benefit to...	Low Scenario	2013	2014	2015	2016	2017	PV (5 years)
Theoretically covered by packaging producers, since all contribute to 'net additional costs of recycling' calculation –	Collection costs	-13.22	-7.52	-15.85	-16.62	-17.38	-70.59
	Revenues	17.48	15.04	18.33	18.54	18.75	88.21
	Landfill collection and disposal Savings	10.06	6.55	11.55	11.98	12.39	52.54
Society	Carbon Benefits	17.5	18.7	29.2	21.1	20.2	106.8
	Net benefit	31.82	32.77	43.23	35	33.96	176.96

*Table 11b: Summary – Option 1: Present Value of Costs and Benefits (£m) – High Scenario*

Cost / benefit to...	High Scenario	2013	2014	2015	2016	2017	PV (5 years)
Theoretically covered by packaging producers: all contribute to 'net additional costs of recycling'	Collection costs	-79.08	-73.77	-78.49	-77.6	-76.73	-385.7
	Revenues	65.9	53	49.7	49.1	48.4	266.1
	Landfill Savings	47.92	44.7	47.56	47.03	46.5	233.71
Society	Carbon Benefits	17.32	19.2	44.62	43.71	49.67	174.52
	Net benefit	52.06	43.13	63.39	62.24	67.84	288.66

## **RISKS**

There are no imperative risks associated with this option. For prior years, the UK has met its targets and there is sufficient capacity in the system to manage the physical tonnes for future years given the forecasted packaging waste arisings.

There are however 'market risks', whereby due to the lack of demand-pull created by increasing targets PRNs remains at the floor price. This would discourage entry into the market and long-term investment. Since 2009, the average PRN price for most materials has been close to the historic low. The current levels would not provide a significant revenue stream and probably only cover admin costs. This has resulted in a 22% reduction in the number of reprocessor /exporter accreditations for compliance year 2011.

## **DIRECT COST TO BUSINESS**

Direct costs to business is calculated in 2 different ways (see Box 2).

The costs below are calculated relative to the 'notional baseline' of no intervention. The summary sheet shows the costs and benefits relative to the EU minimum, which will be 0 for this option.

### Direct cost to packaging producers: Increase in PRNs



For the purpose of assessing the cost on businesses who are obligated under the Packaging Regulations, we have estimated the likely compliance costs of obtaining additional evidence notes (PRNs/PERNs) from accredited reprocessors or exporters for each year. These are the marginal costs visible to businesses; they are not the full social costs of the additional recycling. PRN/PERN values are dictated by supply and demand relationships, which are themselves a function of recycling capacity, market demand for materials, and the administrative costs of accreditation and reporting. For further information on PRNs/PERNs please see Annex 2.

Compared to the notional baseline of no intervention, the total *cost* to obligated business as a result of the proposed targets ranges over the 5 years is £134m, with an equivalent annual net cost of £14.7m, calculated as per the Impact Assessment guidance. The analysis assumed PRN prices remain constant for this purpose and applied to the tonnages recycled each year. Since this revenue flows to reprocessors, it is a transfer from certain businesses to other and the net effect is 0. See annexes for a breakdown.

This estimate of PRN revenues is the closest estimate of we can make of costs to business, however it is important to emphasise is the imperfect market for waste management: there is a long 'chain' of waste management, with rigidities in contracts. The PRN price only reflects on the incentive required at the end of the chain but we can't account for other costs/benefits which are held by business throughout the chain.

#### Direct cost to packaging producers: 'Bottom-up'

An alternative is to calculate the costs to business, using the 'bottom-up' method, as per the social costs and benefits (above). This will calculate the *private* balance of recycling compared to landfilling, i.e. the additional costs and benefits to business that would take place in a perfect market (if all the revenues and costs were to flow without imperfections). This includes the additional material revenues, minus additional collection costs (net of landfill collection and gate fees), plus savings in landfill tax. This is not included in social cost benefit analysis but it is a factor of *private* prices. The net effect over 5 years is a benefit of £70m to £114m.

#### OIOO

As the PRN system has been classified as a 'tax and spend' would be outside of the scope of the "One-In, One-Out principle.

## Option 2a - Increase recycling targets for plastic and aluminium (backed by responsibility deals)

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Under this option, higher volumes will lead to higher costs as more, harder to obtain material is collected and sorted. As described in option 1, **the higher costs of recycling this material will either be indirectly or directly paid for by packaging producers via the PRN system. See Box 3.** Box 2 provides an additional explanation for the methodology of these calculations and the reason why the additional costs and benefits of recycling will not match the calculation of additional PRN revenues.

Costs and benefits are calculated relative to the EU minimum (Option 1). To be comparable across all options, the summary sheet displays the figures below *plus* the costs and benefits for option 1. For the benefits, the unit values are taken from annex 3: “headline assumptions”.

It should be noted that, for this option, there are higher tonnages of key materials (aluminium and plastic) and there are higher *overall* tonnages of recycling. However the statutory quantities of ‘general recycling’ (the difference between a producer’s material specific target and the overall recycling target) are lower than the EU minimum in the final 3 years, since the overall recycling levels are increasing at a slower rate than the material specific targets. The figures below model the impacts of this decrease in ‘general recycling’.

It may be the case that these reductions in ‘general recycling’ are not observed - even though the statutory tonnages will decrease, the incentives in the paper and wood recycling market may mean that this drop does not take place – recycled paper is a viable commodities in the absence of regulation.

### Benefits of Option 2a – Higher Targets for plastic and aluminium

#### Material revenues (‘Additional costs of recycling’ calculation)

Based on the materials values set out in Table 20, the additional revenues for the higher volumes are have a PV of **£20m** for aluminium and **£158m** for plastic. The decrease in ‘general recycling’ leads to a *decrease* in material revenues of **£15**, resulting in an overall PV of **£163.6m** over the 5 years.

As described in Option 1, this funding flow may be *seen* by disposal authorities and business who deal with the waste (through lower gate fees in materials recycling facilities etc), however, these material revenues should be considered as one part of the calculation of the additional costs of recycling, financed by packaging producers.

#### Greenhouse Gas (GHG) Emissions (Societal benefit)

The additional tonnages of plastic and aluminium recycling have a carbon value with a PV of **£19.6m** over the 5 year period. However, the *decrease* in material specific recycling leads to a worsening of carbon emissions with a value of £17.7m. The offsetting reductions from general recycling (explained above) results in an overall GHG benefit with a value of **£1.9m**. The avoided emissions and value of the benefits in greenhouse emission reductions are as set out in the methodology outlined under the section “headline assumptions”.

#### Other Benefits

Higher targets could help the UK develop its recycling markets by giving certainty for investors developing collection, reprocessing and treatment infrastructure. This will enable the UK to build expertise in such activities. It is particularly pertinent in relation to plastics where the cost of diverting additional material could be potentially be greater than the benefits, unless technology improves and costs fall substantially.

Statutory targets maintain a level playing field between signatories and non-signatories to responsibility deals. Without the spur of targets, participation in responsibility deals could not be secured, whereas the combination would allow leveraging and pooling of resources across a sector.

Increased collection and recycling of packaging waste could also have additional social benefits by acting as a driver for collection of other waste streams. Finally, increased recovery and recycling of packaging waste could have amenity benefits by contributing to a decrease in packaging litter.

## Costs of Option 2a – Higher Targets

Under this option, the main requirement is to improve waste collection as, for most materials, there appears to be sufficient reprocessing capacity. The detailed costs for greater collection vary by material. Our initial views on these likely costs have been drawn from existing research and modelling around which there is a good deal of uncertainty and many assumptions. Ranges for the costs where appropriate have been used.

### Collection Costs ('Additional costs of recycling' calculation)

As described above, these additional collection costs will likely be *directly* paid for by local authorities and business (for household and business waste respectively). However, where the statutory recycling targets lead to a requirement for more collections, these are likely to be indirectly funded (at least partially) through raised PRN prices increasing the price paid for materials. The higher demand for recyclates will increase the PRN price and the higher price paid for materials is likely to partially cover the additional costs of collection of materials. They also may be directly funded through responsibility deals (as mentioned above).

**Improving collections:** To achieve targets, the key changes to existing collection systems are likely to be the addition of plastics (either bottles or mixed plastics) to existing systems. The costs involved in this are detailed in Annex 3, where describing the choice of targets.

For **plastics**, a ratio of 45:55 between household and commercial & industrial collections gives an average cost of between **£183** per tonne to **£224** per tonne, explained below.

C&I collection for plastic is assumed to be £148/tonne. It should be possible to achieve the targets by increasing the participation and yields from existing bottle and mixed plastics household collections and the levels from C&I source. However, this I.A. takes a conservative approach and assumes that significant collection infrastructure is required for household collection. Drawing on work from WRAP on household collection of plastic, we anticipate that the collection of bottles will take precedent (being the cheaper alternative - £212 per tonne), followed by domestic film. We have used the average costs for adding bottle collection for additional volumes in the period to 2014/15 and average costs of adding bottles and film for the period thereafter (£295 per tonne).

For **aluminium**, in the absence of better market information, we have used average collection costs of **£102** to local authorities for household collections and **£80** to business for commercial waste, similar to Option 1. However, it is anticipated that the costs and requirements will be lower than this with innovation and investment along the lines pursued in the steel industry.

Given the range of costs and options available, especially for plastic, this IA includes a variance around this of +/- 10%, though arguably the market might make even better use of the cheaper cost options. This variance is included in the 'high' and 'low' range of costs.

For comparative purposes, please see the difference in collection costs for Option 1, EU minimum and this option.

Table 12: Collection costs per tonne for EU minimum and higher targets

Material	EU Min		Higher Targets	
	C&I	Hh'd	C&I	Hh'd
Aluminium	£80	£115	80	102
Plastic	£80	£115	£145	£278

In aggregate, the anticipated range in collection costs have an NPV of **£1.8m** over 5 years for the additional tonnages of aluminium and an NPV of **£114m** for the collection of plastic. The reduction in 'general recycling' reduces collection costs by £19m over the 5 years. In total, collection costs for this target have a present value of around **£96.9m**. See tables in Appendix 5 for a breakdown.

### Resource savings ('Additional costs of recycling' calculation)

These additional costs of collection and sorting will be offset by a reduction in the resource costs of mixed waste, i.e. the costs of mixed waste collection and the gate fees of landfill. This benefit is only applied to the additional tonnes of recycling overall (i.e. netting off the reduction in 'general recycling'). As explained above, this does not include landfill tax, which is a transfer payment.

The resource savings from reduced mixed waste collection are around **£6.2m**. The resource savings from a reduction in disposal (resource costs) are around **£3.2m**. Both are present value over the 5 year period.

See tables in Appendix 5 for a breakdown.

## Summary of Costs and Benefits (£m)

Table 13: Summary table – additional costs and benefits of option 2a, compared to EU min (£m)

Cost / benefit to...	Cost / Benefit	2013	2014	2015	2016	2017	Total
Theoretically covered by packaging producers: all contribute to 'net additional costs of recycling'	Collection costs*	-9.04	-13.65	-18.73	-24.79	-30.69	-96.9
	Revenues	14.07	24.43	31.69	41.77	51.61	163.56
	Resource Savings (reduced mixed waste)	4.84	4.56	0	0	0	9.4
Society	Carbon Benefits	3.24	2.80	-1.06	-1.35	-1.69	1.9
	<b>Total NPV</b>	<b>13.11</b>	<b>18.14</b>	<b>11.9</b>	<b>15.63</b>	<b>19.23</b>	<b>78.0</b>

\* Average collection costs of high and low scenario

## RISKS

On collection costs, it is assumed there is spare sufficient capacity for the collection and handling of the additional tonnages overall i.e.

- No need to increase collection pass rates (i.e. frequency of collection)
- No need to increase emptying frequency of vehicles
- No need for additional compaction infrastructure, or retro fit bays
- No need to increase staff numbers (except where explicitly included, e.g. as part of additional vehicle running costs).

There is considerable uncertainty in the collection costs, especially for plastics. The modelling of kerbside sort costs by WRAP is driven mainly by increases in vehicle loading times, around which there is relatively high uncertainty<sup>1</sup>.

## SENSITIVITY ANALYSIS

The NPV is highly dependent on the material prices and the collection costs of the materials in question (plastic and aluminium).

### Material prices

Recyclable materials are a bulk commodity which has a fluctuating market price. The price is determined by a combination of global factors and thus it is difficult to forecast what this will be over the target setting period 2013 to 2017. A standard assumption based on previous impact assessments has been to use the most recent material prices and this is used for the front sheet NPV. For a more complete picture, sensitivity has been carried out on these figures.

<sup>1</sup> For instance, there may be scale efficiencies in loading vehicles where more than one material is collected. This would mean the costs currently being modelled are too high.

Aluminium has maintained a fairly stable, high price, however the price for plastic has been more volatile over the past few years. The 5 year analysis covers the length of a business cycle, which means that the *average material price* over the course of a business cycle is the price of importance.

This switching point analysis calculates the drop in material price that would be required in order to change the sign of the *overall NPV* – i.e. in order for the NPV to change from positive to negative or vice versa, keeping everything else constant. For aluminium, the average material price (over the course of the 5 year period) would have to drop by 380% from current levels to switch the sign of the NPV (this would mean a *negative* price paid for this material, which is unrealistic). For plastic, average material revenue would have to drop to ~ £115 per tonne to switch the sign of the NPV (i.e. a drop of **61%** from current levels).

#### Collection costs

The NPV is also sensitive to the collection costs, (particularly of plastic, where the highest tonnages are involved). The collection costs for aluminium would have to increase to £2188/tonne to switch the sign of the NPV. This is considered an unrealistic level of costs.

The switching point for plastics is a lot lower, requiring only a **46%** increase in collection costs for initial years and **19%** increase in following years (where more expensive collection methods have been assumed). It should be highlighted again that a conservative estimate has already been modelled for plastic, (taking costs which are potentially higher than those which will be observed), however, this switching point sensitivity is fairly close and should be noted.

### **DIRECT COST TO BUSINESS – OPTION 2a**

Direct costs to business is calculated in two different ways (see Box 2): the increase in PRNs and a 'bottom-up' estimate of the overall benefits and costs of recycling.

The summary sheet shows the PRN revenues, which is the closest estimate of costs to business which can be *directly attributed to this intervention* – the PRN costs to obligated businesses and the PRN revenue to reprocessors. However it is important to emphasise is the imperfect market for waste management: there is a long 'chain' of waste management, with rigidities in contracts. The PRN price only reflects on the incentive required at the end of the chain but we can't account for other costs/benefits which are held by other business throughout the chain. The bottom-up costs attempt to demonstrate the overall costs and benefits of which a proportion may fall to business as a result of the intervention.

#### Direct cost to obligated business: Increase in PRNs

The analysis assumed PRN prices increase due to higher targets (as shown in annex 3 – headline assumptions). This means that the additional PRN costs include the PRN paid on the tonnages of plastic and aluminium beyond the EU minimum as well as the change in the PRN price for the tonnes up to the EU minimum. Note that this revenue flows straight to reprocessors (business) to finance the additional costs of recycling compared to the next alternative.

The PV of this additional PRN revenue is £58.0m over the 5 years. See annexes for a yearly breakdown, separated by material. This is a cost of £58.0m to obligated business and handlers (over the £2million de minimus threshold). Since this PRN revenue is a direct gain to recycling reprocessors, there is a business benefit of £58.0m over the 5 years to reprocessors. The Equivalent Annual Net Cost to Business is **£11.7m** (with **£11.7m** for the equivalent benefit). The net effect of this to business overall is **£0m**, which involves a redistribution from obligated business (i.e. large obligated business and handlers) to reprocessors.

#### Direct cost to obligated business: 'Bottom-up'

An alternative method is to calculate the costs to business, as described under option 1. The net effect over 5 years is a benefit of £76m (with additional private benefits of £43.6m avoided landfill tax). When avoided landfill tax is included, this is an annual private benefit to business of £27.9m.

### One In One Out

Given that PRN revenue has been classified by ONS as a tax rather than a regulatory cost, it should not come with the scope of One In, One-Out.

## **Option 2b: Keep all statutory targets to the EU minimum until 2017, and negotiate responsibility deals to recycle more plastic and aluminium packaging.**

This would achieve our EU targets, but any additional recycling would be subject to the level of interest in a responsibility deal among obligated businesses. The 5% and 10% annual increases, modelled below, have been chosen as realistic levels which could be proposed for a voluntary responsibility deal.

The levels of recycling outlined above, in 2a are not likely to be met, since the external benefits will not be included in the private costs and benefits faced by the business (as they would be under statutory targets and the PRN system).

Responsibility deals for packaging recycling could see one or a group of packaging producers striking a funding arrangement to improve recycling rates with selected local authorities. However, once the statutory obligations have been met, businesses no longer need to buy PRNs for additional recycling achieved either under business as usual or when partaking in a producer responsibility deal.

Costs and benefits are calculated relative to the EU minimum (Option 1). To be comparable across all options, the summary sheet displays the figures below *plus* the costs and benefits for option 1. For the benefits, the unit values are taken from annex 3: "headline assumptions".

### **Box 5: How much additional recycled tonnage would Voluntary Responsibility Deals deliver?**

For the current level of infrastructure in place, once a given amount of recyclables is collected and sorted from the waste stream, the cost of then sending this to landfill is higher than to have it reprocessed or sent to an MRF. The WRAP Gate Fees 2009 report states gate fees of £24 per tonne for an MRF site versus £22 plus landfill tax (£56 increasing to £80) for landfill.

However to introduce a responsibility deal and ensure businesses meet their agreed targets, a sufficient level of recyclables needs to be captured from either the household or commercial waste stream.

Without intervention, if the additional material is being accessed from the household waste stream, Local Authorities would not necessarily bear the additional direct cost of collection and sorting without any financial incentive and thus businesses would need to intervene. How much they are willing to subsidise depends on two main factors.

#### **1) The additional costs of collection**

The additional costs of recycling for the increase in tonnage would depend on; how much is being currently captured and recycled from the waste stream and whether further collection infrastructure would be needed as modelled in Option 2 for the higher targets.

The costs used in the analysis are averages which only vary by scale or when further infrastructure is needed. As mentioned in the 'rationale for targets', a typical assumption however is that the marginal costs will rise as the use of a particular treatment increases. So as the level of recycling increases, less good materials is likely to be sourced, requiring more sorting and higher collection costs. In a producer responsibility deal, businesses would typically cover the difference in costs local authorities would pay to collect the waste as recyclables rather than within the residual waste stream.

#### **2) The additional benefits from partaking in the scheme**

The main benefits of partaking in a voluntary responsibility deal for producers would be that the involvement in a RD will enable a company to differentiate itself through its brand and positive relationship between corporate social performance and corporate financial performance.

Recycling activity from a responsibility deal is not likely to change the price for recycled materials, since virgin and recycled materials are complimentary goods and the prices are pegged. This means that the business is unlikely to benefit from reduced costs for materials.

In conclusion, *the level of recycling which would be delivered by voluntary responsibility deals would thus be where the net additional cost of collecting and sorting the additional tonne of waste would be equal to the increase in private benefits delivered from that tonne.* Given that the benefits are non-monetised and information on collection costs is sparse, this reflects the theoretical scenario.

## **Benefits of Option 2b**

### Material revenues

Based on the material prices set out in the headline assumptions section, the additional revenues for the higher volumes under this option would be a total of **£28** for a 5% increase per annum and **£56m** for a 10% increase per annum. Additional tonnages are table A36, and a breakdown by material and year is in Annex 5, table A37.

### Greenhouse Gas (GHG) Emissions

The avoided emissions and value of the benefits in greenhouse emission reductions are as set out using the additional volumes in Table 19 and the methodology outlined in the section “headline assumptions”. For the 5% and 10% increase per annum, these total 0.25 m tonnes and 0.5m tonnes co2 over the 5 year period, with an associated present value of **£3.7m** and **£7.7m** respectively. These are broken down in Annex 5, table A38.

### Other Benefits: Non monetised private benefits

Examples of private benefits are:

- Improved recruitment and retention of staff as employees feel a stronger identification with the company and its role in society.
- Possible perceived lower level of risk related to environmental accidents and consequent harm to reputation.
- Involvement in a RD will enable a company to differentiate itself through its brand.
- Positive relationship between corporate social performance and corporate financial performance.

## **Costs of Option 2b – Voluntary Responsibility Deals**

Under this option, given that the additional tonnage recycled is marginal, the analysis continues to use the cost figures for the EU minimum.

### Collection Costs

There will be additional collection costs with a present value of **£6.8m** and **£13.6m** over the 5 year period, for the 5% and 10% increase levels. These are broken down in Annex 5, table A39. These costs will only fall on packaging producers who choose to take part in the scheme.

### Resource savings

Resource savings are estimated to total **£4.1m** and **£8.2m** present value over the 5 year period for the 5% and 10% increase. These are broken down in the annexes.

The net costs of recycling collection are therefore £2.7m to £5.4m.

### Fixed costs: Administration of scheme

In terms of costs, there are the administrative and enforcement costs of setting up and monitoring/administering any voluntary responsibility scheme. Taking information from WRAP’s Courtauld campaign, an annual cost of £3.5million is used.

## Summary of Costs and Benefits

These net costs have been measured against a base case modelling recycled tonnages in the absence of targets.

Table 14a: Summary NPV for EU Min plus 5% voluntary increase (£m)

Cost / benefit to...	Cost / Benefit	2013	2014	2015	2016	2017	Total
Theoretically covered by packaging producers: all contribute to 'net additional costs of recycling'	Collection costs	-1.38	-1.36	-1.34	-1.36	-1.35	-6.79
	Revenues	5.75	5.66	5.58	5.61	5.53	28.1
	Resource Savings (reduced mixed waste)	0.83	0.82	0.81	0.83	0.82	4.12
Society	Carbon Benefits	0.7	0.7	0.7	0.8	0.8	3.7
Delivery bodies	Cost of delivery / administration	-3.27	-3.16	-3.05	-2.95	-2.85	-15.27
	<b>Total NPV</b>	<b>2.63</b>	<b>2.66</b>	<b>2.7</b>	<b>2.93</b>	<b>2.95</b>	<b>13.87</b>

\* One off campaign costs added to 2013

Table 14b: Summary NPV for EU Min plus 10% voluntary increase (£m)

Cost / benefit to...	Cost / Benefit	2013	2014	2015	2016	2017	Total
Theoretically covered by packaging producers: all contribute to 'net additional costs of recycling'	Collection costs*	-2.75	-2.72	-2.69	-2.73	-2.69	-13.58
	Revenues	11.49	11.32	11.16	11.21	11.05	56.2
	Resource Savings (reduced mixed waste)	1.67	1.65	1.63	1.65	1.63	8.24
Society	Carbon Benefits	1.5	1.6	1.5	1.6	1.5	7.7
Delivery bodies	Cost of delivery / administration	-3.27	-3.16	-3.05	-2.95	-2.85	-15.27
	<b>Total NPV</b>	<b>8.64</b>	<b>8.69</b>	<b>8.55</b>	<b>8.78</b>	<b>8.64</b>	<b>43.3</b>

## RISKS

**Participation rate:** There is huge uncertainty around the scope for joining a voluntary responsibility deal without higher targets. Local authorities will have little incentive to increase their collection costs and capture more recyclable without any financial incentive. Depending on the marginal costs of collecting and sorting more of the packaging from the waste stream, the marginal benefits to business may not be enough to fund this additional cost.

**Measurability of targets:** The credibility of voluntary responsibility deals is susceptible to the difficulty that the targets achieve to no more than business – as – usual. Given that businesses only pay for PRN's to prove they have met their individual statutory target, any recycling achieved over and above this is currently not measured.

**Concentration of costs:** Whether a voluntary scheme alone would be able to achieve the necessary diversion of packaging wastes at comparable cost to the above options is not proven. Furthermore, only a certain percentage of those obligated businesses will commit to a responsibility deal therefore the costs accrue to fewer participants.

**Market failures:** In theory, incentives should be passed through the chain between obligated parties, collectors and waste producers, in order to encourage the necessary sorting from waste producers to meet the targets. However, in practice there may be reasons – contractual rigidities, information failures – that mean that the necessary signals are not passed on. Therefore PRDs could become more expensive than the alternative means of delivering additional diversion.



## **DIRECT COST TO BUSINESS – OPTION 2b**

### **Tonnages above the EU minimum:**

There are no additional PRN revenues which have to be paid under this voluntary option.

Given that joining a responsibility deal is voluntary, it is assumed that the additional private costs of collection will be balanced with private benefits to the business of equal value.

Costs of collection have a *net* value between £2.7m and £5.4m, which is calculated as **£0.8m** Equivalent Annual Cost to Business.

In terms of benefits, businesses are likely to gain from the material revenue of the recyclates, but not *all* of the value, due to recycling collection contracts. There are also likely to be private benefits to business in the form of improved reputation, staff retention, etc, (examples in 'other benefits', above). It is assumed that these private business benefits will be at least equal to the likely costs to business, so the benefits are estimated at **£0.8m** (equivalent annual).

The net costs of this option are therefore **£0m**.

## Option 3a - Increase recycling targets for plastic, aluminium and steel and split the glass recycling target (backed by responsibility deals)

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As per option 2a, higher volumes will lead to higher costs as more, harder to obtain material is collected and sorted. **As described previously, the higher costs of recycling this material will either be indirectly paid for by producers through the PRN system, or directly paid for through arrangements with local authorities, which has taken part in the past. See box 3.**

The relevant costs and benefits which contribute towards the 'additional costs of recycling', (paid for by obligated business) is labelled as such. Box 2 describes why the bottom up calculations here will not match the actual PRN revenues paid for by producers.

Costs and benefits are calculated relative to the EU minimum (Option 1). To be comparable across all options, the summary sheet displays the figures below *plus* the costs and benefits for option 1.

As per option 2a there are higher tonnages of key materials (this time also including steel and a split glass target) and there are higher *overall* tonnages of recycling. However the quantities of 'general recycling' (the difference between a producer's material specific target and the overall recycling target) are lower than the EU minimum, since the overall recycling levels are increasing at a slower rate than the material specific targets. Recycling and recovery tonnages *overall* increase.

The figures below model the impacts of this decrease in 'general recycling'. However, it may be the case that these reductions in 'general recycling' are not observed - even though the statutory tonnages will decrease, the incentives in the paper and wood recycling market may mean that this drop does not take place – recycled paper is a viable commodities in the absence of regulation.

### Benefits of Option 3a – Higher Targets for plastic, aluminium and steel, split glass

#### Material revenues ('Additional Costs of Recycling' Calculation)

Based on the materials values set out in Table 20, the additional revenues for the higher volumes have a PV of £61m for aluminium and £396m for plastic and £11m for steel. The split target of glass provides an additional £3.9m in material revenues, since the price for separated colour glass is higher than that of mixed glass. There will be a reduction in the material revenues from general recycling, with a PV of -£20.7m.

#### Greenhouse Gas (GHG) Emissions (Societal Benefit)

The additional tonnages of plastic have a carbon value of £38m, aluminium £13m and steel £2.5m (each present value for the £5 year period). Splitting the glass target leads to GHG benefits of £0.8m PV over the 5 years. The reduction in general recycling reduces carbon savings compared to the EU baseline, with a value of -£24m: an overall total PV of **£30.5m**.

The avoided emissions and value of the benefits in greenhouse emission reductions are as set out in the methodology outlined under the section "headline assumptions".

#### Other Benefits

Higher targets could help the UK develop its recycling markets by giving certainty for investors developing collection, reprocessing and treatment infrastructure. This will enable the UK to build expertise in such activities. It is particularly pertinent in relation to plastics where the cost of diverting additional material could be potentially be greater than the benefits, unless technology improves and costs fall substantially.

Statutory targets maintain a level playing field between signatories and non-signatories to responsibility deals. Without the spur of targets, participation in responsibility deals could not be secured, whereas the combination would allow leveraging and pooling of resources across a sector.

Increased collection and recycling of packaging waste could also have additional social benefits by acting as a driver for collection of other waste streams. Finally, increased recovery and recycling of packaging waste could have amenity benefits by contributing to a decrease in packaging litter.

## **Costs of Option 3a – Higher Targets for plastic, aluminium, steel and split glass**

Under this option, the main requirement is to improve waste collection as, for most materials, there appears to be sufficient reprocessing capacity. The detailed costs for greater collection vary by material. Our initial views on these likely costs have been drawn from existing research and modelling around which there is a good deal of uncertainty and many assumptions. Ranges for the costs where appropriate have been used.

### Collection Costs ('Additional costs of recycling' calculation)

As above, these costs would be directly paid by LAs and business but indirectly funded through the PRN system, or directly funded through responsibility deals.

It is assumed that there are no significant jumps in marginal collection costs for **aluminium**, so these costs are as above (in option 2a). For **plastics**, it should be possible to achieve the targets by increasing the participation and yields from existing bottle and mixed plastics household collections and the levels from C&I source. However, we have again taken a conservative approach and assumes that significant collection infrastructure is required for household collection. We have again used the average costs for adding bottle collection for additional volumes in the period to 2014/15 and average costs of adding bottles and film for the period thereafter.

For **steel**, Industry information predicts that new technology coming on stream, in combination with joint working with local authorities (to improve collection from households) should meet the increased demands for packaging recycling. Based on joint work with around 50-75 Local Authorities, and assuming the upfront costs to improvements to collection are effective for around 10 years, the expected cost for this element of the change to collection is likely to be in the range of £30-£45 per tonne per annum. The expected weighted average cost for additional steel packaging is therefore expected to be around **£25** per tonne per annum.

For **glass**, Eunomia (2011) collection costs for commercial collection are £36 for a mixed collection, before (revenue from material sales). WRAP's figures for kerbside collections are £115 / tonne (assuming a 50:50 rural urban split) and Eunomia modelling for household comingled collections are £103 (before revenue from material sales). A 45:55 household:C&I split is again taken for calculating costs. For household costs, it is assumed that  $\frac{3}{4}$  of glass is collected from kerbside and  $\frac{1}{4}$  from mixed collection. In the absence of more detailed information, **C&I** collection costs are assumed to be similar, since a similar collection process will be required. It is assumed that  $\frac{3}{4}$  will be collected with kerbside costs (as per household kerbside) and  $\frac{1}{4}$  collected with costs of mixed collection (as per Eunomia C&I costs above). This leads to a cost for household collection of £112 and a cost for C&I collection of £95.

For glass with an end use of aggregates, costs of comingled collection are taken for household and C&I collection, both using Eunomia figures of £36 and £103 respectively.

In aggregate, these collection costs are £5.5m, £1.5m and £285m for aluminium, steel and plastic respectively (all 5 year PV). For glass, the additional collection costs required for a switch to greater proportions of remelt are assumed to be around £6m. The reduction in 'general recycling' collection is estimated at £26.1m, which leads to a net total of £271.9m including the split glass target and £266m without.

### Resource savings ('Additional costs of collection' calculation)

These additional costs of collection and sorting will be offset by a reduction in the resource costs of mixed waste, i.e. the costs of mixed waste collection and the gate fees of landfill. As explained above, this does not include landfill tax, which is a transfer payment.

These additional costs of collection and sorting will be offset by a reduction in the resource costs of mixed waste, i.e. the costs of mixed waste collection and the gate fees of landfill. As explained above, this does not include landfill tax, which is a transfer payment.

The resource savings from reduced mixed waste collection are around **£34.7m**. The resource savings from a reduction in disposal (resource costs) are around **£18.2m**. Both are present value over the 5 year period and there is no difference with the split in the glass targets, since the overall tonnage of recycled glass remains the same.

See appendix 5 for a breakdown.

### IT / Database costs

The split glass target will be achieved by having separate targets for aggregates and re-melt (with separate PRN notes). There will be IT and database costs associated with this split. The Environment Agency administer the PRN scheme and have estimated a transition cost of £50k-£100k (which would take place in the 1<sup>st</sup> year). The average of these is a present value of **£0.07m**.

## Summary of Costs and Benefits (£m)

Table 15a: Summary table – additional costs and benefits, compared to EU min (£m) – with split glass target

Cost / benefit to...	Cost / Benefit	2013	2014	2015	2016	2017	Total
Theoretically covered by obligated business: all contribute to 'net additional costs of recycling'	Collection costs*	-16.23	-32.38	-55.38	-74.42	-93.47	-271.9
	Revenues	31.58	62	88.72	117.69	145.8	445.81
	Resource Savings (reduced mixed waste)	4.84	9.12	8.89	13.02	16.94	52.81
Society	Carbon Benefits	2.8	5.4	4.6	7.5	9.9	30.5
Delivery bodies	IT / Database costs	-0.07					-0.07
	<b>Total NPV</b>	<b>22.9</b>	<b>44.1</b>	<b>46.8</b>	<b>63.8</b>	<b>79.2</b>	<b>256.8</b>

\* Average collection costs of high and low scenario

## RISKS

As above (Option 2a).

## SENSITIVITY ANALYSIS

As above, the NPV is highly dependent on the material prices and the collection costs of the materials targetted (plastic, aluminium, steel, glass).

As explained above, material prices are volatile, however the price of importance is the *average* price over a business cycle, since the 5 year time period of analysis is likely to follow the length of a business cycle.

For **plastics**, a drop in price to £93/tonne (a drop of 68% from current levels) would switch the sign of the NPV to negative. Since the material price for plastic has not fallen below £112 in the past number of years, this is an unlikely drop for the *average* material price over a business cycle.

A fairly large increase in collection costs would be required to switch the overall balance: an increase in collection costs of 87% in the initial years and 53% in the final years (where higher costs are assumed) is necessary to change the sign of the overall NPV. Although we have attempted to be conservative in accounting costs of collection, there is limited evidence available and this sensitivity may be realistic for later years.

For **aluminium**, and all other materials, a decrease in material prices or an increase in costs would have to be very significant in order to switch the NPV of the whole option.

However, it may be the case that *aspects* of the option have a net negative or positive effect, depending on the collection costs for each: for example, the additional tonnages of one of the materials may have a net negative effect, but this will not impact the overall direct of the NPV. Currently as modelled, each additional material contributes a positive NPV to the overall total.

### **DIRECT COST TO BUSINESS – OPTION 3a**

Direct costs to business is calculated in two different ways (see Box 2): the increase in PRNs and a 'bottom-up' estimate of the overall benefits and costs of recycling.

The summary sheet shows the PRN revenues, which is the closest estimate of costs to business which can be *directly attributed to this intervention* – the costs to obligated business and the revenue to reprocessors. However it is important to emphasise is the imperfect market for waste management: there is a long 'chain' of waste management, with rigidities in contracts. The PRN price only reflects on the incentive required at the end of the chain but we can't account for other costs/benefits which are held by other business throughout the chain. The bottom-up costs attempt to demonstrate the overall costs and benefits of which a proportion may fall to business as a result of the intervention.

#### Direct cost to obligated business: PRN revenues

The additional PRN revenues have a PV of £178.3m over the 5 years. As explained above in 2a, this incorporates the increase in PRN prices on tonnages up to the EU minimum as well as the full PRN price on the additional tonnages.

Note that this revenue flows straight to reprocessors (business) to finance the additional costs of recycling compared to the next alternative. See annexes for a yearly breakdown, separated by material.

Over the 5 year period, this is therefore a cost of £175.5m to packaging producers and handlers (those over the £2million de minimus threshold). Since this PRN revenue is a direct gain to recycling reprocessors, there is a business benefit of £175.5m over the 5 years to reprocessors. The Equivalent Annual Net Cost to Business is **£35.4m** (with **£35.4m** for the equivalent benefit). The net effect of this to business overall is **£0m**, which involves a redistribution from obligated business (i.e. large packaging producers and handlers) to reprocessors.

#### Direct cost to obligated business: 'Bottom-up'

An alternative method is to calculate the costs to business, as described under option 1. The net effect over 5 years is a benefit of £227m (with additional private benefits of £72.2m avoided landfill tax). When avoided landfill tax is included, this is an annual private benefit to business of £69.9m.

### One In One Out

Given that PRN revenue has been classified by ONS as a tax rather than a regulatory cost, it should not come with the scope of One In, One-Out.

## **Option 3b: Keep all statutory targets to the EU minimum until 2017, and negotiate responsibility deals to recycle more plastic, aluminium and steel metal packaging.**

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This would achieve our EU targets, but any additional recycling would be subject to the level of interest in a responsibility deal among obligated businesses. The 5% and 10% annual increases, modelled below, have been chosen as realistic levels which could be proposed for a voluntary responsibility deal.

The levels of recycling outlined above, in 2a are not likely to be met, since the external benefits will not be included in the private costs and benefits faced by the business (as they would be under statutory targets and the PRN system).

Details of the modelled scheme are as per option 2b, with the only difference being the inclusion of steel.

Voluntary responsibility deals with higher levels of recycling have *not* been modelled for option 3, since the levels of recycling under option 2b (5% annual increase and 10% annual increase) are considered to be a reasonable expectation for a voluntary scheme.

Costs and benefits are calculated relative to the EU minimum (Option 1). To be comparable across all options, the summary sheet displays the figures below *plus* the costs and benefits for option 1.

### **Benefits of Option 3b – Voluntary Responsibility Deals**

#### Material revenues

The inclusion of steel in this voluntary responsibility deal leads to an additional material revenue of £7.8m for the 5% PRD and £15.6m for the 10% PRD, a total of **£35.9m** and **£71.8m** respectively.

#### Greenhouse Gas (GHG) Emissions

The additional benefit of steel is £1.8m for 5% levels and £3.6m for 10% levels, totalling **£5.6m** and **£11.2m** for the 2 different levels.

#### Other Benefits

As above (2b)

### **Costs of Option 3b – Voluntary Responsibility Deals**

Under this option, given that the additional tonnage recycled is marginal, the analysis continues to use the cost figures for the EU minimum.

#### Collection Costs

For steel, there will be additional collection costs with a present value of £4.3m and £8.5m over the 5 year period, for the 5% and 10% increase levels. This leads to total collection costs of **£11.1m** and **£22.1m** respectively.

#### Resource savings

Resource savings are estimated to total **£6.7m** and **£13.4m** present value over the 5 year period for the 5% and 10% increase. These are broken down in the annexes.

The resulting net costs of additional recycling are estimated at £4.4m and £8.7m for the 5% and 10% levels of annual increase in recycling.

### Fixed costs: Administration of scheme

In terms of costs, there are the administrative and enforcement costs of setting up and monitoring/administering any voluntary responsibility scheme. Taking information from WRAP's Courtauld campaign, an annual cost of £3.5million is used.

### Summary of Costs and Benefits

These net costs have been measured against a base case modelling recycled tonnages in the absence of targets.

Table 16a: Summary NPV for EU Min plus PRDs – 5% scheme (£m)

Cost / benefit to...	Cost / Benefit	2013	2014	2015	2016	2017	Total
Theoretically covered by packaging producers & handlers: all contribute to 'net additional costs of recycling'	Collection costs	-2.30	-2.24	-2.19	-2.18	-2.13	-11.05
	Revenues	7.43	7.28	7.14	7.10	6.96	35.92
	Resource Savings (reduced mixed waste)	1.39	1.36	1.33	1.32	1.29	6.70
Society	Carbon Benefits	1.1	1.1	1.1	1.2	1.1	5.6
Delivery Bodies	Scheme delivery / Administration	-3.27	-3.16	-3.05	-2.95	-2.85	-15.27
	<b>Total NPV</b>	<b>4.35</b>	<b>4.34</b>	<b>4.33</b>	<b>4.49</b>	<b>4.37</b>	<b>21.9</b>

Table 16b: Summary NPV for EU Min plus PRDs – 10% scheme (£m)

Cost / benefit to...	Cost / Benefit	2013	2014	2015	2016	2017	Total
Theoretically covered by packaging producers & handlers: all contribute to 'net additional costs of recycling'	Collection costs	-4.59	-4.49	-4.39	-4.36	-4.27	-22.09
	Revenues	14.86	14.56	14.27	14.21	13.93	71.8
	Resource Savings (reduced mixed waste)	2.79	2.72	2.66	2.65	2.59	13.40
Society	Carbon Benefits	2.2	2.3	2.2	2.3	2.2	11.2
Delivery Bodies	Scheme delivery / Administration	-3.27	-3.16	-3.05	-2.95	-2.85	-15.27
	<b>Total NPV</b>	<b>12.0</b>	<b>11.9</b>	<b>11.7</b>	<b>11.9</b>	<b>11.6</b>	<b>59.0</b>

## RISKS

As above (2b)

### DIRECT COST TO BUSINESS – OPTION 3b

#### Tonnages above the EU minimum:

There are no additional PRN revenues which have to be paid under this voluntary option.

Given that joining a responsibility deal is voluntary, it is assumed that the additional private costs of collection will be balanced with private benefits to the business of equal value.

Costs of collection have a *net* value between £4.4m and £8.7m, which is calculated as **£1.3m** Equivalent Annual Cost to Business.

In terms of benefits, businesses are likely to gain from the material revenue of the recyclates, but not *all* of the value, due to recycling collection contracts. There are also likely to be private benefits to business in the form of improved reputation, staff retention, etc, (examples in 'other benefits', option 2b). It is

assumed that these private business benefits will be at least equal to the likely costs to business, so the benefits are estimated at **£1.3m** (equivalent annual).  
The net costs of this option are therefore **£0m**.



## Option 3c: Set recycling targets to meet the EU minimum and introduce a deposit refund system (DRS) for drinks containers

Taking the net benefits from EU minimum (Option 1) the following cost benefit analysis will consider the additional impact of a parallel DRS system in which the kerbside recycling scheme continues to be provided alongside the DRS scheme.

All the following information is taken from the report “Have we got the bottle: Implementing a deposit refund scheme in the UK” conducted by Eunomia and commissioned by the Campaign to Protect Rural England. This means that the costs and benefits follow a slightly different structure to those above. Where possible, for each of the main components, the methodology and headline assumptions are highlighted.

*There is not currently a specific policy option for the implementation of a DRS in the UK. The section below outlines how a typical DRS could operate in England and presents the figures from the report with greater detail and clarity. However, should this be considered a potential option requiring further examination, we would seek further information and opinion during consultation on any further work required to inform whether this can indeed be considered a viable option.*

### Benefits of Option 3c- DRS

#### Environmental Effects

The main environmental impacts associated with the introduction of a DRS will occur from changes in emissions associated with the changes in disposal of beverage containers (to recycling) and changes in the collection and transportation of containers to recyclers.

**Overall Environmental emission savings:** Using a similar approach to the cost-benefit analysis work undertaken by Eunomia on the potential impacts of landfill bans across the UK, two main impacts were monetised - GHG emissions and air quality impacts. The inclusion of air quality impacts is a deviation from the environmental analysis presented for the options listed above where, due to the uncertainty in the balance of different treatment options, only GHG emissions have been monetised. Local environmental quality has only been considered in non-monetised costs and benefits. The inclusion of air quality impacts in the Eunomia NPV does not dramatically alter the comparison with other options, or the sign of the NPV.

#### **Environmental benefit from containers being diverted from disposal to recycling:**

Eunomia models annual recycling benefits of £84m (including air quality and GHG emissions), plus £6m savings due to diverting more containers from disposal, i.e. an annual total of £90m (**£393m PV over the 5 years**). This modelling assumes that 75% of packaging waste is diverted from landfill and 25% is diverted from energy from waste (incineration). The environmental benefit from diverting additional containers from landfill is assumed to be zero, as the landfill externality is already included in the landfill tax, which forms part of the financial impact calculations of the DRS. This means that only the air quality and GHG benefits of the 25% *diverted from EFW* are included in the Eunomia analysis.

This is different from the modelling for the rest of the options above. The environmental (carbon) calculations of the other options i) assume that additional recycling is diverted from landfill *only*, (since additional recycling is most likely to be diverted from landfill rather than EfW) and ii) the carbon benefit of the tonnes diverted from landfill *are* included, since landfill tax is a transfer payment and is not included in social cost benefit analysis. One last difference is the carbon values used: Eunomia models the 2020 carbon values whereas the method for other options uses the traded and untraded carbon values for 2013-2017.

If the environmental benefits were calculated consistently with the other options, (assuming that all tonnes are diverted to recycling from landfill and multiplying by the traded and untraded carbon factors), there are carbon benefits over the 5 years of **£120m**. See annex 5 for all tables.

This is smaller than the £393m present value over the 5 years estimated by Eunomia for the environmental impacts of diverting containers from disposal to recycling, due to the differences in

assumptions of EFW and Air Quality benefits and choice of carbon value. Since this does not change the scale or the size of the NPV of options, we have kept Eunomia’s detailed modelling. However, calculating the benefits consistently with the options would *reduce* the benefits of this option, i.e. would result in a lower NPV.

**Cost of collection of beverage containers:** The report calculates the additional environmental costs associated with having to transport the beverage containers across large distances to reach reprocessing facilities and from additional consumer journeys required to return empty containers to collection points. The additional distance travelled is estimated to be 409,104km per annum. The total environmental damages from the increase in transportation requirement is calculated at £25million in present value terms (based on Euro 5 emissions limits for HGVs).

**Disamenity costs of litter:** To stay consistent with the other options, the disamenity costs of litter have not been factored into the final NPV. Quantification is notoriously difficult. The report estimates benefits of £1,248m from a 20% reduction in litter however this figure must be treated with caution. Given the lack of evidence in monetising this impact, Eunomia used research from Australia that indicated that households were willing to pay AU\$4.15 per 1% reduction in litter. Multiplying this by 26million UK households obtained the final figure. The limitations of this methodology have been outlined in the “risks section”.

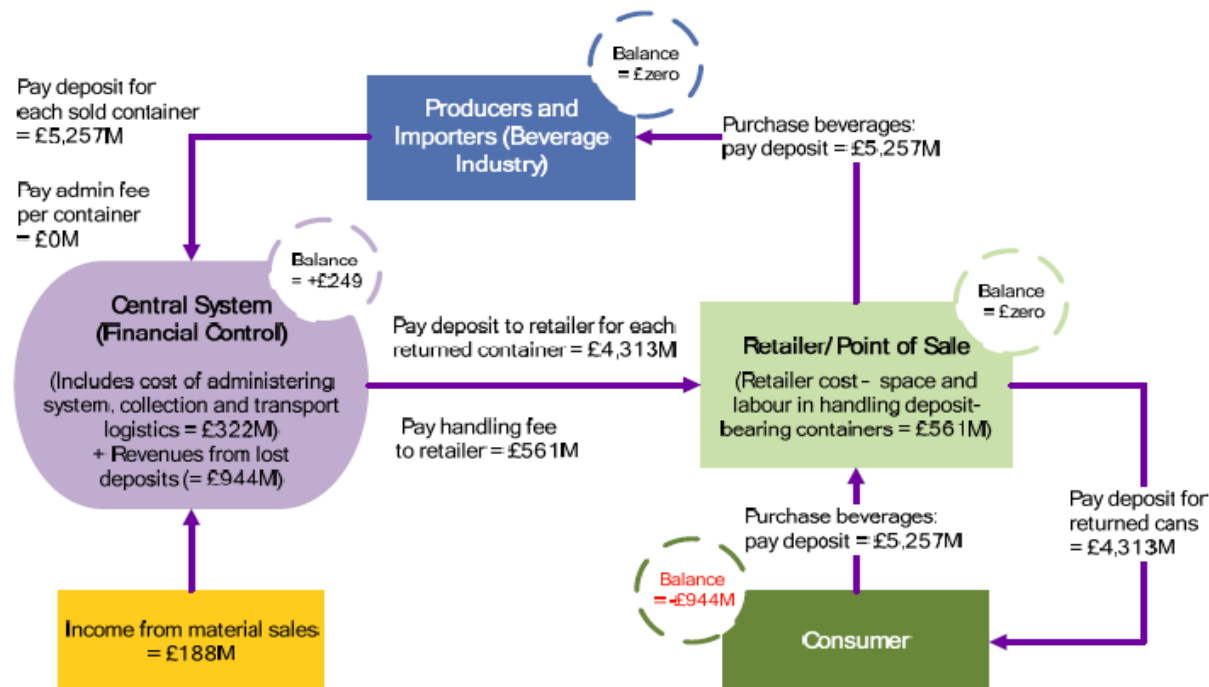
### Costs of Option 3c – DRS

It is important to note that various stakeholders are involved in managing the material flows of beverages, deposit payments, other finances and sales or container return data. Figure 1 begins by showing diagrammatically an overview of the key material and finance flows for a UK based DRS model. For a detailed description please see Annex 2.

Figure 1: Cash Flows in the Deposit Refund System – Parallel Scenario, £million

80% overall return rate, £millions 2010 Real Terms

Source: Eunomia



#### Financial Impacts of DRS on Producers

The Eunomia report calculates surplus revenue of £249million to producers from implementing the DRS. This is based on the breakdown in costs given in Table 19. The admin costs refer to the on-going costs associated with administration of the central system. The retailer handling fee is the cost of handling the containers at retail outlets and the material revenue is dependent upon the additional tonnage diverted from the residual waste stream. For a full assessment of these costs please see Annex 6.

Table 19: Breakdown of Costs to Producers (£m)

Return rate (%)	Deposit un-reclaimed (£)	Admin costs	Retailer handling fee	Material Sales Values	NET COST
82	-£944	£322	£561	-£188	<b>-£249</b>

Note positive figures imply costs, negative figures imply savings

### Financial Impacts of DRS on Consumers (Unclaimed Deposits)

For the parallel DRS, the current kerbside system remains in operation for beverage containers alongside the DRS. In the modelling a return rate through the DRS of 80% was estimated, with the remaining consumers continuing to place containers in their household recycling or refuse collection, even though they have paid the deposit, on the premise that the convenience factor outweighs the financial loss of the deposit. In a full cost-benefit analysis, those unclaimed deposits that the consumer 'loses' as a result of not returning their containers in order to collect their deposit can be considered a cost to the consumer. Taking figures from Table 24 and 25, the values are as follows.

Table 20: Number of Unclaimed Deposits for parallel DRS

	No. of containers (millions)	Unclaimed deposits (£m)
Total	5,013	<b>£944</b>

### Financial Impacts of DRS on Local Authorities (Collection and Treatment/Disposal)

The headline assumptions section (Annex 4) models the change in waste mass flows per material from implementing the parallel DRS in the UK. This provides savings to local authorities as illustrated in Table 21 and as stated in the report.

Table 21: Split in Local Authorities' Savings (£m) per annum

Parallel	% Split	LA
Change in household recycling collection costs	81%	£115
Change in bring back costs	2%	£3
Change in HWRC costs	1%	£1
Change in litter collection costs*	17%	£24
<b>Total</b>	<b>100%</b>	<b>£143</b>

\* Savings from avoided street sweeping and collection from litter bins

### Change in Cost of PRNs (conservative estimate)

The **£30m** savings estimated by Eunomia due to the increase in recycling through the DRS is determined by looking at PRN and PERN sales in past years. Eunomia expects that the "deposit scheme would reduce the price of PRNs against the counterfactual levels".

### Financial Impacts of DRS on Commercial Enterprises (Collection and Treatment/Disposal – to commerce)

The report calculates the costs of commercial waste collection (and therefore the costs avoided with a reduction in demand for commercial waste collection services) for each material as detailed in Table 22. There is also a further saving associated with the reduction in the amount of material requiring disposal.

Table 22: Reduced Demand for Collection Services (£m)

Material	Saving per tonne – Collection (£)	Saving per tonne – Disposal (£)	Waste Diverted, kt	Total Saving
Metals / Plastics	£136	N/A	-44	£6

Glass	£41	N/A	-394	£16
Refuse	£35	£100	-89	£12
Total				<b>£34</b>

Source: Eunomia

The total savings associated with commercial waste collections are estimated to be £34m per annum in present value terms. This is based on 553kt of waste being diverted out of the commercial waste stream.

An additional cost to commerce of **£19m** is also factored into the overall cost-benefit analysis of the DRS, to account for the additional costs to those retail outlets which are assumed to fall outside the DRS. The net balance to commerce is a saving of £15m per annum.

### Summary Table – Costs and Benefits of a DRS

Table 23: Summary Table excluding Litter Disamenity (£m)

	Cost or Benefit (-ve is a cost), in £m
<b>Financial Effects</b>	
Deposit Refund System (to Producers)	£249
Collection and Treatment/Disposal (to Local Authorities)	£143
Change in Cost of PRNs (conservative estimate)	£30
Collection and Treatment/Disposal (to Commerce)	£15
Consumers (Unclaimed Deposits)	<b>-£944</b>
Net Financial Costs	<b>-£508</b>
<b>Environmental Effects</b>	
Excluding disamenity	£65
<b>Total Benefit to Society</b>	
Excluding disamenity	<b>-£443</b>

### Enforcement costs

For any system, there will be associated monitoring and enforcement costs. The introduction of a new system which would bring many operators within the scope of waste regulation (outlets receiving waste containers as part of the return may require waste permits) will have an impact on the monitoring and enforcement activities of the environment agencies.

It is likely that only the larger stores (having to store more than 50 cubic metres of waste) will have to register with the Environment Agency (due to existing exemption criteria). This means that any additional burdens are likely to be fairly small, but in the absence of reliable figures, this is included in 'non monetised costs'.

### One off Costs (producers and retailers)

The summary of costs and benefits detailed above does not include the one-off costs that would be incurred in order to set up the DRS. The one-off costs stated in the report (page 78) include a central system cost of £32m (to be met by joining fees from producers and retailers), plus label cost £1.25m plus £51m retailer store adaptation cost (optimising shop and store space). Significant investment would be required in order to purchase infrastructure such as RVMs and counting centres. Since this infrastructure would be financed over a number of years, these are incorporated in the overall ongoing annualised logistics costs of the system included in the summary above.

### EU Minimum with DRS - Summary Table

Table 25: Final NPV for Option 2 in present value terms (£m)

	2013	2014	2015	2016	2017	Total

EU MINIMUM TARGETS							
	Low	10.8	10.8	12.6	12.5	12.4	59.1
	High	31.0	115.2	104.6	104.8	104.2	459.7
DEPOSIT REFUND SYSTEM							
<i>Annual Costs</i>							
	Deposit Refund System (to Producers)	224.6	217.0	209.7	202.6	195.7	1049.5
	Collection and Treatment/Disposal (to Local Authorities)	129.0	124.6	120.4	116.3	112.4	602.7
	Change in Cost of PRNS (conservative estimate)	27.1	26.1	25.3	24.4	23.6	126.4
	Collection and Treatment/Disposal (to Commerce)	13.5	13.1	12.6	12.2	11.8	63.2
	Consumers (Unclaimed Deposits)	-851.4	-822.6	-794.8	-767.9	-742.0	-3978.8
<i>Fixed Costs</i>							
	Net Financial Costs	-530.3	-441.8	-426.9	-412.4	-398.5	-2210
<i>Environmental Effects</i>							
		58.6	56.6	54.7	52.9	51.1	274.0
	Total	-471.7	-385.2	-372.2	-359.6	-347.4	-1936
FINAL NPV							
	Low	-460.9	-374.3	-359.6	-347.0	-335.0	-1877
	High	-440.7	-270.0	-267.6	-254.8	-243.2	-1476

\*Assumes the tonnages and corresponding unit costs remain constant

## RISKS

*Appraisal period:* It would take approximately 2 years to set up a DRS scheme. However, in order to compare the impacts of the DRS option over the same time period as the other options, the analysis models the impact from 2013 onwards. The analysis identifies the potential range in costs and benefits associated with a DRS. However if this option were to be considered further, there would be certain assumptions which would require further analysis. The baseline year is 2014/15 in which the landfill tax escalator has risen to £80 per tonne, but to consider the effects for the appraisal period of 2013-2017 the analysis assumes all the parameters, assumptions and therefore performance remain the same throughout this period.

*Disamenity effects:* As stated previously, in order to incorporate the disamenity benefits associated with reduced litter in the environment resulting from the introduction of a DRS, further evidence on the valuation of littering disamenity is needed. At present, the calculations used are too basic - for example, the willingness to pay for a reduction in litter is assumed to be constant and uniform across all households in the UK.

*Cross-border issues:* Unless all four nations of the United Kingdom adopt a deposit scheme, cross-European experience suggests that there may be some cross-border issues whereby containers are bought in the nation without a DRS, then returned in the nation with a DRS, thereby resulting in a deposit being redeemed which has not been paid for, which would increase costs on businesses in the nation which has implemented the DRS. Such cross-border issues can however be minimised by sufficient labelling to identify those containers that are included in the DRS from those which are not.

*Competition and single market distortions* A proposed DRS would be supported by a central clearing house for the deposits. Unclaimed deposits would go to a body which would then be in a position to reimburse retailers for providing deposit returns to consumers. The body given these functions is likely to be an industry-wide body set up for this purpose rather than an existing government agency. Whilst there is no difficulty with the appointment of a private body to such a role, there may be an issue if the effect of its role was to distort the market or to force those placed under an obligation to 'join' a scheme. There are objections on human rights grounds to forcing people to join an association. This has been established by the European Court of Human Rights in cases concerning Article 11 of the ECHR (right to freedom of association).

Monopolies are generally considered void at common law unless they have been created under statute. However, we must also consider the impact of any such body on the market from a competition perspective. Abuse of a dominant position in the market – which might come about as a result of how it collects or distributes funds – is prohibited. This covers exclusionary behaviour such as creating barriers to entry to the market. An example might be a clearing house set up by an industry body acting to promote the interests of a certain section of its membership. In such circumstances, the body would appear to be abusing its position and so it is important that there are safeguards in place to prevent this type of situation occurring, which might include more prescriptive provisions on duties.

*Effects on SMEs:* The Packaging Regulations include a *de minimis* threshold, exempting businesses which have a turnover below £2m and who handle under 50 tonnes of packaging a year; they are ‘not obligated’. In order to maintain this exemption for small businesses, any DRS would need to include a *de minimis*.

*Potential for further research:*

More detailed logistics study of supermarkets and beverage suppliers to assess the potential for backhauling empty containers, and affirm the financial implications.

More detailed breakdown of the composition of metal cans.

Study on sales of beverage containers to assess the nature and scale of the collection network. For example, if there was detailed information on what proportion of the different containers were sold at what type of stores, then there would be better handle on the likely number of RVMs and collection centres required (and therefore the costs of infrastructure).

Potential consultation with the retail trade on lost opportunity cost and labour costs etc from handling the take-back of containers.

Litter disamenity research.

## **SENSITIVITY ANALYSIS**

Sensitivity analysis is applied to the return rate achieved through the DRS to assess the change in net cost to producers from a DRS.

It is possible to estimate the “deposits unclaimed” and material sales for different return rates. For the retail handling fee and admin costs, the report provides these estimates for an 80% and 90% return rate. Interpolating between this based on the different return rates provides an approximation of these fees. As expected, a significant proportion of these costs are subject to the total number of containers rather than the proportion that is returned so there is less fluctuation in these costs.

*Table 26: Critical values for net cost to producers*

Return rates (%)	Deposits unclaimed (£)	Admin costs	Retailer handling fee	Material sales values	<b>NET COST</b>
82	£944	£322	£561	£188	<b>-£249</b>
84	£835	£326	£565	£182	<b>-£127</b>
86	£730	£327	£566	£186	<b>-£23</b>
87	£678	£331	£570	£189	<b>£34</b>
88	£625	£333	£572	£191	<b>£88</b>
91	£491	£337	£576	£210	<b>£212</b>

The system breaks even if approximately 86% to 87% of containers are returned and the deposits reclaimed. If the return rate is below 87%, drinks manufacturers could make a profit (though local authorities would save less than estimated above). With a return rate above 87%, producers would bear costs of up to £212m for a 90% return rate.

## **DIRECT COST TO BUSINESS – OPTION 3c**

To comply with the EU, the cost of PRNs to business for the EU minimum targets is 269.7m between 2013 and 2017.

The CPRE report estimates set-up costs of £81m for the DRS and annual running costs in the region of - £249m given that this is subsidised by £944m in unclaimed deposits by consumers.

### *One In One Out*

A deposit scheme is likely to be classified as a tax and thus would be out of scope of the “One-In, One-Out” principle.

## Summary of Options: Proposals for increases in recycling (option 1, 2 and 3) with alternatives for implementation

All costs and benefits are PV over the 5 year period.

Option	Additional costs of recycling (covered by packaging producers*)	Carbon implications / Other costs:
<b>Option 1:</b> EU minimum  <b>NPV of £0 (relative to EU min)</b> <b>£231m compared to 'notional' baseline of no intervention</b>		
<b>Option 2a:</b> Statutory targets for aluminium and plastic  <b>NPV of £78m</b>	Additional collection costs between <b>£97m</b> Savings in collection and disposal of <b>£9m</b> .  Revenue benefits of <b>£164m</b> .	Carbon benefits of <b>£2m</b>
<b>Option 2b:</b> Statutory targets to EU minimum plus voluntary responsibility deals for aluminium and steel  <b>NPV of £29m</b>	Additional collection costs between <b>£7m-£14m</b> Savings in collection and disposal of <b>£4m to £8m</b> .  Revenue benefits of <b>£28m to £56m</b> .	Carbon benefits of <b>£3m to £6m</b>  Admin cost of <b>£15.3m</b> to administer scheme
<b>Option 3a:</b> Statutory targets for aluminium, plastic, steel and a split target for glass end use (labelled as Option 4)  <b>NPV of £257m</b> <b>This is the preferred option</b>	Additional collection costs of <b>£272m</b> Savings in collection and disposal of <b>£53m</b> .  Revenue benefits of <b>£446m</b> .	Carbon benefits of <b>£19m</b>  Admin cost of <b>£0.7m</b> to set up IT for split glass targets.
<b>Option 3b:</b> Statutory targets to EU minimum plus voluntary responsibility deals for aluminium, plastic and steel  <b>NPV of £40m</b>	Additional collection costs between <b>£11m-£22m</b> Savings in collection and disposal of <b>£7m to £13m</b> .  Revenue benefits of <b>£36m to £72m</b> .	Carbon benefits of <b>£5m to £10m</b>  Admin cost of <b>£15.3m</b> to administer scheme
<b>Option 3c:</b> Statutory targets to EU minimum plus deposit refund scheme  <b>NPV of -£1,677m</b>	Different modelling from Defra	Different modelling from Defra

\*Through PRN system either directly or indirectly, through voluntary deals with e.g. local authorities) Where not directly paid for by packaging producers, the costs of collection and revenues from materials will flow to business and local authorities and any additional costs will be indirectly paid for by the PRN system.

The preferred option is option 3a, since there is clear economic and environmental reasoning for increasing the targets beyond EU minimum levels. Businesses support higher targets and the additional PRN revenue generated will finance improvements in collection and reprocessing infrastructure in the UK.



## **SPECIFIC IMPACT TESTS**

### **Equity and Fairness**

The proposed changes have no undue effect on rural areas, racial groups, income groups, gender groups, age groups, people with disabilities, or people with particular religious views.

### **Small firms impact test**

Businesses that do not simultaneously satisfy the two threshold tests in the Regulations (i.e. an annual turnover in excess of £2m and handle more than 50t of packaging) are excluded from the producer responsibility obligations in the Regulations. The proposed changes do not directly affect small businesses below these thresholds, though they may incur indirect costs through overall increased costs in the supply chain.

### **Competition**

The proposed target scenarios will affect the recovery and recycling obligations of approximately 6,500 businesses in the UK. The costs incurred under any new targets (in the same way as for existing targets) will be greater for some businesses than others, since the costs are related to the amount and type of packaging the business handles. Therefore, the more packaging a business handles the larger the obligation and the higher the likely costs of meeting that obligation.

The Government does not expect the proposals to affect the current market structure or change the number or size of firms. New businesses will not face higher charges than existing companies and the proposals should not restrict businesses choice of products. The Government is not aware of the industry being characterised by technological change that would radically alter the state of the market.

The Government have examined competition in the recycling market, material specific market (e.g. glass and plastic) and the end user market (e.g. the market for bottles). In general, the Government has been unable to identify markets where there are serious competition concerns. Competition in the recycling market is unlikely to be adversely affected as a result of adopting any of the proposed options and related targets. Indeed, the setting of future targets for recycling of particular materials may well increase demand for recycling and this could lead to new entry in the market and increase competition in recycling services.

The proposal sets material specific targets and may therefore cause a distortion in the market for particular types of packaging. An example of this is the market for bottles where glass currently faces a higher recycling target than plastic. This recycling differential could put glass manufacturers at a disadvantage, for example when fillers are selecting the container for their goods, although plastics have greater difficulties in terms of collection, sorting and end-use markets. However, the proposed new targets will put the targets for all the materials to similar levels and so will counter-act this effect.

It is anticipated that the increased cost of this regulation will be small in relation to a manufacturers total costs. Therefore, the Government does not believe that competition will be significantly affected in either this or other sectors with potentially high or differing recycling rates e.g. the aluminium and steel markets.

## Annex 2: PRN/PERNs Mechanism and Cash Flows

Over the period of operation of the producer responsibility system and the requirement to show evidence of compliance in the form of Packaging Recovery Notes/ Packaging Recovery Export Notes (PRN/PERNs), the overall cost of PRN/PERNs to producers has remained relatively stable on average; rising slightly as targets have increased. There have been significant variability and price spikes for short periods for particular materials, as would be expected in a market. The relative stability has been regarded as evidence that the system can compensate for incrementally rising targets with costs returning to an 'equilibrium level' that reflects the additional cost to the existing waste management system of extracting the required material from the waste stream.

In theory, in a functioning market with few imperfections, the additional PRN/PERN cash flows should reflect the costs of collecting, sorting, and transporting the additional waste to the reprocessor, minus the revenues from the sale of the material collected at the reprocessor gate<sup>1</sup> and the 'costs avoided' of collecting the materials as refuse and disposing these to landfill (see Box 1).

It is then left to the market to find the most cost effective ways of working collaboratively across the supply chain to carry out investments in the recycling infrastructure, to be innovative and to exploit new markets. Inevitably, markets are not perfect and the relative costs of compliance with the packaging requirements will depend on the relative knowledge and bargaining powers of producers, waste managers and local authorities and vary across the country depending on relative levels of demand/supply for waste materials.

The market mechanism used to achieve targets has delivered compliance with costs associated with PRN/PERNs over the last 5 years that have been between £45m and £64m per year, despite constantly rising targets. Where annual compliance costs have exceeded this range (2005 and 2008/9), the underlying cause can be attributed to factors external to the system (such as global drop in demand for material, or improper activity in the market).

<b>Box 4: Costs for collection of household packaging waste</b>	
A) Cost of collecting and sorting, and delivery of segregated packaging to reprocessor	Say £110 per tonne
<i>Revenues</i>	
B) Avoided landfilling cost of packaging material	Say £50 per tonne
C) Market value (price paid) of packaging material for sale to reprocessor	Say £20 per tonne
Revenue Total	£70 per tonne
D) Net loss	£40 per tonne
<p>To cover (D) revenue needs to come from the PRN system. A number of actions (or combination of actions) can be taken, for example:</p> <ul style="list-style-type: none"> <li>• pay capital cost of the system (A) - thus reducing the operational costs;</li> <li>• invest in technology, develop new markets for recycled material to increase demand, hence the value of packaging waste and price (C);</li> </ul> <p>The decision is in the hands of industry, primarily the reprocessors in collaboration with obligated businesses, on what mixture of support measures is needed for any given material.</p> <p>Other factors can affect (A), (B) and (C) and hence the deficit (D) the PRN revenues need to cover. For example:</p>	

<sup>1</sup> Alternatively, the value of the reprocessed material could be considered alongside the additional, average re-processing cost.

- costs of (A) may change as economies of scale and improvements in sorting technology develop;
- costs of (B) may change due to increases in the tax levy on landfill or mandatory targets;
- the price of (C) is affected by global supply and demand factors in markets for specific recycled materials.

As the PRN/PERN system is a market based mechanism, industry opinion suggests that without a degree of 'stretch' in the targets there will be no 'demand-pull' for PRNs and, linked to the belief that similar levels of recycling will occur annually, the PRN/PERN price will be likely to start to drop towards a floor price.

This has been seen in the market for PRNs for paper and wood where, due to the existing infrastructure and material price, there has historically been an over-supply of evidence for these materials and so depressed PRN/PERN prices (that have been around £2-4 for long periods in recent times).

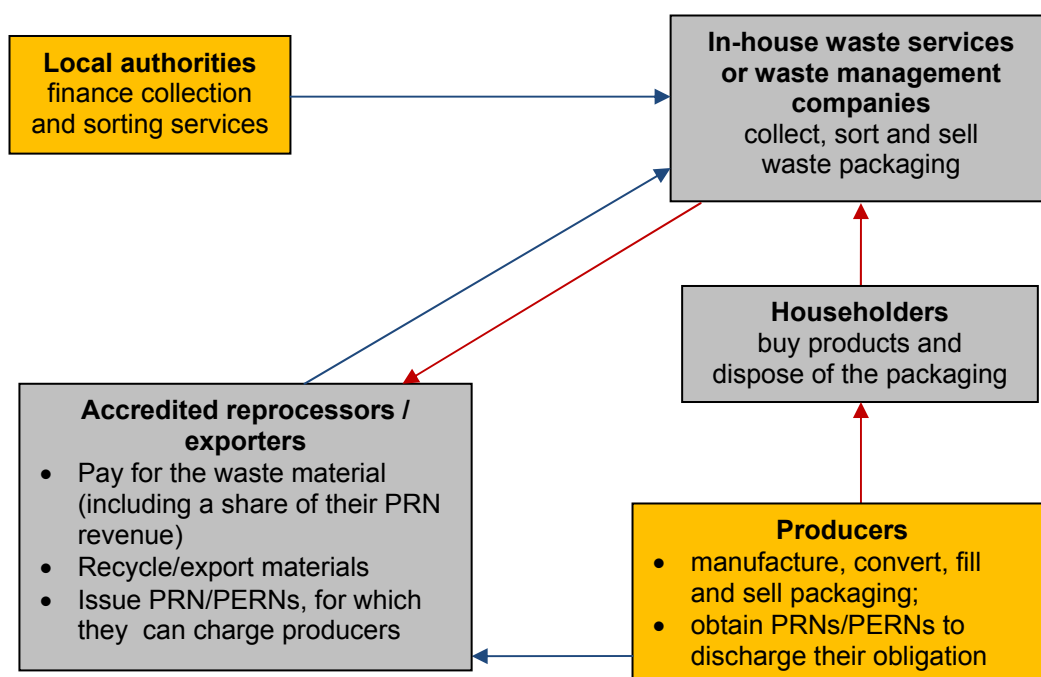
A long term depression in PRN prices would mean low costs for producers, but would remove an important source of funds for investment and support to collectors/reprocessors/exporters of materials and indirectly to Local Authorities.

To a limited extent, given market imperfections, the estimated costs for PRNs can be used to cross check the anticipated costs of acquiring additional packaging waste. PRN costs should (in an effective market) broadly equate to the difference between material revenues (at the reprocessor gate) plus avoided costs of disposal, less costs of acquiring the material (collection and sorting).

Figure 1 gives a depiction of the flow of funds within the PRN system on the household side<sup>2</sup>.

**Figure 1: Funds flow of PRNs (household)**

The diagram below shows the flow of materials (in red) and the funding flows (in blue) between the key actors in the household packaging chain. For commercial and industrial waste, the situation is similar in many respects, though businesses pay waste management companies (or local authorities) to collect their recyclable waste, or they may have direct contracts with reprocessors or exporters.



<sup>2</sup> There is a funding issue here with regard hidden subsidy to producers from local authorities, in that some packaging waste gets picked up by local authorities and treated as municipal waste and therefore funded by local authorities rather than business.

## Annex 3: Choice of recycling levels

### Considering efficient levels:

As discussed above, the 'optimum' level of recycling will be reached where the marginal *social* costs of recycling an additional tonne are equal to the marginal *social* benefits. It is only efficient to send an additional tonne to recycling where this provides the least-cost option, considering all social costs and benefits of waste disposal alternatives.

Current evidence, broken down by material, is presented below. This explains the marginal costs per tonne (additional collection costs of recycling) as well as the marginal benefits per tonne (additional carbon benefits and additional material benefits), to consider whether the optimal level will be above the EU level. Note that this Impact Assessment is only for packaging recycling, however a truly efficient level of recycling would cover all sources of the material, not just that from packaging. The information below indicates only the broad direction of change, rather than stating exact rates, therefore this packaging vs. other split does not affect the analysis.

One aspect of the costs and benefits that requires further explanation is the **marginal collection costs** for each material. The figures below consider the additional costs of recycling, compared to alternative waste disposal options. Since this is a *social* cost benefit analysis, these costs do not include landfill tax, which is a transfer payment.

For recycling collection, the evidence of *marginal* collection costs (per tonne) for each material is not available. In general, a typical assumption is that the marginal costs will rise as the use of a particular treatment increases. The cost curve is typically assumed to take a convex functional form, which seems broadly reasonable in the context of recycling. For example, recycling is cheapest where there is a large and consistent source of high quality material, with low associated transport costs. As the level of recycling increases, less good quality materials is likely to be sourced, requiring more sorting and higher collection costs. There could be some offsetting impacts, such as economies of scale in collection. In the absence of concrete information on marginal costs, we have taken an estimate of the average costs and considered where there may be 'tipping points' where increases in tonnages are likely to lead to much higher costs. Recommendations from the Advisory Committee on Packaging (ACP) and further discussions with industry have provided suggestions for the additional tonnages which would be feasibly possible to collect and sort.

The current evidence available is laid out by material below. Details and sources for these costs are in the 'Costs and Benefits' section for option 2. **Any updates or amendments to these figures for costs, benefits and levels of feasibility would be appreciated as part of this consultation's response.**

The **carbon benefits** quoted below are calculated relative to emissions associated with landfill, since the additional recycled material is assumed to be diverted from landfill. For paper, energy from waste is also considered. The carbon value includes carbon saved and carbon produced throughout the chain, i.e. avoided carbon from production of a raw material, and avoided carbon associated with landfill gas, minus carbon associated with the recycling process and transport of recyclates. Carbon values have taken the central 2011 traded and untraded price.

All **material prices** below are the current material price, correct at September 2011. It should be noted that is therefore a 'snapshot' – an indication is also given of the variation in prices which has been observed.

### Considering requirement for intervention

The section below also examines whether specific intervention in recycling is required for each material. This builds upon the baseline scenarios, to consider what would happen in the absence of specific intervention in recycling and whether this would reach the socially efficient level. This accounts for existing interventions (landfill tax) and the split of private and social benefits.

It should be noted that recycling intervention through statutory targets requires producers of packaging to purchase evidence of recycling: additional PRNs act as a tax on the production of packaging and creating a flow of funds to flow straight to the recycling industry. Depending on the level of the PRN price, this can act to internalise the carbon externality.

### **Aluminium**

The additional costs for collecting and sorting aluminium are assumed to be, on average, £90 per tonne.

Net of the reduction in resource costs of collection and disposal to landfill of around £59/tonne, these additional costs of collecting aluminium recycling are around **£31/tonne** (all collection costs are detailed in the costs and benefits section).

This additional collection cost should be compared to the benefit gained from additional tonnes. The production of aluminium has a particularly high carbon impact. This means that recycling aluminium delivers significant environmental benefits in the form of avoided GHG emissions. One additional tonne of recycled aluminium has carbon benefits of a value of **£202** (i.e. £202 of environmental benefit *not* captured in market prices).

Material revenues for aluminium are also high, with current prices around £985 / tonne. (The material revenue is the price paid for collected recyclates, so therefore incorporates the costs associated with reprocessing.) This current price is fairly close to the average price over the past few years. In theory, this high material revenue, combined with the landfill tax, should be enough to incentivise additional collection of aluminium. However, in practice, these high revenues may not filter down to those who are collecting: it will be collection authorities (and business) who pay for additional collections and disposal authorities and business who gain from the material revenue and avoided landfill tax.

The existing intervention, the landfill tax, does not provide sufficient incentives to recycle aluminium, since i) as mentioned before, the landfill tax only incentivises material away from landfill, rather than up the waste hierarchy into recycling and ii) aluminium is a light, relatively bulky material, making it more costly to collect and offering less benefit in terms of avoiding landfill costs than other, denser materials. This existing intervention therefore does not accurately reflect the relatively higher carbon benefits of aluminium.

*In total, there are benefits of around £1187/tonne of aluminium, compared to additional costs of around £31/tonne, which suggests that it is efficient to recycle aluminium to levels beyond the EU minimum (up to a point where marginal costs of collection are much higher.) Due to the external carbon benefits (£202/tonne) and the misalignment of private benefits and costs of recycling, efficient levels of recycling are unlikely to be met if the market is left to itself.*

Comments from industry have assessed that yearly increases of up to **3%** would be feasibly possible. This is the increase proposed for Option 3. Option 2 proposes a lower target, of **1%** yearly increases.

## **Steel**

Additional collection costs for steel were provided by industry and estimated at around £25 per tonne. (This would suggest a net benefit of £34 for every tonne recycled, since the resource costs of collecting and sorting steel are less than the resource costs of collecting and disposing of a tonne of landfill.) Any updates to these figures would be appreciated as part of the consultation response.

Steel also has a fairly high carbon impact, so recycling steel delivers significant benefits in the form of avoided GHG emissions. One additional tonne of recycled steel has carbon benefits of a value of £38.05. Additional to this, there are material revenues of £175/tonne, totalling around **£213/tonne**. Again, this would suggest that the material revenues should incentivise additional recycling of steel if the market was left with no further intervention. However, similarly to aluminium, the benefits and costs of additional collection of steel are bourn by different stakeholders, which means that the efficient level is unlikely to be met if the market is left to itself. Furthermore, the price of steel has been fairly volatile and since the material price is a large aspect of the private benefit, this discourages longer term investment.

Packaging steel tends to be of lower quality than waste steel from other sources, suggesting that specifically *packaging* steel would not necessarily be picked up if the market was left to itself. Even though it may be more efficient to focus initial recycling on other sources of steel (where there are greater benefits), there are still clear net benefits of additional recycling of packaging steel. Since the absence of intervention may lead to a focus on other sources of steel, it is likely that the UK would *not* meet the targets specific for *packaging* steel in the absence of intervention.

*In total, there are benefits of around £231/tonne of steel, compared to additional collection benefits of around £34/tonne, which suggests that it is efficient to recycle steel to levels beyond the EU minimum (up to a point where marginal costs of collection are much higher.) Due to the external carbon benefits (£38/tonne) and the misalignment of private benefits and costs of recycling, efficient levels of recycling are unlikely to be met if the market is left to itself.*

It may be the case that steel packaging is not the best aspect in which to focus this increase in levels of steel recycling (above EU levels), since higher quality may be achieved elsewhere. However, packaging material is the only current area of the waste stream with existing interventions that can increase levels. Current evidence suggests there are net benefits of recycling additional tonnes of steel.

*At the least, it is important to maintain EU target levels for steel packaging, since levels of recycling in the absence of intervention would be likely to drop below the EU levels.*

The advisory committee on packaging recommended year on year increases of around **2%** every year as feasibly possible. Option 3 proposes a year-on-year increase of 1% every year, based on the above discussion around specifically *packaging* steel. Option 2 proposes no yearly increases for steel.

### **Plastics**

There is relatively high uncertainty in the calculation of marginal collection costs for plastic. Taking a ratio of 55:45 between commercial and household collections gives an average cost of between £183 per tonne to £224 per tonne, or **£124 to £165**, net of the £59 reduction in collection and disposal costs to landfill. This is modelled on the realistic assumption that changes to household infrastructure would not be rolled out until 2015, which is consistent with improvements available in existing C&I and household collections. The calculation and detail of this is below and the uncertainty in the costs is tested in sensitivity analysis (see the costs and benefits section).

This IA has considered where there may be step changes in these marginal costs. The plastic waste stream consists of many different 'types': bottles, other dense plastic, film plastic and plastic bags. The collection cost curve for plastics is likely to contain a number of 'kinks', relating to initially improving the yield of existing services then relating to the different costs associated with additional collection of the different types of plastic.

For collection costs from business premises (i.e. costs incurred by the business who produce the waste), the best available figures are from Eunomia's (2010) modelling of recycling costs, modelled as £148 per tonne for dense plastics and £153 per tonne for an average of film and plastic.

Costs of collection from household (i.e. costs incurred by LAs) are taken from recent modelling by WRAP<sup>1</sup>. For household collections, many local authorities do not currently take plastics and where they do, a large proportion only collect bottles. It should be possible to achieve higher levels of recycling by increasing the participation and yields from existing bottle and mixed plastics household collections. An initial step change in the costs will be the point where plastic has to be added to an existing recycling collection. The element of these costs attributed to adding just bottles to an existing collection system is between £74 and £149 for one/two stream co-mingled collection system and between £287 and £334 for a kerbside sort system. The next step change in the curve will be the addition of domestic film, where the costs are considered to be an *additional* £150 to £232 for comingled and £44 to £217 for kerbside sort. In practice, if a Local Authority was intending to add collection of both to its existing system, the combined cost is likely to be lower than the sum of both (as shown) and significantly lower than the ranges used.

Each additional tonne of recycled plastic has carbon benefits of a value of **£27**, for a tonne of average 'closed loop' recycled plastic. For plastics the vast majority of new (i.e. marginal) recycling is closed loop application or material. In fact the open loop growth is likely to come from residue from closed loop recycling processes. Based on WRAP's Market Situation Report Spring 2010, 900,000t of plastics were collected for recycling in the UK and 700,000t were exported for reprocessing. Virtually all exported recovered plastics are reprocessed in closed loop applications. WRAP are in the process of increasing our understanding of plastic recycling capacity so it is not easy to estimate how much plastic recycled in the UK go to open loop processes but this is probably quite low – perhaps under 50k t/a.

Current material revenues are £300/tonne, which totals around **£327** per tonne. This high material revenue suggests there should be sufficient private incentive to recycle plastic, however, the private incentives will not include the additional benefit of avoided carbon and are therefore likely to be below optimal levels. Additionally, this material price has been fairly volatile over the past few years, which is a disincentive to longer term investment. Modelling has considered the outcomes of a range of material

<sup>1</sup> [http://www.wrap.org.uk/downloads/The\\_Financial\\_Costs\\_of\\_Collecting\\_Mixed\\_Plastics\\_Packaging.40588df5.7205.pdf](http://www.wrap.org.uk/downloads/The_Financial_Costs_of_Collecting_Mixed_Plastics_Packaging.40588df5.7205.pdf)

prices for plastic, with a low point of £150/tonne. It is difficult to accurately forecast future material prices. Plastic material prices tend to mirror the price of oil, which displays fairly high volatility.

#### Requirement for additional recycling incentive

Existing intervention (the landfill tax) is ineffective in providing incentives to recycle plastic. Plastic is a relatively low density material, which makes it more costly to collect than other materials and provides relatively less benefit in the form of avoided landfill tax. In 2010, the UK only recycled 24% of packaging plastics.

This means there is a key rationale in additional intervention, to encourage additional recycling of plastic. Since plastic collection costs increase fairly significantly as the different types are required to be added, there will be a 'tipping point' for plastic recycling levels, where the additional collection and sorting costs are greater than the additional benefits. However, market information suggests that there is a proportion of plastic which is currently being recycled without producing PRNs, so there is likely to be slack in the system. It has been suggested that it should be possible to achieve higher targets by increasing the participation and yields from existing bottle and mixed plastics household collections and the levels from C&I source, rather than a requirement for much higher costs of collection. Even if significant collection infrastructure *is* required for household collection and there is a step change to 'harder to get' material, it is unlikely that the marginal costs will pass the 'tipping point' for the 2% and 5% changes proposed. A 5% yearly increase is proposed for Option 3. Option 2 proposes a lower target, of a 2% yearly increase in the plastic recycling rate.

#### **Glass**

The end-use of recycled glass determines the benefits per tonne. Glass with an end-use of re-melt (i.e. recycled into containers) has a much higher carbon benefit than a tonne of glass recycled into aggregates (see table below). This works out as around £8/tonne carbon benefit for glass recycled back into glass and little carbon benefit for glass recycled into aggregates.

*Table A1: Relative carbon benefits of a sample of recycling method*

<b>1 tonne of...</b>	<b>Saves...</b>
glass recycled into containers	0.263-0.315t of CO <sub>2</sub> eq
glass recycled into aggregates	on average 0

Colour-purity is important for going into the re-melt industry, which means that it is mainly colour-separated glass which ends up recycled back into glass. Completely mixed glass must instead go to alternative uses. The demand for glass in the non-aggregate business is reflected in the significantly higher price: material prices in August 2011 were £26, £10 and £28 / tonne for amber, green and clear glass respectively and £5 for mixed glass (Source: WRAP, 2011). Including the carbon value, the total benefits of each type of glass are therefore **£32/tonne** for colour sorted (taking proportions of 20:20:60 for the colours above and therefore an average material revenue of £24). Total benefits of a tonne of glass used for aggregates is around £5. British glass have stated that the existing reprocessing capacity in the UK could produce more glass for re-melt, but the restricting factor is the collection method.

Since colour separation is important, the collection type (mixed vs. separated) often determines the end use of glass and the resulting benefits. Some household collections separate glass at the kerbside, which ensures that glass can be colour separated. There may be greater contamination where glass is collected mixed and sorted at materials recycling facilities. However, glass makers are starting to use colour-sorting equipment, which may mean collection type is less important in the future for determining end use.

The cost of collection for glass with an end-use of re-melt is estimated as £103 (assumption that majority of kerbside sort can be used for re-melt and around 33% of mixed collections are used for remelt, taking a 45:55 ratio of household to C&I collection). The cost of collection for glass used as aggregates is taken as £68 (or **£44** and **£9** net of landfill collection and disposal).

The difference in collection costs between material collected with an end use of re-melt and aggregates is highly uncertain – we would appreciate any further information as part of the consultation response.

As the costs stand, the benefits of additional collection of glass do *not* outweigh the additional costs incurred, therefore the efficient level may lie below the EU minimum. The rationale for intervention in glass recycling is currently only in order to meet EU targets. Glass recycling targets have been met to date, but they remain challenging.

Depending on the *accurate* difference in collection costs for re-melt and aggregate glass, there may be a rationale for intervention in splitting the glass target by end use (i.e. stating the proportion destined for an end use of remelt and aggregates). This would be the case if the additional benefits of remelt over aggregates outweighed the additional costs of the collection of glass suitable for remelt. Due to the uncertainty in the current evidence stands, this may or may not be the case. A split target for glass is included in Option 3.

### **Paper**

There currently does not appear to be a need to intervene in the paper recycling market, since existing interventions (the landfill tax) acts as a strong incentive to divert dense materials away from landfill and there is no significant external benefit in moving paper further up the hierarchy to recycling. As described in the baselines above, there is a mature market in recycled paper and the high material price means it is unlikely that the quantity of paper recycling would drop in the absence of intervention.

It is likely that the increase in the overall targets for recycling will 'pull up' recycling of paper and wood, as described in the IA. This is because the gap between a producer's the material specific target and overall recycling target is filled by 'general recycling'. This recycling can come from any material and therefore tends to focus on the materials with the lowest PRN costs (i.e. paper and wood).

## **If there are benefits of recycling, why are these not reflected in decision-making?**

**Misaligned incentives in waste disposal:** the final financial benefits of recycling are not reflected in collection / business decisions earlier in the chain

With no market intervention, there are *overall* financial benefits of moving a tonne of some recyclates from landfill to recycling. Revenue can be gained from recycling and landfill tax is avoided, which are greater than the additional costs of collection. However, there is a long 'chain' in waste disposal leading to this point: benefits are gained at the end, but costs fall throughout the chain. The chain is linked with a combination of fairly rigid contracts, including those which may not vary with tonnage. For example, businesses are often charged a set fee *per lift* for their residual / recycling bin, or have a set contract meaning there is no incentive to change the proportions falling into the residual vs. recycling stream. This means there are many players who do not benefit in full (and do not face the disincentive of the landfill tax): starting from the household/business who disposes waste, to the collection authority or waste collection contractor, to links between MRFs and the final end market for recyclates vs. landfill. See diagram below.

In particular, **plastic** is relatively costly to collect per tonne (since it is a relatively low density material and fills up trucks quickly). Landfill tax incentives (on a tonnage basis) provide relatively *less* incentives to invest in collection infrastructure for plastic compared to higher density materials such as glass, even though the carbon benefits are higher.

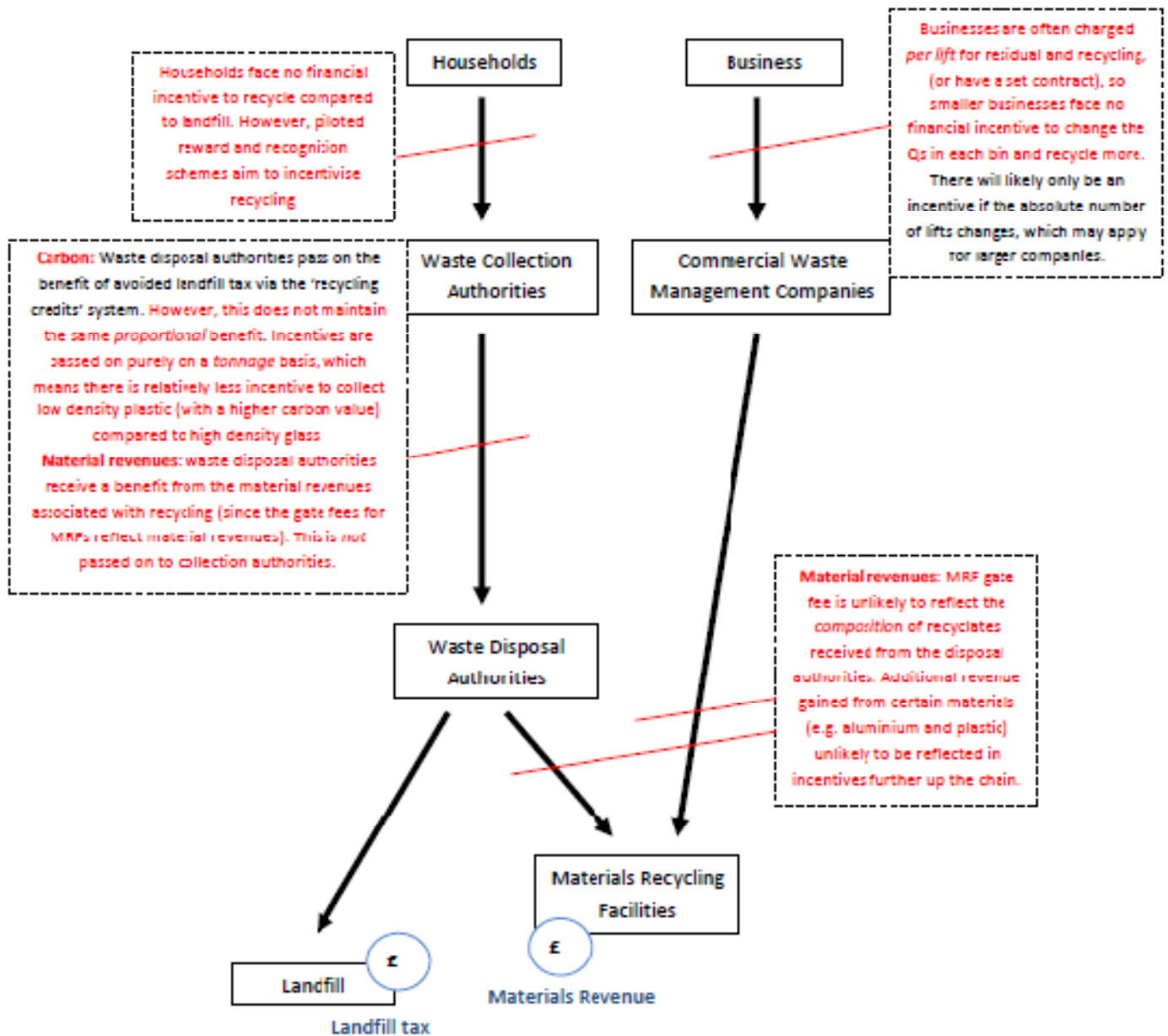
### **Why only packaging – are these issues not the same for all waste of these materials?**

It is inefficient to focus only on packaging, since the environmental externalities and misaligned incentives are the same for all waste streams of these materials.

However, we have an existing market mechanism for packaging (the PRN system), and even though it is a 2<sup>nd</sup> best solution, it is a solution which allows us to target and increase levels of these key materials.



At the end of the chain, there are benefits compared to recycling: landfill tax avoided and material revenue gained. This relative benefit of recycling is unlikely to filter up to the beginning of the chain. Red lines and boxes highlight the areas where the benefits are *not* passed on.



## Annex 4: Headline Assumptions

### Headline Assumptions

There are a number of assumptions which underpin the costs and benefits for each option. These are as follows:

#### Baseline

Packaging waste will rise in line with industry predictions which are set out in Table 3.

The obligated tonnage will increase at the same rate as packaging arisings as set out in Table 5.

The existing breakdown between materials will be maintained (i.e. there will be no major changes in material use).

No new types of packaging material will enter the market during the period.

Packaging waste is split 45:55 between household waste and commercial/industrial waste.

#### **Key Assumptions for Option 1, 2a, b and 3a, b, c which increase recycling via targets or PRDs**

#### Material Prices

All the packaging materials are traded in global commodities markets, but due to market fluctuations it is very difficult to assess the price of any material in future years. Therefore under benefits for each of the options, the material revenue is based on recent material prices and this is used for the front sheet figures.

For a more complete picture however, within the sensitivities sections each option has its NPV recalculated based on a range of material prices. The 'switching point' has been calculated, to provide an estimate of how low material prices would need to fall in order to change the sign of the NPV. Since the time frame for analysis is likely to cover the length of a business cycle, the *average* material price over the course of a business cycle is the price of importance, rather than specific peaks or drops.

Table A2: Material Price

Material	Price per tonne (£)*	Price per tonne (£)
	Current: used for 'best estimate'	Low: used for 'low' estimate on summary sheet
Paper	90	30
Glass – colour separate	24	21
Glass – mixed	5	
Aluminium	985	900
Steel	185	90
Plastic	300	150
Wood	(12)	(16)

\* Figures as of September 2011 from WRAP materials pricing report

#### Cost to business: PRN prices

Table A3: PRN prices under each option

	EU minimum	Higher targets for alu & plastic	Higher targets for alu, plastic, steel and split glass target
Paper	£1.50	£1.50	£1.50

Glass	£10.50	£10.50	Increase to £22
Aluminium	£12	Increase to £30	Increase to £30
Steel	£6	£6	Increase to £15
Plastic	£5	Increase to £20	Increase to £20
Wood	£1.50	£1.50	£1.50
'General Recycling'	£1.50	£1.50	£1.50
Energy from Waste	£1	£1	£1

### GHG Benefits

The key environmental benefit of the options will be the greenhouse gas savings associated with the diversion from landfill and the resource efficiency (in particular, the associated energy savings) of replacing virgin materials with recycled materials. For biodegradable products, there is significant benefit from reduced methane emissions. WRAP has identified the relative GHG savings from the recycling of a tonne of key materials. For this I.A., the emissions for each material have been separated into the carbon which is valued as traded and untraded, taking calculations based on data from WRAP/Zerowaste Scotland's England carbon factor (2011).

Traded carbon is the carbon in sectors covered by the EU Emissions Trading System (ETS). This includes electricity involved in the recycling process and reductions in emissions overseas. 'Non-traded carbon' is that outside this sector and includes reduction in landfill emissions and emissions associated with UK transport of recyclates. The breakdown of 'untraded' and 'traded' carbon for each material is shown below.

Table A4: Carbon factors (CO<sub>2</sub> equivalent)

Material	Carbon factor (Tonnes of CO <sub>2</sub> equivalent benefit / tonne of material recycled) <b>Traded</b>	Carbon factor (Tonnes of CO <sub>2</sub> equivalent benefit / tonne of material recycled) <b>Untraded</b>	Carbon factor (Tonnes of CO <sub>2</sub> equivalent / tonne of material recycled) <b>Total</b>
Paper	0.22	0.52	0.74
Glass (separated)	0.38		0.38
Glass (mixed)	0.19		0.19
Aluminium	9.32	-0.05	9.27
Steel	1.72	0	1.72
Average Plastic	1.19	0.01	1.2
Wood	0.56	0.75	1.32

Source: Zerowaste Scotland calculations, based on WRAP/Zerowaste Scotland England carbon factor.

### Monetising the GHG Impacts

In accordance with guidance from DECC on the valuation of carbon in policy appraisal, the value of carbon varies depending on whether the reduction/increase in emissions occurs in traded or untraded sectors, or internationally. As laid out above, carbon emissions have been split into those which fall into the traded or untraded sectors and central price (below) has been applied.

The traded price is based in the short term on estimates of the future price of EU allowances (EUAs). The non-traded price based on estimates of the marginal abatement cost (MAC) required to meet a specific emission reduction target.

Table A5: Traded and non-traded carbon prices (£)

	Traded	Non-traded
	Central	Central
<b>2013</b>	23	54
<b>2014</b>	23	55

<b>2015</b>	23	56
<b>2016</b>	24	57
<b>2017</b>	24	57

Offsetting reduction in the disposal cost of refuse to landfill

By increasing recycling, handlers of waste will be able to save resource costs of disposal to landfill, equal to the landfill gate fee plus the avoided cost of collecting mixed waste. On average, the gate fee is around £20 per tonne for the UK (WRAP gate fees report, 2011) and the average ‘mixed waste’ collection cost is about £38 per tonne, based on Eunomia modelling (2011).

In addition, there would be savings in cash outflow on landfill tax however, in an IA looking at social cost-benefits; this element is excluded from the NPV assessment.

Landfill tax is set to increase over the period 2010-14, so the cost of disposal of waste to landfill will become a relatively more expensive option compared with alternative waste treatments. Landfilled material will be subject to the following prevailing rates of landfill tax:

Table A6: Landfill tax obligations

	<b>Landfill tax</b>
<b>2010/11</b>	£48/t
<b>2011/12</b>	£56/t
<b>2012/13</b>	£64/t
<b>2013/14</b>	£72/t
<b>2014/15</b>	£80/t

**Deposit Refund Scheme**

To assess the costs and benefits of a deposit refund scheme (DRS), we have used a recent study conducted by Eunomia on behalf of CPRE, titled “*Have we got the bottle: Implementing a deposit refund scheme in the UK*”, as a source of evidence.

The overall evidence base around this type of scheme and which specifically tailors to the UK is limited. To sense check the figures in the Eunomia report and understand the methodology and assumptions, where possible the costs and benefits have been tested.

The main tables which have been used and which underpin the final results for Option 3 are shown below.

Table A7: Change in waste mass flows by material as a result of the implementation of a parallel DRS in the UK

Products	Tonnes (000 tonnes)									
	hhld Kerbside		Bring	HWRCs		Commercial		Litter		
	Recycling	Refuse	Recycling	Recycling	Refuse	Recycling	Refuse	Recycling	Refuse	Environment
Glass Bottles	-1002	-246	-192	-27	-4	-414	-73	-14	-56	-19
PET Bottles	-71	-152	-4	-3	-1	-12	-11	-1	-30	-3
Cans (Fe.)	-45	-77	-6	-2	0	-26	-6	-2	-15	-2
Cans (Al)	-34	-42	-1	-1	0	-8	-3	0	-21	-1
<b>Total</b>	<b>-1152</b>	<b>-517</b>	<b>-203</b>	<b>-33</b>	<b>-5</b>	<b>-460</b>	<b>-93</b>	<b>-17</b>	<b>-122</b>	<b>-25</b>

Source: CPRE Table A-23 Change in Mass Flows Resulting from Introduction of Complimentary and Parallel Deposit Refund Systems

Table A8: Number of containers requiring collection for a “parallel” system, millions

<b>Product</b>	<b>RVMs</b>	<b>Manual</b>	<b>Containers returned</b>	<b>Total Containers in the Market</b>
<b>Glass ≤0.5 l</b>	894	1646	2540	3204
<b>Glass &gt;0.5 l</b>	754	1387	2141	2701
<b>PET ≤ 0.5 l</b>	1599	1974	3573	4239
<b>PET &gt; 0.5 l</b>	1738	2145	3883	4607
<b>Cans (Fe.)</b>	1664	2997	4661	5717
<b>Cans (Al)</b>	2116	3812	5928	7271
<b>Total</b>	<b>8,765</b>	<b>13,961</b>	<b>22,726</b>	<b>27,739</b>

Source – CPRE Table A-28: Number of Containers requiring collection via RVMs or through Manual take back, millions and Table A-9: Mass Flow Baseline for CBA Modelling

Table A10: Deposit for DRS scheme

<b>Container Size</b>	<b>% of UK Market</b>	<b>Deposit</b>
£ 500ml	65%	£0.15
> 500ml	35%	£0.30

Source – CPRE Table A-24: Proposed Deposits for Containers in UK Deposit Refund System

Please note, in some cases where the calculations and methodology was unclear, Eunomia provided further information which has been reported, but which it is not possible to source specifically from the report.

## Annex 5: Tables and figures for each option

### Baseline scenarios

Table A11 sets out forecast packaging waste arisings up to 2017.

Table A11: Estimated total packaging in the UK waste stream

	2013	2014	2015	2016	2017
Paper	3,867,645	3,886,984	3,906,419	3,925,951	3,945,580
Glass	2,795,062	2,823,013	2,851,243	2,879,756	2,908,553
Aluminium	152,579	154,105	155,646	157,202	158,774
Steel	642,269	639,057	635,862	632,683	629,519
Plastic	2,617,385	2,682,820	2,749,890	2,818,638	2,889,104
Wood	1,029,058	1,034,204	1,039,375	1,044,572	1,049,795
Other	22,555	22,555	22,555	22,555	22,555
Total	11,126,554	11,242,738	11,360,990	11,481,356	11,603,880

Source: Based on Packflow, with 2011 amendments

[http://www.valpak.co.uk/nav/redir.aspx?l=/docs/packaging/packflow\\_2012\\_final\\_report\\_19\\_11\\_2009.pdf](http://www.valpak.co.uk/nav/redir.aspx?l=/docs/packaging/packflow_2012_final_report_19_11_2009.pdf)

In order to assess the extent to which the Directive targets would be met, the changes in recycling and recovery rates estimated in Table 2 (in the text) were applied to the waste arisings estimated in Table A11 for each scenario:

- Low scenario: relatively small difference in recycling rate compared to current achievement (and thus EU minimum) in the absence of targets shown in Table A12a;
- High scenario: greater drop in recycling rate and thus greater divergence from EU Directive targets as reflected in Table A12b.

Table A12a: Aggregate tonnage and recycling and recovery rate (%R&R) in Notional Baseline – Low Scenario

Material	2013		2014		2015		2016		2017	
	% R&R	Tonnages	% R&R	Tonnages	% R&R	Tonnages	% R&R	Tonnages	% R&R	Tonnages
Paper	82%	3,167,602	82%	3,183,440	82%	3,199,357	82%	3,215,354	82%	3,231,430
Glass	59%	1,662,671	59%	1,679,298	59%	1,696,090	59%	1,713,052	59%	1,730,182
Aluminium	41%	62,405	41%	63,029	41%	63,659	41%	64,296	41%	64,939
Steel	56%	361,822	56%	360,013	56%	358,213	56%	356,422	56%	354,640
Plastic	22%	567,711	22%	581,904	22%	596,451	22%	611,363	22%	626,647
Wood	38%	378,351	45%	456,291	45%	458,573	45%	460,866	45%	463,170
Total Recycling	56%	6,200,561	56%	6,323,974	56%	6,372,343	56%	6,421,351	56%	6,471,007
Recovery	59%	6,564,667	59%	6,633,215	59%	6,589,374	58%	6,774,000	58%	6,846,289

Table A12b: Aggregate tonnage and recycling and recovery rate (%R&R) in Notional Baseline – High Scenario

Material	2013		2014		2015		2016		2017	
	% R&R	Tonnages	% R&R	Tonnages	% R&R	Tonnages	% R&R	Tonnages	% R&R	Tonnages
Paper	82%	3,167,601	82%	3,183,440	82%	3,199,357	82%	3,215,354	82%	3,231,430
Glass	49%	1,357,282	49%	1,370,855	49%	1,384,564	49%	1,398,410	49%	1,412,393
Aluminium	33%	49,924	33%	50,423	35%	54,110	35%	54,651	35%	55,198
Steel	42%	266,606	44%	284,221	47%	301,653	47%	300,145	47%	298,644
Plastic	19%	504,632	20%	549,576	20%	563,315	20%	577,398	20%	591,833
Wood	15%	155,182	15%	155,958	15%	156,738	15%	157,521	15%	158,309

Total Recycling	49%	5,501,227	46%	5,594,472	45%	5,659,736	45%	5,703,479	45%	5,747,807
Recovery	55%	6,119,605	52%	6,183,506	52%	5,907,715	51%	5,970,305	51%	5,917,979

Table A13: Estimated obligated tonnage source: NPWD actuals; Defra estimated forecasts

	2013	2014	2015	2016	2017
Paper	3,655,956	3,674,236	3,692,607	3,711,070	3,729,625
Glass	2,130,471	2,151,775	2,173,293	2,195,026	2,216,976
Alu'm	156,223	157,786	159,363	160,957	162,567
Steel	481,250	478,844	476,450	474,067	471,697
Plastic	1,935,402	1,983,787	2,033,382	2,084,217	2,136,322
Wood	1,003,584	1,008,602	1,013,645	1,018,713	1,023,807
Other	17,938	17,938	17,938	17,938	17,938
Total	9,380,825	9,472,968	9,566,678	9,661,989	9,758,932

## Option 1: EU minimum Tonnages

Table A14: Tonnage delivered by the proposed Option 1 targets (tonnes)

	2013	2014	2015	2016	2017
Paper	2,540,889	2,553,594	2,566,362	2,579,194	2,592,090
Glass of which is	1,725,681	1,742,938	1,760,367	1,777,971	1,795,751
aggregates	690,273	697,175	704,147	711,188	718,300
remelt	1,035,409	1,045,763	1,056,220	1,066,783	1,077,451
Aluminium	62,489	63,114	63,745	64,383	65,027
Steel	341,688	339,979	338,279	336,588	334,905
Plastic	619,329	634,812	650,682	666,949	683,623
Wood	220,788	221,892	223,002	224,117	225,237
<b>Material specific</b>	<b>5,513,989</b>	<b>5,556,330</b>	<b>5,602,438</b>	<b>5,649,202</b>	<b>5,696,633</b>
General recycling	872,476	892,867	998,570	1,017,570	1,037,031
<b>Recycling</b>	<b>6,386,465</b>	<b>6,449,197</b>	<b>6,601,008</b>	<b>6,666,772</b>	<b>6,733,663</b>
<b>Recovery</b>	<b>6,941,810</b>	<b>7,009,996</b>	<b>7,175,009</b>	<b>7,246,491</b>	<b>7,319,199</b>
EFW	555,345	560,800	574,001	579,719	585,536

## Incremental tonnage

Table A15a: Incremental tonnage delivered by targets compared to the baseline – Low scenario

Low	2013	2014	2015	2016	2017
Paper	-	-	-	-	-
Glass	63,011	63,641	64,277	64,919	65,569
Alu	84	85	86	87	88
Steel	-	-	-	-	-

Plastic	51,618	52,908	54,231	55,587	56,976
Wood	-	-	-	-	-
'General recycling'*	71,191	8,589	110,071	124,828	140,023
<b>Overall Recycling</b>	<b>185,904</b>	<b>125,223</b>	<b>228,665</b>	<b>245,421</b>	<b>262,656</b>
<b>Recovery</b>	<b>377,143</b>	<b>376,781</b>	<b>585,635</b>	<b>472,491</b>	<b>472,910</b>
<b>EFW</b>	<b>191,239</b>	<b>251,559</b>	<b>356,970</b>	<b>227,070</b>	<b>210,254</b>

\* The gap between a producer's material specific target and overall recycling target is filled by 'general recycling'. This recycling can come from any material and therefore tends to focus on the materials with the lowest PRN costs (i.e. paper and wood). It is assumed that 50% will come from wood and 50% from paper.

Table A15b: Incremental tonnage delivered by targets compared to the baseline – High scenario

High	2013	2014	2015	2016	2017
Paper	-	-	-	-	-
Glass	368,399	372,083	375,804	379,562	383,358
Alu	12,565	12,691	9,635	9,731	9,829
Steel	75,082	55,758	36,626	36,443	36,261
Plastic	114,697	85,236	87,367	89,551	91,790
Wood	65,606	65,934	66,264	66,595	66,928
'General recycling'*	248,889	263,023	365,576	381,411	397,690
<b>Overall Recycling</b>	<b>885,238</b>	<b>854,725</b>	<b>941,272</b>	<b>963,293</b>	<b>985,856</b>
<b>Recovery</b>	<b>822,205</b>	<b>826,490</b>	<b>1,267,294</b>	<b>1,276,186</b>	<b>1,401,220</b>
<b>EFW</b>	<b>-63,033</b>	<b>-28,234</b>	<b>326,022</b>	<b>312,893</b>	<b>415,364</b>

\* The gap between a producer's material specific target and overall recycling target is filled by 'general recycling'. This recycling can come from any material and therefore tends to focus on the materials with the lowest PRN costs (i.e. paper and wood). It is assumed that 50% will come from wood and 50% from paper.

## Costs and benefits

### Benefits Option 1: EU

#### Material revenue

Table A16a: Associated material revenue (£m) - Low Scenario

	2013	2014	2015	2016	2017	Total
Paper	0.0	0.0	0.0	0.0	0.0	<b>0.0</b>
Glass	0.91	0.89	0.87	0.85	0.83	<b>4.34</b>
Alu'm	0.07	0.07	0.07	0.07	0.06	<b>0.33</b>
Steel	0.0	0.0	0.0	0.0	0.0	<b>0.0</b>
Plastic	13.91	14.46	14.18	14.04	13.91	<b>70.90</b>
Wood	0.0	0.0	0.0	0.0	0.0	<b>0.0</b>
Overall 'material specific' recycling	<b>14.89</b>	<b>14.74</b>	<b>14.59</b>	<b>14.44</b>	<b>14.30</b>	<b>73.0</b>
'General recycling' – paper	2.99	0.35	4.32	4.73	5.13	<b>17.51</b>
'General recycling' - wood	-	-	-	-	-	-
	0.40	0.05	0.58	0.63	0.68	<b>2.30</b>
<b>Overall recycling</b>	<b>17.48</b>	<b>15.04</b>	<b>18.33</b>	<b>18.54</b>	<b>18.75</b>	<b>88.21</b>

**Discounted PV over 5 years: £88.2m**

Table A16b: Associated material revenue (£m) - High Scenario

	2013	2014	2015	2016	2017	Total
Paper	0.0	0.0	0.0	0.0	0.0	<b>0.0</b>
Glass	5.33	5.20	5.08	4.95	4.83	<b>25.40</b>



Alu'm	10.44	10.19	7.47	7.29	7.12	<b>42.51</b>
Steel	12.97	9.30	5.90	5.68	5.46	<b>39.31</b>
Plastic	32.12	23.06	22.84	22.62	22.40	<b>123.05</b>
Wood	-0.73	-0.71	-0.69	-0.67	-0.65	<b>-3.5</b>
Overall 'material specific' recycling	<b>56.9</b>	<b>43.9</b>	<b>37.6</b>	<b>36.9</b>	<b>36.3</b>	<b>211.6</b>
'General recycling' – paper	10.5	10.7	14.3	14.5	14.6	<b>64.5</b>
'General recycling' - wood	-	-	-	-	-	-
	1.5	1.6	2.2	2.3	2.4	<b>9.9</b>
<b>Overall recycling</b>	<b>65.9</b>	<b>53.0</b>	<b>49.7</b>	<b>49.1</b>	<b>48.4</b>	<b>266.1</b>

**Discounted PV over 5 years: £266.1m**

## GHG emissions

Monetising the environmental benefits is as follows.

*Table A17a: Present value of the GHG savings from proposed targets (£m) – Low Scenario*

	<b>2013</b>	<b>2014</b>	<b>2015</b>	<b>2016</b>	<b>2017</b>	<b>Total</b>
Paper	0.0	0.0	0.0	0.0	0.0	0.0
Glass	0.4	0.4	0.4	0.4	0.4	1.9
Aluminium	0.0	0.0	0.0	0.0	0.0	0.1
Steel	0.0	0.0	0.0	0.0	0.0	0.0
Plastic	<b>1.7</b>	<b>1.7</b>	<b>1.7</b>	<b>1.8</b>	<b>1.8</b>	<b>8.7</b>
Wood	0.0	0.0	0.0	0.0	0.0	0.0
Overall 'material specific' recycling	<b>0.98</b>	<b>1.01</b>	<b>1.00</b>	<b>1.03</b>	<b>1.02</b>	<b>5.04</b>
'General recycling' – paper	1.1	0.1	1.6	1.8	2.0	6.7
'General recycling' - wood	1.8	0.2	2.6	3.0	3.2	10.8
Energy from Waste	12.9	16.7	23.3	14.5	13.2	80.6
<b>Total</b>	<b>17.5</b>	<b>18.7</b>	<b>29.2</b>	<b>21.1</b>	<b>20.2</b>	<b>106.8</b>

**Discounted PV over 5 years: £106.8m**

*Table A17b: Present value of the GHG savings from proposed targets (£m) – High Scenario*

	<b>2013</b>	<b>2014</b>	<b>2015</b>	<b>2016</b>	<b>2017</b>	<b>Total</b>
Paper	0.0	0.0	0.0	0.0	0.0	0.0
Glass	3.5	3.6	3.5	3.5	3.4	17.5
Aluminium	2.4	2.4	1.8	1.8	1.8	10.1
Steel	2.7	2.0	1.3	1.3	1.2	8.4
Plastic	<b>2.9</b>	<b>2.2</b>	<b>2.1</b>	<b>2.2</b>	<b>2.2</b>	<b>11.6</b>
Wood	3.2	3.2	3.2	3.2	3.1	15.9
Overall 'material specific' recycling	<b>14.7</b>	<b>13.4</b>	<b>11.9</b>	<b>12</b>	<b>11.7</b>	<b>63.5</b>
'General recycling' – paper	3.8	4.0	5.4	5.6	5.6	24.5
'General recycling' - wood	6.2	6.5	8.8	9	9.1	39.6
Energy from Waste	-4.3	-1.9	21.3	19.9	26.0	61.1
<b>Total</b>	<b>20.4</b>	<b>22</b>	<b>47.4</b>	<b>46.5</b>	<b>52.4</b>	<b>188.7</b>

**Discounted PV over 5 years: £188.7m**

## **Costs Option 1: EU**

### Collection costs

*Table A18a: Collection costs of proposed targets compared to the baseline (£m) – Low Scenario*

	2013	2014	2015	2016	2017	<b>Total</b>
Paper	0.0	0.0	0.0	0.0	0.0	<b>0.0</b>
Glass	5.6	5.5	5.4	5.2	5.1	<b>26.8</b>

Alu	0.0	0.0	0.0	0.0	0.0	<b>0.0</b>
Steel	0.0	0.0	0.0	0.0	0.0	<b>0.0</b>
Plastic	4.6	4.6	4.5	4.5	4.4	<b>23</b>
Wood	0.0	0.0	0.0	0.0	0.0	<b>0.0</b>
Overall 'material specific' recycling	<b>6.87</b>	<b>6.78</b>	<b>6.68</b>	<b>6.58</b>	<b>6.49</b>	<b>33.4</b>
'General recycling' – paper and wood	6.35	0.74	9.17	10.04	10.89	37.19
<b>Total</b>	<b>13.22</b>	<b>7.52</b>	<b>15.85</b>	<b>16.62</b>	<b>17.38</b>	<b>70.59</b>

**Discounted PV over 5 years: £70.6m**

Table A18b: Collection costs of proposed targets compared to the baseline (£m) – High Scenario

	<b>2013</b>	<b>2014</b>	<b>2015</b>	<b>2016</b>	<b>2017</b>	<b>Total</b>
Paper	0.0	0.0	0.0	0.0	0.0	<b>0.0</b>
Glass	32.9	32.1	31.4	30.6	29.9	<b>156.9</b>
Alu	1.1	1.1	0.8	0.8	0.8	<b>4.57</b>
Steel	6.7	4.8	3.1	2.9	2.8	<b>20.35</b>
Plastic	10.3	7.4	7.3	7.2	7.1	<b>39.27</b>
Wood	5.9	5.7	5.5	5.4	5.2	<b>27.67</b>
Overall 'material specific' recycling	<b>56.88</b>	<b>51.10</b>	<b>48.04</b>	<b>46.91</b>	<b>45.81</b>	<b>248.8</b>
'General recycling' – paper and wood	22.20	22.67	30.45	30.69	30.92	136.93
<b>Total</b>	<b>79.08</b>	<b>73.77</b>	<b>78.49</b>	<b>77.6</b>	<b>76.73</b>	<b>385.73</b>

**Discounted PV over 5 years: £385.7m**

### Reduction in collection and disposal costs

Table A19a: Savings in landfill disposal resource costs (£m) – Low Scenario

	<b>2013</b>	<b>2014</b>	<b>2015</b>	<b>2016</b>	<b>2017</b>	
Mixed waste collection	6.6	4.3	7.58	7.86	8.13	<b>34.48</b>
Landfill gate fee	3.46	2.25	3.97	4.12	4.26	<b>18.06</b>
	10.06	6.55	11.55	11.98	12.39	<b>52.54</b>

**Discounted PV over 5 years: £52.5m**

Table A19b: Savings in landfill disposal resource costs (£m) – High Scenario

	<b>2013</b>	<b>2014</b>	<b>2015</b>	<b>2016</b>	<b>2017</b>	
Mixed waste collection	31.45	29.34	31.22	30.87	30.52	<b>153.38</b>
Landfill gate fee	16.47	15.36	16.35	16.16	15.98	<b>80.33</b>
	47.92	44.7	47.56	47.03	46.5	<b>233.72</b>

**Discounted PV over 5 years: £233.7m**

### Costs to Business

Table A20a: Low - 2010 averages (January to June) prices for EU minimum obligated tonnage (£,m) Present Value

<b>Material</b>	<b>PRN (£)</b>	<b>2013</b>	<b>2014</b>	<b>2015</b>	<b>2016</b>	<b>2017</b>
Paper	1.50	3.56	3.45	3.35	3.26	3.16
Glass	10.50	16.91	16.51	16.11	15.72	15.34
Aluminium	12.00	0.74	0.68	0.67	0.65	0.63
Steel	6.00	1.91	1.84	1.77	1.70	1.63
Plastic	5.00	2.89	2.86	2.84	2.81	2.78
Wood	1.50	0.31	0.30	0.29	0.28	0.27
'General recycling'*	1.50	1.22	1.21	1.31	1.29	1.27
Energy from Waste	1.00	0.52	0.51	0.50	0.49	0.48
<b>Total</b>		<b>28.06</b>	<b>27.36</b>	<b>26.83</b>	<b>26.19</b>	<b>25.57</b>

\* 'general recycling' is a category used to complement some businesses' material-specific recycling up to their overall 60% target (eg if a business only has a recycling obligation in plastic, the target that applies to plastic being 32%, it has to buy evidence notes in another material to take it to 60%). This shortfall is normally made up by obtaining paper or wood PRNs,

which tend to be the cheapest.

## Option 2a: Higher Targets

### Additional tonnages

Table A21: Impact of higher targets above the EU minimum (tonnages)

	2013	2014	2015	2016	2017
Alu'm	1,562	3,156	4,781	6,438	8,128
Plastic	38,708	79,351	122,003	166,737	213,632
Total material specific additional tonnages	<b>40,270</b>	<b>82,507</b>	<b>126,784</b>	<b>173,176</b>	<b>221,761</b>
'General recycling'*	49,158	4,644	(126,784)	(173,176)	(221,761)
EFW**	-	7,578	0	0	0

\* This quantity depends on the difference between a producer's material specific target and the overall recycling target. Since the material specific targets are increasing and the overall recycling levels are increasing but at a slower rate, a lower proportion comes from this 'general recycling' category. This recycling can come from any material and therefore tends to focus on the materials with the lowest PRN costs (i.e. paper and wood). It is assumed that 50% will come from wood and 50% from paper.

\*\* This depends upon the overall 'recovery' target – the remaining tonnages not going to recycling are allocated to EFW.

## Costs and Benefits

### Benefits Option 2a: Higher targets

#### Material revenues

Table A22: Associated material revenue – additional recycling from higher targets (£m)

	Current price	2013	2014	2015	2016	2017	Total
Alu'm	£985/t	1.44	2.80	4.10	5.34	6.51	<b>20.20</b>
Plastic	£300/t	10.84	21.47	31.90	42.12	52.14	<b>158.46</b>
Total material specific additional tonnages		<b>12.28</b>	<b>24.27</b>	<b>36.00</b>	<b>47.46</b>	<b>58.65</b>	<b>178.66</b>
'General recycling'	£90 for paper; - £12 for wood	£1.79	£0.16	-£4.31	-£5.69	-£7.04	-£15.10
Overall tonnage		<b>£14.07</b>	<b>£24.43</b>	<b>£31.69</b>	<b>£41.77</b>	<b>£51.61</b>	<b>£163.56</b>

Discounted PV over 5 years: £163.6m

### Sensitivity

Lower material prices	Alum: £900/t Plastic: £150/t	£8.52	£13.46	£15.39	£20.25	£24.98	£82.58
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### Greenhouse Gas (GHG) Emissions

The avoided emissions and value of the benefits in greenhouse emission reductions are as set out in the methodology outlined under the section "headline assumptions".

Table A23: Present Value of GHG emissions associated with higher targets (£m, PV)

	2013	2014	2015	2016	2017	Total
Alu'm	0.3	0.6	0.9	1.2	1.5	4.4
Plastic	<b>1.0</b>	<b>2.0</b>	<b>3.0</b>	<b>4.1</b>	<b>5.1</b>	<b>15.2</b>
Total material	<b>1.30</b>	<b>2.60</b>	<b>3.90</b>	<b>5.30</b>	<b>6.60</b>	<b>19.60</b>

<b>specific additional tonnages</b>						
'General recycling'*	2.0	0.2	-4.9	-6.6	-8.2	-17.7
<b>Overall</b>	<b>3.24</b>	<b>2.80</b>	<b>-1.06</b>	<b>-1.35</b>	<b>-1.69</b>	<b>1.9</b>

**Discounted PV over 5 years: £1.9m**

\*50% paper and 50% wood. Reduction in 'general' recycling, as described under additional tonnages, means that the overall effect may not be positive in carbon terms.

## Costs option 2a: Higher Targets

### Collection costs

Table A24: Collection costs (£m)

	2013	2014	2015	2016	2017	Total
Alu'm	0.1	0.3	0.4	0.5	0.6	1.8
Plastic	6.6	13.1	23.9	31.5	39.0	114.1
Total	6.74	13.35	24.23	31.99	39.59	115.9
General recycling*	2.3	0.3	-5.5	-7.2	-8.9	-19
<b>Overall</b>	<b>9.04</b>	<b>13.65</b>	<b>18.73</b>	<b>24.79</b>	<b>30.69</b>	<b>96.9</b>

**Discounted PV over 5 years: £96.9m**

\*(50% paper; 50% wood)

### Sensitivity

	2013	2014	2015	2016	2017	Total
Low costs for aluminium and plastic (-10%)	8.4	12.3	16.3	21.6	26.7	85.3
High costs for aluminium and plastic (+10%)	9.7	15	20.9	28	34.7	108.5

### Reduction in collection and disposal costs

Table A25: Savings in landfill disposal resource costs (£m)

	2013	2014	2015	2016	2017	Total
Collection	3.18	2.99	0	0	0	6.17
Landfill gate fees	1.66	1.57	0	0	0	3.23
Total	4.84	4.56	0	0	0	9.4

**Discounted PV over 5 years: £9.4m**

Note that the reduction in 'general recycling' cancels out the increase in material specific recycling in the final years, resulting in no reduction in residual collection and disposal costs.

## Option 2a: Costs to Business

Table A26: Additional costs of PRNs on additional tonnages (note increase in PRN due to higher targets)  
PV (£,m)

Material	Assumed PRN under option or increase in PRN (£)	2013	2014	2015	2016	2017
Aluminium additional tonnes	30.00	0.04	0.09	0.12	0.16	0.20
Aluminium tonnes to EU min	Increase in PRN of £18 for tonnes up to EU min	1.05	1.02	1.00	0.98	0.95
Plastic additional tonnes	20.00	0.72	1.43	2.13	2.81	3.48

Plastic tonnes to EU min	Increase in PRN of £15 for tonnes up to EU min	8.67	8.59	8.51	8.42	8.34
General recycling	£1.50	0.07	0.01	-0.17	-0.22	-0.27
Energy from waste	£1.00	-0.15	0.0	0.0	0.0	0.0
<b>Total</b>		<b>10.4</b>	<b>11.14</b>	<b>11.59</b>	<b>12.15</b>	<b>12.7</b>

Total Discounted PV over 5 years: £58.0m

## Option 2b: Responsibility Deal

Table A27a: Current split for recycled for Aluminium (tonnes)

Aluminium	2013	2014	2015	2016	2017
Top 30 obligated tonnage (75%)	44,713	45,161	45,612	46,068	46,529
Remaining companies (25%)	15,295	15,448	15,602	15,758	15,916

Table A27b: Current split for recycled for Plastics (tonnes)

Plastics	2013	2014	2015	2016	2017
Top 30 obligated tonnage (42%)	263,592	270,182	276,936	292,730	300,049
Remaining companies (58)	358,318	367,276	376,458	397,927	407,876

Table A28a: Achievement from PRD to deliver levels of recycling matching higher targets for Aluminium

Aluminium	2013	2014	2015	2016	2017
Higher Target	43%	46%	49%	52%	55%
Additional tonnage required	1,562	3,156	4,781	6,438	8,128
% rise in tonnage recycled	3%	7%	10%	14%	17%
Relative to 2010 levels	13%	9%	13%	18%	23%

Table A28b: Achievement from PRD to deliver levels of recycling matching higher targets for Plastics

Plastics	2013	2014	2015	2016	2017
Higher Targets	37%	42%	47%	52%	57%
Additional tonnage required	38,708	79,351	122,003	166,737	213,632
% rise in recycled tonnage	15%	29%	44%	57%	71%
Relative to 2010 levels	23%	48%	74%	100%	129%

### For costs and benefits, see option 3b.

The only differences between 2b and 3b are:

- The outcomes and costs and benefits of a voluntary responsibility deal are compared to regulatory and other options **for achieving different targets**.
- This means that 3b includes steel (compared to an option including steel) and 2b does not include steel in the responsibility deal.

## Option 3a: Higher targets for aluminium, plastic, steel, split target for glass

### Additional tonnages

Table A29: Additional tonnages recycled above EU minimum

Material	2013	2014	2015	2016	2017
Glass (aggregates)	-	17,429	35,207	53,339	89,788

Glass (remelt)	-	17,429	35,207	53,339	89,788
Alu'm	4,687	9,467	14,343	19,315	24,385
Steel	4,813	9,577	14,293	18,963	23,585
Plastic	96,770	198,379	305,007	416,843	534,081
Total material specific tonnages	<b>106,269</b>	<b>217,423</b>	<b>333,644</b>	<b>455,121</b>	<b>582,050</b>
'General recycling'	16,841	43,120	157,617	188,450	222,922
Energy from Waste	7,504	15,156	15,306	23,189	31,229

## Costs and Benefits

Costs and benefits both with and without the split glass target are shown

### Benefits Option 3a: Higher targets

#### Material revenues

Table A30: Present value of material revenues (£m)

	Current material prices	2013	2014	2015	2016	2017	Total
Glass (change to remelt)	Difference of £19	0.0	0.3	0.6	0.9	1.4	3.1
Alu'm	£985	4.3	8.4	12.3	16.0	19.5	60.6
Steel	£175	0.8	1.5	2.2	2.8	3.4	10.6
Plastic	£300	27.1	53.7	79.7	105.3	130.3	396.2
Total material specific		32.20	63.52	94.08	123.88	152.87	<b>466.55</b>
General recycling	£90 for paper; - £12 for wood	-0.62	-1.52	-5.36	-6.19	-7.07	-20.74
<b>Total</b>		<b>31.58</b>	<b>62</b>	<b>88.72</b>	<b>117.69</b>	<b>145.8</b>	<b>445.81</b>
<b>Without glass</b>		<b>31.58</b>	<b>61.68</b>	<b>88.14</b>	<b>116.81</b>	<b>144.43</b>	<b>442.76</b>

Discounted PV over 5 years: £445.8m with glass; £442.8m without glass

#### Sensitivity

Lower material prices	Alum: £900/t Plastic: £150/t	17.28	33.78	46.84	62.51	77.53	237.96
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#### GHG savings

Table A31: Present value of GHG savings (£m)

	2013	2014	2015	2016	2017	Total
Glass (change to remelt)	0.0	0.1	0.1	0.2	0.3	0.8
Alu'm	0.9	1.8	2.6	3.6	4.4	13.3
Steel	0.2	0.3	0.5	0.7	0.8	2.5
Plastic	2.4	5.0	7.5	10.3	12.7	38.0
Total material specific	3.5	7.2	10.7	14.8	18.2	54.6
General recycling	-0.7	-1.8	-6.1	-7.3	-8.3	-24.1

<b>Total</b>	<b>2.8</b>	<b>5.4</b>	<b>4.6</b>	<b>7.5</b>	<b>9.9</b>	<b>30.5</b>
<b>Without Glass</b>	<b>2.8</b>	<b>5.3</b>	<b>4.5</b>	<b>7.3</b>	<b>9.6</b>	<b>29.7</b>

**Discounted PV over 5 years: £30.5m with glass; £29.7m without glass**

### Costs Option 3a: Higher targets

#### Collection costs

Table A32: Present value of collection costs (£m)

	<b>2013</b>	<b>2014</b>	<b>2015</b>	<b>2016</b>	<b>2017</b>	<b>Total</b>
Glass (change to remelt)	0.0	0.6	1.1	1.6	2.6	5.9
Alu'm	0.4	0.8	1.1	1.5	1.8	5.5
Steel	0.1	0.2	0.3	0.4	0.5	1.5
Plastic	16.5	32.7	59.6	78.8	97.5	285.2
Total material specific	17.03	34.28	62.18	82.22	102.37	<b>298.1</b>
General recycling	-0.8	-1.9	-6.8	-7.8	-8.9	-26.2
<b>Total</b>	<b>16.23</b>	<b>32.38</b>	<b>55.38</b>	<b>74.42</b>	<b>93.47</b>	<b>271.9</b>
<b>Without glass</b>	<b>16.23</b>	<b>31.82</b>	<b>54.28</b>	<b>72.82</b>	<b>90.86</b>	<b>266</b>

**Discounted PV over 5 years: £271.9m with glass; £266m without glass**

**Sensitivity of +/- 10%: £262m - £321m with glass; £268 - £328m without glass**

#### Resource savings

Table A33: Present value of resource savings (£m)

	<b>2013</b>	<b>2014</b>	<b>2015</b>	<b>2016</b>	<b>2017</b>	<b>Total</b>
Reduction in collection	3.18	5.98	5.84	8.54	11.12	<b>34.66</b>
Reduction in landfill gate fee	1.66	3.13	3.06	4.47	5.82	<b>18.15</b>
<b>Total</b>	<b>4.84</b>	<b>9.12</b>	<b>8.89</b>	<b>13.02</b>	<b>16.94</b>	<b>52.81</b>

**Discounted PV over 5 years: £52.8m**

(same figures without glass, since same tonnages)

### Cost to Business Option 3a: Higher targets

Table A34: PV of Additional costs of PRNs: Higher PRN values and additional tonnage, all in PV

This incorporates the increase in PRN prices on tonnages up to the EU minimum as well as the full PRN price on the additional tonnages.

<b>Material</b>	<b>Assumed PRN or change in PRN (£)</b>	<b>2013</b>	<b>2014</b>	<b>2015</b>	<b>2016</b>	<b>2017</b>
Aluminium additional tonnes	30.00	0.13	0.26	0.37	0.49	0.60
Aluminium tonnes to EUmin	Increase in PRN of £18 for tonnes up to EU min	1.05	1.05	1.02	1.00	0.98
Plastic additional tonnes	20.00	1.81	3.58	5.32	7.02	8.69
Plastic tonnes to EUmin	Increase in PRN of £15 for tonnes up to EU min	8.67	8.67	8.59	8.51	8.42
Steel additional tonnes	15.00	0.07	0.13	0.19	0.24	0.29
Steel tonnes to EUmin	Increase in PRN of £9 for tonnes up to the EU min		2.87	2.76	2.65	2.55
Glass tonnes to EU min	Increase in PRN of 11.5 for tonnes up to the EU minimum	18.53	18.08	17.64	17.22	16.80

General recycling	£1.50	-0.02	-0.06	-0.21	-0.24	-0.27
Energy from waste	£1.00	0.01	0.01	0.01	0.02	0.03
<b>Total</b>		<b>30.25</b>	<b>34.59</b>	<b>35.69</b>	<b>36.91</b>	<b>38.09</b>

**Present value over the 5 year period: Total of £175.53**

## Option 3b

### Background tables

Table A27c: Current split for recycled for Steel (tonnes)

Steel	2013	2014	2015	2016	2017
<b>Top 30 obligated tonnage (60%)</b>	206,279	205,247	204,221	203,200	202,184
<b>Remaining companies (40%)</b>	137,519	136,831	136,147	135,467	134,789

Table A35a: Achievement from PRD to deliver levels of recycling matching higher targets for Aluminium

Aluminium	2013	2014	2015	2016	2017
<b>Higher Target</b>	43%	46%	49%	52%	55%
<b>Additional tonnage required</b>	4,687	9,467	14,343	19,315	24,385
<b>% rise in tonnage recycled</b>	10%	21%	31%	42%	52%
<b>Relative to 2010 levels</b>	<b>13%</b>	<b>26%</b>	<b>40%</b>	<b>53%</b>	<b>68%</b>

Table A35b: Achievement from PRD to deliver levels of recycling matching higher targets for Plastics

Plastics	2013	2014	2015	2016	2017
<b>Higher Targets</b>	37%	42%	47%	52%	57%
<b>Additional tonnage required</b>	96,770	198,379	305,007	416,843	534,081
<b>% rise in recycled tonnage</b>	37%	73%	110%	142%	178%
<b>Relative to 2010 levels</b>	<b>58%</b>	<b>120%</b>	<b>184%</b>	<b>251%</b>	<b>322%</b>

Table A35c: Achievement from PRD to deliver levels of recycling matching targets for Steel

Steel	2013	2014	2015	2016	2017
<b>Higher Targets</b>	72%	73%	74%	75%	76%
<b>Additional tonnage required</b>	4,813	9,577	14,293	18,963	23,585
<b>% rise in recycled tonnage</b>	2%	5%	7%	9%	12%
<b>Relative to 2010 levels</b>	<b>3%</b>	<b>6%</b>	<b>8%</b>	<b>11%</b>	<b>14%</b>

### Additional tonnages

Table A36: Tonnages above the EU minimum: 5% and 10% annual levels of responsibility deal

	2013	2014	2015	2016	2017	Total
Aluminium 5% per annum PRD	2,236	2,258	2,281	2,303	2,326	11,404
10% per annum PRD	4,471	4,516	4,561	4,607	4,653	22,808
Steel (not included in 2b) 5% per annum PRD	10,314	10,262	10,211	10,160	10,109	51,056
10% per annum	20,628	20,525	20,422	20,320	20,218	102,113



PRD						
Plastic 5% per annum PRD	13,180	13,509	13,847	14,637	15,002	70,175
10% per annum PRD	26,359	27,018	27,694	29,273	30,005	140,349

## Costs and Benefits

### Benefits of option 2b and 3b: Responsibility Deal

#### Material revenues

Table A37: Associated material revenue (£m)

PRD	Material	2013	2014	2015	2016	2017	Total
5% increase per annum	Aluminium	2.06	2.01	1.96	1.91	1.86	<b>9.79</b>
	Steel	1.68	1.62	1.56	1.50	1.44	<b>7.80</b>
	Plastic	3.69	3.66	3.62	3.70	3.66	<b>18.32</b>
	Total w/out steel (option 2b)	<b>5.75</b>	<b>5.66</b>	<b>5.58</b>	<b>5.61</b>	<b>5.53</b>	<b>28.12</b>
	Total with steel (option 3b)	<b>7.43</b>	<b>7.28</b>	<b>7.14</b>	<b>7.10</b>	<b>6.96</b>	<b>35.92</b>
10% Increase per annum	Aluminium	4.11	4.01	3.92	3.82	3.73	<b>19.59</b>
	Steel	3.37	3.24	3.11	2.99	2.88	<b>15.60</b>
	Plastic	7.38	7.31	7.24	7.39	7.32	<b>36.65</b>
	Total w/out steel (option 2b)	<b>11.49</b>	<b>11.32</b>	<b>11.16</b>	<b>11.21</b>	<b>11.05</b>	<b>56.24</b>
	Total with steel (option 3b)	<b>14.86</b>	<b>14.56</b>	<b>14.27</b>	<b>14.21</b>	<b>13.93</b>	<b>71.83</b>

**Discounted PV over 5 years: £ 36m-£72m with steel; £28m-£56m without steel**

#### Greenhouse Gas (GHG) Emissions

The avoided emissions and value of the benefits in greenhouse emission reductions are as set out using the additional volumes in Table 19 and the methodology outlined in the section "headline assumptions".

Table A38: Present value of the GHG savings from increased recycling above 2010 levels (£m)

PRD	Material	2013	2014	2015	2016	2017	Total
5% increase per annum	Aluminium	0.4	0.4	0.4	0.4	0.4	2.1
	Steel	0.4	0.4	0.4	0.4	0.3	1.8
	Plastic	<b>0.3</b>	<b>0.3</b>	<b>0.3</b>	<b>0.4</b>	<b>0.4</b>	<b>1.7</b>
	Total w/out steel (option 2b)	0.7	0.7	0.7	0.8	0.8	<b>3.7</b>
	Total with steel (option 3b)	1.1	1.1	1.1	1.2	1.1	<b>5.6</b>
10% Increase per annum	Aluminium	0.8	0.9	0.8	0.9	0.8	4.2
	Steel	0.7	0.7	0.7	0.7	0.7	3.6
	Plastic	<b>0.7</b>	<b>0.7</b>	<b>0.7</b>	<b>0.7</b>	<b>0.7</b>	<b>3.5</b>
	Total w/out steel (option 2b)	<b>1.5</b>	<b>1.6</b>	<b>1.5</b>	<b>1.6</b>	<b>1.5</b>	<b>7.7</b>
	Total with steel (option 3b)	<b>2.2</b>	<b>2.3</b>	<b>2.2</b>	<b>2.3</b>	<b>2.2</b>	<b>11.2</b>

**Discounted PV over 5 years: £5.6-£11.2m with steel; £3.7-£7.7m without steel**

## Costs of Option 2b and 3b: Producer Responsibility Deals

Under this option, given that the additional tonnage recycled is marginal, the analysis continues to use the cost figures for the EU minimum.

### Collection Costs

Table A39: Collection costs (£m)

PRD	Material	2013	2014	2015	2016	2017	Total
5% increase per annum	Aluminium	0.2	0.2	0.2	0.2	0.2	0.95
	Steel	0.9	0.9	0.9	0.8	0.8	4.26
	Plastic	1.2	1.2	1.2	1.2	1.2	5.84
	Total w/out steel (option 2b)	1.38	1.36	1.34	1.36	1.35	<b>6.79</b>
	Total with steel (option 3b)	2.30	2.24	2.19	2.18	2.13	<b>11.05</b>
10% Increase per annum	Aluminium	0.4	0.4	0.4	0.4	0.4	1.90
	Steel	1.8	1.8	1.7	1.6	1.6	8.52
	Plastic	2.4	2.3	2.3	2.4	2.3	11.67
	Total w/out steel (option 2b)	2.75	2.72	2.69	2.73	2.69	<b>13.58</b>
	Total with steel (option 3b)	4.59	4.49	4.39	4.36	4.27	<b>22.09</b>

**Discounted PV over 5 years: £11.1m-£22.1m with steel; £6.8m-£13.6m without steel**

### Resource savings

Table A40: Savings in landfill disposal resource costs (£m)

PRD	Material	2013	2014	2015	2016	2017	Total
5% increase per annum	Total w/out steel (option 2b)	0.83	0.82	0.81	0.83	0.82	<b>4.12</b>
	Total with steel (option 3b)	1.39	1.36	1.33	1.32	1.29	<b>6.70</b>
10% increase per annum	Total w/out steel (option 2b)	1.67	1.65	1.63	1.65	1.63	<b>8.24</b>
	Total with steel (option 3b)	2.79	2.72	2.66	2.65	2.59	<b>13.40</b>

**Discounted PV over 5 years: £6.7m-£13.4m with steel; £4.1m-£8.2m without steel**

## Option 3c

### Additional tonnages

Table A41: Additional tonnages recycled by DRS (t)

	2013	2014	2015	2016	2017
Glass	420,000	420,000	420,000	420,000	420,000
Aluminium	64,000	64,000	64,000	64,000	64,000
Steel	98,000	98,000	98,000	98,000	98,000
Plastic	192,000	192,000	192,000	192,000	192,000
<b>Total</b>	<b>773,000</b>	<b>773,000</b>	<b>773,000</b>	<b>773,000</b>	<b>773,000</b>

Source: Table A-34: Recovery Rates and Additional Material Recycled (thousand tonnes)

Table A21: Carbon benefits of tonnages diverted from landfill (Defra calculations, carbon benefits per tonne of material displaced from landfill to recycling, consistent with other options for comparison):

	2013	2014	2015	2016	2017	Total
Value of carbon	<b>20.38</b>	<b>20.59</b>	<b>19.89</b>	<b>20.05</b>	<b>19.38</b>	<b>100.3</b>

benefits (£,m)						
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Avoided disposal (£,m)

	GHG unit	AQ unit	Total	Tonnes recycled	Benefit if recycling (GHG+ AQ) (Annual £,m)
Glass Bottles	£13	£10	<b>£24.00</b>	420,000	£10.08
PET Bottles	£62	£53	<b>£116</b>	192,000	£22.27
Cans (Fe.)	£64	£51	<b>£24*</b>	98,000	£2.35
Cans (Al.)	£430	£333	<b>£764</b>	64,000	£48.90
				Totals	<b>£83.60</b>

Table 17 illustrates the environmental benefits associated with the additional recycling that occurs due to the DRS; £84m is the annual emissions savings figure used in the Eunomia modelling, whereas this

figure would be reduced to £51m if the modelling were only to consider GHG emissions.

Table A22: Eunomia modelling – Annual Recycling Impacts for GHGs and Air Emissions for Parallel DRS

Material	Unit Impacts	25% Efw	Reduction in Disposal, kt	Savings £m
Glass	£1	£0.37	-375	£0.14
Plastics	£117	£29.24	-186	£5.45
Fe.	£1	£0.37	-94	£0.04
Al.	£1	£0.37	-62	£0.02
<b>Total</b>				<b>£5.65</b>

\* Unit impact differs to final figures from Table A-35 for ferrous metal

Table A23: Eunomia modelling – Annual Benefits from Containers being Diverted away from Disposal and into Parallel DRS (£,m)

## Annex 6: Key principles of Depository Refund Scheme

- As beverages are produced and sold to wholesalers, or directly to retailers, producers send sales data to a central system along with a payment matching the total value of the deposits on all items sold. The cost of the deposits is then paid back to the producers, by wholesalers or retailers, upon sale. The same happens as wholesalers sell items to retailers. Producers also pay an administration fee to cover the remaining costs of the system. This is set each year to reflect market prices of recyclate, amongst other factors;
- When the consumer purchases a beverage they pay the deposit to the retailer, so the retailers are also reimbursed the total value of deposits;
- As consumers return empty containers to stores or other take-back centres, the deposit is paid to them by the retailer. This puts the retailer out of pocket, so the retailer then sends the returns data to the central system, which then reimburses the retailer for those returned containers for which a deposit has been paid out to the consumer. Thus the circle of deposit payments is closed. As the return rate for containers is not 100%, the unclaimed deposits result in revenue being retained by the system, which can be used to fund its operation.
- In addition to the deposit, the central system pays a handling fee to the retailer for each returned container, the intention being to compensate the retailer for loss of space (storage requirements) and time (in processing the deposit and taking back the containers). Handling fees are reviewed and adjusted each year;
- Returned empty containers are collected in a number of ways. Automated systems of collection use reverse vending machines or automated counting machines. Manual collection is also possible. In this instance the retailer accepts the container, over the counter, and stores it in bags or crates within the store/outlet for transport;
- 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. This differs to the typical systems employed in countries such as Sweden and Canada, where collections occur at a small number of redemption centres rather than at every retail outlet. We believe that in order to maximize return rates and to remove the need for consumers to travel individually make their way to redemption centres to return their containers, a denser network of collection points would be more appropriate for the UK, and would eliminate additional environmental impacts which might arise from making 'dedicated journeys' to redemption centres. Thus we have modelled the system based on a higher number of collection points via both automated and manual methods of collection, similar to systems used in Norway and Denmark. Material revenues will also be paid on those containers that are collected manually, though this material will first have to be transported to a dedicated centre for counting, sorting and compacting, before it can be hauled on to a recycling facility. These costs are met by the central system;
- The central system is the focal point for the flow of information regarding container sales and finance for the whole DRS. A significant one-off cost will be required to initially set up the DRS, including all the necessary administrative support, which we have modelled as being met by 'one-off' producer and retailer joining fees. There will also be on-going costs associated with administering the system which are covered as part of the producer administration fee paid on each unit 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 the DRS is 'cost neutral' overall.

## Annex 7: Breakdown in costs of Deposit Refund System to Producers

The saving to producers is equal to the retailer and admin cost minus the material revenue from sales and unclaimed deposits.

### Retailers Cost

The cost of handling the containers at retail outlets is equal to **£561m** though this is then compensated by the central system. There are two main collection systems the analysis models; 36,000 outlets setting up reverse vending machines (RVMs) and the remaining 150,000 undertaking manual container take-back. Section A.3.2 of the report outlines the determination of these costs however for ease of reading, the table below summarises these costs.

Table A4-1: Breakdown of the costs involved in setting up RVM or manual container take back

<b>Retail Space Infringement Costs (£m)</b>	<b>£166</b>
Rvm store costs	£65
Manual take back store costs	£101
<b>Labour Costs</b>	<b>£217</b>
Customer take back via RVMs	£34
Manual customer take back	£102
Customer take back from retailers outside of deposit system	£19
Container collection	£13
Logistic container costs	£49
<b>Transport costs</b>	<b>£178</b>
Plastics and Cans	£3
Glass	£9
Dedicated collection rounds	£152
Transporting cleared and compacted containers to reprocessors	£14
<b><u>Total Calculated Handling Fees</u></b>	<b><u>£561</u></b>
Retailers using automated machine	£358
Retailers undertaking manual take back	£203

### Costs of Central System

There is limited information on this cost therefore it is difficult to remodel the estimates based on the information in the annex.

### Revenue from lost deposits

Using a combination of Table 25 and 26, it is possible to calculate the value of unclaimed deposits, and hence revenue to producers from introducing the scheme.

Table A4-2: Revenue in the form of unclaimed deposits to Producers (£m)

	Deposit price	Total Containers sold	Pay deposit for each sold container (£m)	Total Containers Returned	Deposit for container returned (£m)
<b>Glass ≤0.5 l</b>	0.15	3204	£481	2540	£381
<b>Glass &gt;0.5 l</b>	0.30	2701	£810	2141	£642
		5905		4681	
<b>PET ≤ 0.5 l</b>	0.15	4239	£636	3573	£536

<b>PET &gt; 0.5 l</b>	0.30	4607	£1,382	3883	£1,165
		8846		7456	
<b>Cans (Fe.)</b>	0.15	5717	£858	4661	£699
<b>Cans (Al)</b>	0.15	7271	£1,091	5928	£889
<b>Total</b>		<b>27739</b>	<b>£5,257</b>	<b>22726</b>	<b>£4,313</b>
<b>Unclaimed Deposits</b>					<b>£944m</b>

### *Income from Material Sales*

Table A-21 in the Eunomia report provides “Average weight per Container Type” and applying this to Table 24 provides an approximation of the tonnage and corresponding material revenue. Section A.3.4 of the report states the difference in price from retrieving the material from the deposit refund scheme and the results are outlined in the table as follows.

*Table A4-3: Income from material sale (£m)*

<b>Material</b>	<b>Material Price per tonne</b>	<b>Tonnage</b>	<b>Material Revenue (£m)</b>
Glass	£12	1,832,500	£22.0
PET ≤ 0.5 l	£220	293,385	£64.5
Cans (Fe.)	£66	163,135	£10.8
Cans (Al)	£900	100,776	£90.7
<b>Total</b>		<b>2,389,796</b>	<b>£188</b>