

Title: Reforming the packaging producer responsibility system in the United Kingdom IA No: RPC Reference No: Lead department or agency: Department for Environment, Food and Rural Affairs (Defra) Other departments or agencies:	Impact Assessment (IA)			
	Date: 14/02/2019			
	Stage: Consultation			
	Source of intervention: Domestic			
	Type of measure: Primary legislation			
Contact for enquiries: Ladislav Tvaruzek, Zack Ollerton				

Summary: Intervention and Options	RPC Opinion: RPC Opinion Status
--	--

Cost of Preferred (or more likely) Option

Total Net Present Value	Business Net Present Value	Net cost to business per year (EANDCB in 2014 prices)	One-In, Three-Out	Business Impact Target Status
£245m	-£7,384m	£626m	Not in scope	Qualifying provision

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

The current packaging producer responsibility system is over 20 years old. Whilst it has enabled the UK to meet its EU recycling targets and kept the cost of compliance to business low, it provides little incentive for producers to design for greater re-use or recyclability. At the same time, demand for collected materials is not being stimulated sufficiently, local authorities receive limited financial support for collections, and many people continue to be confused over what packaging can and can't be recycled. There are concerns around the transparency of the current system and that there is not a level playing field for domestic reprocessing. Contrary to polluter pays principle, a range of environmental externalities (e.g. carbon emissions and disamenity impacts from littering) are not fully accounted for in producers' decisions. Without government intervention these problems will persist.

What are the policy objectives and the intended effects?

The objective is to reform the current packaging producer responsibility system to deliver Government's ambitious aims, including zero avoidable plastic waste and doubling resource efficiency by 2042, through the application of Extended Producer Responsibility (EPR) principles. The reformed regulations should incentivise recyclability and recycled content by rewarding/penalising good/poor design. Money raised through the system should fund better recycling collections, domestic recycling infrastructure and services under clear conditions that deliver overall system savings. Consumers should find it easier to recycle, and monitoring and enforcement of existing export regulation will be tightened.

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

One regulatory option was considered and three scenarios for this option have been analysed. A non-regulatory option was not appraised as there are existing regulations in place, deriving from EU requirements. The current regulations need reforming to meet government ambitions for higher packaging recycling rates and drive the use of more recyclable packaging. Regulations are required to create a level playing field where all obligated producers are part of the system. The IA represents an initial and partial assessment of the possible impacts of a reformed packaging producer responsibility scheme. It illustrates how a reformed system would work. It is partial because at this current time evidence is only available to assess the expected change in packaging use for two key materials: Polyvinyl Chloride (PVC) and polystyrene. The EPR packaging reform option introduces modulated, full-net cost fees for producers. This is assumed to incentivise the correct behaviours to deliver the policy objectives. This option is then tested against the backdrop of the implementation of a Deposit Return Scheme and whether it is 'all-in' or 'on-the-go'. This fundamentally affects the packaging material eligible under a packaging producer responsibility scheme and how these materials are collected for recycling.

Baseline - Do Nothing - do not reform the packaging regulations but implement the changes in municipal recycling collections as set out in the Consistent municipal recycling collections IA.

Scenario 1 – Reform the packaging producer responsibility system towards full net costs covered by packaging producers and introduce modulated fees or differentiated deposit rates on packaging (presented on the summary sheet).

Scenario 2 – As Scenario 1. In addition, exclude the 'all-in' Deposit Return Scheme (DRS) packaging materials from kerbside collections.

Scenario 3 – As Scenario 1 but exclude the 'on-the-go' DRS packaging materials from kerbside collections.

The exact detail on the governance model is still to be decided – possible governance models are detailed below.

Does implementation go beyond minimum EU requirements?	No			
Are any of these organisations in scope?	Micro Yes	Small Yes	Medium Yes	Large Yes
What is the CO ₂ equivalent change in greenhouse gas emissions? (Million tonnes CO ₂ equivalent)	Traded: -0.9Mt		Non-traded: -0.5Mt	

Will the policy be reviewed? It will be reviewed. **If applicable, set review date:** December 2025

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

Scenario 1: EPR without a DRS

Description: Reform the packaging producer responsibility system and introduce modulated fees without the DRS.

FULL ECONOMIC ASSESSMENT

Price Base Year 2017	PV Base Year 2023	Time Period Years 10	Net Benefit (Present Value (PV)) (£m)		
			Low: -£3,133m	High: £3,597m	Best Estimate: £245m
COSTS (£m)		Total Transition (Constant Price) Years	Average Annual (excl. Transition) (Constant Price)	Total Cost (Present Value)	
Low		0	£1,288 m	£11,075m	
High			£1,681m	£14,374m	
Best Estimate			£1,409m	£12,097m	
<p>Description and scale of key monetised costs by 'main affected groups'</p> <p>Administrative costs of running a Producer Responsibility Management Organisation (£25m). Landfill tax loss to HM Government (£17m). Full net costs¹ to packaging producers of covering the management of municipal packaging recycling and waste, paid to Local Authorities (£8,128m) and wider municipal sector (£3,157m). Loss of PRN income to current compliance system beneficiaries (£769m). All values are discounted over the appraised period.</p>					
<p>Other key non-monetised costs by 'main affected groups'</p> <p>Cost to government and also to business of transitioning to the new regulations (IT systems, staff training etc.). Cost to businesses from any change to the definition of who is obligated. Potential price impacts on consumers. Possible loss of business to compliance schemes.</p>					
BENEFITS (£m)		Total Transition (Constant Price) Years	Average Annual (excl. Transition) (Constant Price)	Total Benefit (Present Value)	
Low		0	£1,307m	£11,241m	
High			£1,716m	£14,672m	
Best Estimate			£1,438m	£12,342m	
<p>Description and scale of key monetised benefits by 'main affected groups'</p> <p>Reduced cost of collection, sorting & treatment of packaging recycling to LAs and wider municipal sector (£20m). Additional material revenue sales by reprocessing and recycling industry (£74m). Avoided residual disposal costs from diverting packaging waste from incineration and landfill treatment into recycling, including landfill tax savings (£117m). Avoided greenhouse gas emissions from diverting waste from landfill and energy-from-waste to recycling (£77m). Savings to LAs (£8,128m) and wider municipal sector (£3,157m) from reduced packaging collection and treatment costs (costs are paid by packaging producers – see above). Avoided PRN compliance costs by packaging producers (£769m). All values are discounted.</p>					
<p>Other key non-monetised benefits by 'main affected groups'</p> <p>A more vibrant domestic reprocessing market. Benefits to the environment from reduction of the use of virgin materials, of waste going to landfill and energy-from-waste, and of littering Benefits to consumers of clearer recyclability labelling and communication campaigns. There are also several system-wide benefits including increased transparency in the system.</p>					
Key assumptions/sensitivities/risks				Discount rate (%)	3.5%
<p>There is a risk that the level of packaging placed on market (POM) could be higher than currently estimated, affecting estimated recycling rates and sectoral costs. The high estimate assumes a high growth rate in the packaging POM to reflect this uncertainty. Further, evidence on the collection costs in non-household municipal (NHM) and commercial and industrial (C&I) sectors is limited. Material prices and the landfill tax are assumed to be constant. The analysis is sensitive to the growth of packaging placed on the market (POM); assumed baseline, POM split between Household, NHM, C&I; material revenues and carbon prices.</p>					

BUSINESS ASSESSMENT (Scenario 2)

Direct impact on business (Equivalent Annual) £m:			Score for Business Impact Target (qualifying provisions only) £m:
Costs: £958m	Benefits: £333m	Net: -£626m	£3,128m

¹ Full net costs consist of LAs gross costs of packaging of £9,587m and material revenue of -£1,459m.

Summary: Analysis & Evidence Scenario 2: EPR with a DRS 'All-in'

Description: Reform the packaging producer responsibility system, introduce modulated fees, and exclude 'All-in' DRS type packaging from kerbside collection.

FULL ECONOMIC ASSESSMENT

Price Base Year 2017	PV Base Year 2023	Time Period Years 10	Net Benefit (Present Value (PV)) (£m)		
			Low: -£4,390m	High: £3,958m	Best Estimate: -£243m
COSTS (£m)		Total Transition (Constant Price) Years	Average Annual (excl. Transition) (Constant Price)	Total Cost (Present Value)	
Low		0	£1,233m	£10,613m	
High			£1,772m	£15,128m	
Best Estimate			£1,403m	£12,041m	
<p>Description and scale of key monetised costs by 'main affected groups'</p> <p>Additional net cost of collection, sorting and treatment of packaging recycling to Local Authorities and non-household municipal sector (£87m). Additional administrative costs of running a Producer Responsibility Organisation to monitor and enforce the reformed packaging producer responsibility system (£25m). Landfill tax loss to HM Government (£91m). Full net costs² to packaging producers of covering the management of municipal packaging recycling and waste (transfer from Local Authorities (£8,166m) and wider municipal sector of (£2,113m). Reduced material revenue sales by reprocessing and recycling industry from LAs and wider municipal kerbside collections (diverted to DRS) (£790m). Loss of PRN income to current compliance system beneficiaries (£769m). All values are discounted over the appraised period.</p>					
<p>Other key non-monetised costs by 'main affected groups'</p> <p>Cost to government and also to business of transitioning to the new regulations (IT systems, staff training etc.). Cost to businesses from any change to the definition of who is obligated. Price increases for consumers. Possible loss of business to compliance schemes. Cost associated with the loss of the PRN market under governance model 2. Any costs associated with the packaging collected under the Deposit Return Scheme are excluded.</p>					
BENEFITS (£m)		Total Transition (Constant Price) Years	Average Annual (excl. Transition) (Constant Price)	Total Benefit (Present Value)	
Low		0	£1,249m	£10,738m	
High			£1,704m	£14,571m	
Best Estimate			£1,375m	£11,798m	
<p>Description and scale of key monetised benefits by 'main affected groups'</p> <p>Avoided residual disposal costs from diverting packaging waste from incineration and landfill treatment into recycling, including landfill tax savings (£673m). Savings to LAs (£8,166m) and wider municipal sector (£2,113m) from reduced packaging collection and treatment costs (transfer to packaging producers). Avoided greenhouse gas emissions from diverting waste from landfill and energy-from-waste to recycling (£77m). Avoided PRN compliance costs by packaging producers (£769m). All values are discounted.</p>					
<p>Other key non-monetised benefits by 'main affected groups'</p> <p>A more vibrant domestic reprocessing market. Benefits to the environment from reduction of the use of virgin materials, of waste going to landfill and energy-from-waste, and of littering. Benefits to consumers of clearer recyclability labelling and communication campaigns. There are also several system-wide benefits including increased transparency in the system. <u>Any benefits associated with the packaging collected under the Deposit Return Scheme are excluded.</u></p>					
Key assumptions/sensitivities/risks				Discount rate (%)	3.5%
<p>There is a risk that the level of packaging placed on market (POM) could be higher than currently estimated, affecting estimated recycling rates and sectoral costs. The high estimate assumes a high growth rate in the packaging POM to reflect this uncertainty. Further, evidence on the collection costs in non-household municipal (NHM) and commercial and industrial (C&I) sectors is limited. Material prices and the landfill tax are assumed to be constant. The analysis is sensitive to the growth of packaging placed on the market (POM); assumed baseline, POM split between Household, NHM, C&I; material revenues and carbon prices.</p>					

BUSINESS ASSESSMENT (Scenario 2)

Direct impact on business (Equivalent Annual) £m:			Score for Business Impact Target (qualifying provisions only) £m:	
Costs: £873m	Benefits: £244m	Net: -£629m	£3,144m	

² Full net costs consist of LAs gross costs of packaging of £9,411m and material revenue of -£1,245m.

Summary: Analysis & Evidence

Scenario 3: EPR with a DRS 'OTG'

Description: Reform the packaging producer responsibility system, introduce modulated fees, and exclude on-the-go DRS type packaging from kerbside collection.

FULL ECONOMIC ASSESSMENT

Price Base Year 2017	PV Base Year 2023	Time Period Years 10	Net Benefit (Present Value (PV)) (£m)		
			Low: -£3,603m	High: £3,348m	Best Estimate: £187m
COSTS (£m)		Total Transition (Constant Price) Years	Average Annual (excl. Transition) (Constant Price)	Total Cost (Present Value)	
Low		0	£1,301m	£11,187m	
High			£1,732m	£14,809m	
Best Estimate			£1,404m	£12,050m	
Description and scale of key monetised costs by 'main affected groups' Additional administrative costs of running a Producer Responsibility Organisation to monitor and enforce the reformed packaging producer responsibility system (£25m). Landfill tax loss to HM Government (£50m). Full net costs ³ to packaging producers of covering the management of municipal packaging recycling and waste (transfer from Local Authorities (£8,125m) and wider municipal sector of (£2,832m). Reduced material revenue sales by reprocessing and recycling industry from LAs and wider municipal kerbside collections (diverted to DRS) (£249m). Loss of PRN income to current compliance system beneficiaries (£769m). All values are discounted over the appraised period. All values are discounted.					
Other key non-monetised costs by 'main affected groups' Cost to government and also to business of transitioning to the new regulations (IT systems, staff training etc.). Cost to businesses from any change to the definition of who is obligated. Price increases for consumers. Possible loss of business to compliance schemes. Cost associated with the loss of the PRN market under governance model 2. Any costs associated with the packaging collected under the Deposit Return Scheme are excluded.					
BENEFITS (£m)		Total Transition (Constant Price) Years	Average Annual (excl. Transition) (Constant Price)	Total Benefit (Present Value)	
Low		0	£1,303m	£11,207m	
High			£1,700m	£14,535m	
Best Estimate			£1,726m	£12,238m	
Description and scale of key monetised benefits by 'main affected groups' Avoided residual disposal costs from diverting packaging waste from incineration and landfill treatment into recycling, including landfill tax savings (£407m). Savings to LAs (£8,125m) and wider municipal sector (£2,832m) from reduced packaging collection and treatment costs (transfer to packaging producers). Avoided PRN compliance costs by packaging producers (£769m). Reduced net cost of collection, sorting and treatment of packaging recycling to Local Authorities and non-household municipal sector (£28m). Avoided greenhouse gas emissions from diverting waste from landfill and energy-from-waste to recycling (£77m). All values are discounted.					
Other key non-monetised benefits by 'main affected groups' A more vibrant domestic reprocessing market. Benefits to the environment from reduction of the use of virgin materials, of waste going to landfill and energy-from-waste, and of littering and fly-tipping. Benefits to consumers of clearer recyclability labelling. There are also several system-wide benefits including increased transparency in the system. Any benefits associated with the packaging collected under the Deposit Return Scheme are excluded.					
Key assumptions/sensitivities/risks			Discount rate (%)	3.5%	
There is a risk that the level of packaging placed on market (POM) could be higher than currently estimated, affecting estimated recycling rates and sectoral costs. The high estimate assumes a high growth rate in the packaging POM to reflect this uncertainty. Further, evidence on the collection costs in non-household municipal (NHM) and commercial and industrial (C&I) sectors is limited. Material prices and the landfill tax are assumed to be constant. The analysis is sensitive to the growth of packaging placed on the market (POM); assumed baseline, POM split between Household, NHM, C&I; material revenues and carbon prices.					

BUSINESS ASSESSMENT (Scenario 3)

Direct impact on business (Equivalent Annual) £m:			Score for Business Impact Target (qualifying provisions only) £m:		
Costs: £931m	Benefits: £305m	Net: -£625m	£3,127m		

³ Full net costs consist of LAs gross costs of packaging of £9,528m and material revenue of -£1,403m.

Executive Summary

The aim of this early stage Impact Assessment (IA) is twofold. First it sets out to illustrate the impacts of achieving higher packaging recycling rates under a reformed system that meets the Extended Producer Responsibility (EPR) principles. It does this in an indicative way by focussing on two types of packaging materials that are not readily recyclable and where sufficient evidence exists on tonnages placed on the market (polyvinyl chloride and polystyrene). Second, it estimates the scale of the cost transfer from local authorities (LAs) and wider municipal sector (non-household municipal sector (henceforth NHM)) to packaging producers for all packaging materials. This meets the polluter pays principle. Producers take responsibility of the financial burden of UK municipal packaging's end-of-life costs.

Given the early stage of policy development to identify the appropriate principles of governance of a reformed producer responsibility scheme, we only consider one option in this IA. It is based on an assumption that a reformed packaging producer responsibility scheme successfully delivers on policy objectives to incentivise recyclability and recycled content by rewarding or penalising good or poor design respectively. At this stage, the IA does not take into account the impact of a proposed plastic packaging tax on plastic packaging that does not contain at least 30% recycled plastic.

The option we consider is to reform the packaging producer responsibility system so that producers cover the full net end-of-life costs of municipal packaging. It will introduce different modulated fees or deposit payments for packaging materials. The quantitative assessment we present is only partial. It is based only on increasing the recyclability of plastic packaging. It does this by effectively removing polyvinyl chloride (PVC) and polystyrene as packaging materials and replacing it with readily recyclable alternatives.

The true impact of a reformed packaging producer responsibility scheme is also dependent on a) the nature of kerbside recycling collection consistency which will determine packaging recycling rates and b) the implementation of a deposit return scheme and its scope. The options for these policy measures are considered in the relevant IAs that correspond to these policy consultations. For the former we make an implicit assumption here that the consistent recycling option with the highest net present value would be introduced. For the latter we take the initial position that there is no deposit return scheme and that all drinks container packaging falls under the producer responsibility scheme (Scenario 1). We then assess the impact that having either an 'all-in' (Scenario 2) or an 'on-the-go' DRS (Scenario 3) would have on the materials eligible under the packaging producer responsibility scheme and municipal kerbside recycling.

There are several significant evidence gaps within our analysis and so assumptions have been used throughout – as such the outputs of our analysis are indicative only at this stage. Throughout this IA we have stated where assumptions have been made and outlined the basis for each assumption. We are hoping the corresponding consultation will help develop our data and understanding in areas where there are key evidence gaps for the next IA stage.

The consultation document provides four governance models that could be applied to a reformed system, as well as several other variables, such as who is obligated. The four governance models are:

- **Model 1:** Enhanced near-to-business as usual - compliance schemes.
- **Model 2:** Single not-for-profit producer management organisation.
- **Model 3:** Separate schemes for household/household-like packaging and commercial/industrial packaging.
- **Model 4:** Deposit-based government managed system.

A quantitative appraisal of the governance models is out of scope for this early stage IA and will be addressed at a future consultation. The following aspects are examined in in this IA (see Summary Table below):

- **Recycling rates achieved for each packaging material.** This includes paper, glass, aluminium, steel, plastic and wood packaging materials placed on the UK markets in both consumer (household and wider municipal business sector) and non-consumer (commercial and industrial type packaging).

- **Administrative costs of a reformed packaging Producer Responsibility System.** We have reviewed existing international packaging EPR systems similar to the proposed governance models and have provided an initial estimate of the additional operating costs under a reformed packaging EPR system. These costs will need to be further developed together with the final model proposed at the final version of the IA.
- **Net packaging recycling and waste management costs.** This covers costs of increased collection, sorting and reprocessing of packaging materials sent for recycling minus the material revenue received for separately collected recycled materials. In addition, we have also costed packaging waste sent to residual waste treatment facilities (e.g. energy from waste plants, landfill sites). We have developed an initial methodology to estimate the net collection costs to municipal sector and split to the relevant sectors that produce packaging waste:
 - Household (HH) waste managed by Local Authorities (LAs);
 - Wider municipal sector, household-like, waste (non-household municipal (NHM) waste generated by businesses and public organisations) and
 - Commercial and industrial (C&I) packaging waste.
- **Full net costs to producers.** Under the ‘polluter pays’ principle, the packaging producers would be obliged to cover the net costs of managing packaging waste and recycling, i.e. once accounting for material revenues of separately collected packaging. Our estimates cover the municipal waste only, i.e. HH and NHM packaging waste costs. We estimate substantial saving to LAs if those costs are transferred to packaging producers. Producers would no longer be burdened with compliance costs of the existing Packaging Waste Recovery Notes (PRN) system.
- **Material revenues to the reprocessing and recycling sector.** Apart from direct costs and savings to those sectors generating packaging waste, we account for the additional material revenue sales as a result of increasing supply of packaging recyclates, i.e. materials sent for recycling at first instance. Such material revenue benefits are in addition to those received on the primary market by LAs and the NHM sector. We assume the secondary market buys untreated recycled materials at primary market prices and profit by selling the reprocessed and treated materials at higher prices. Our modelling captures just this profit to avoid double counting.
- **Landfill tax impacts.** This accounts for the fact that diverting packaging materials to reprocessing and recycling would reduce the amount of packaging waste sent to landfill and, consequently, the size of landfill tax collected by HM Government.
- **Greenhouse gases emissions (GHGs) savings.** Increased recycling of packaging materials would reduce the GHGs associated with the raw material extraction, packaging manufacturing and waste management. Recycling packaging materials is generally less carbon-intensive than other packaging waste treatment options. These GHGs emissions savings would contribute to HM Government’s carbon emission reduction targets.

Several other impacts of these reforms have not been monetised. These are listed in Annex F. Even though they are non-monetised, this should not take away from their importance in helping understand the impacts of these reforms. We will be looking to address some of these evidence gaps in the next version of the IA, following this consultation.

The Table below summarises the costs and benefits of EPR packaging reform under three different scenarios. As previously mentioned, for Scenarios 2 and 3, any costs or benefits associated with the DRS materials are excluded from the analysis. Scenario 1 reflects the direct costs and benefits of EPR reform. These are the same under Scenarios 2 and 3 but these scenarios also account for impacts of DRS. For direct benefits or costs of EPR under Scenarios 2 and 3, please refer back to Scenario 1.

Summary of monetised costs (+) and savings (-) of a reformed packaging system under scenarios

Change over 2023-2032 (discounted ⁴ , against baseline)	Scenario 1: Reform the packaging producer responsibility system and introduce modulated fees / deposit payments, with no DRS	Scenario 2: Reform the packaging producer responsibility scheme, excluding packaging materials collected through an 'all-in' DRS	Scenario 3: Reform the packaging producer responsibility scheme, excluding packaging materials collected through an 'on-the-go' DRS
Additional administrative costs of running a reformed packaging EPR system	£25m	£25m	£25m
Additional savings/costs of recycling collections	-£20m	£87m	-£28m
Net savings from residual waste treatment (including landfill tax savings)	-£117m	-£673m	-£407m
Reduced landfill tax to HM Government	£17m	£91m	£50m
Compliance costs to packaging producers (i.e. net packaging recycling and waste management cost)	£8,128m for LAs (gross costs £9,587m and material revenue -£1,459m) £3,157m for NHM sector	£8,166m for LAs (gross costs £9,411m and material revenue -£1,245m) £2,113m for NHM sector	£8,125m for LAs (gross costs £9,528m and material revenue -£1,403m) £2,832m for NHM sector
Savings to municipal sector from reduced packaging recycling and waste management costs	-£8,128m for LAs -£3,157m for NHM sector	-£8,166m for LAs -£2,113m for NHM sector	-£8,125m for LAs -£2,832m for NHM sector
Savings to producers from removing current PRN compliance costs	-£769m	-£769m	-£769m
Loss of funding to current PRN beneficiaries (indirect cost to businesses)	£769m	£769m	£769m
Additional material revenue(-) / loss(+) to the recycling sector (indirect benefit to businesses) ⁵	-£74m	£790m	£249m
GHGs emissions savings(-) / costs(+) ⁶	-£77m	-£77m	-£77m
Net present value⁷ (+ for societal savings, - for societal costs)	£245m	-£243m	£187m
Net cost to businesses (present value)	£7,384m	£7,422m	£7,381m

Summary of projected recycling rates in 2032 under a reformed packaging system

Packaging material	Baseline: No reform to the packaging producer responsibility system, consistency in place	Scenario 1: Reform the packaging producer responsibility system	Scenario 2: as under Scenario 1, including packaging materials collected through the 'All-in' DRS	Scenario 3: as under Scenario 1, including packaging materials collected through the 'OTG' DRS	DRS 'All-in' scenario: as under Scenario 1, excluding packaging materials collected through the 'All-in' DRS	DRS 'OTG' scenario: as under Scenario 1, excluding packaging materials collected through the 'OTG' DRS
Paper	84%	84%	84%	84%	84%	84%
Glass	72%	72%	82%	77%	23%	63%
Aluminium	59%	59%	71%	62%	21%	55%
Steel	87%	87%	88%	87%	82%	87%
Plastic	50%	54%	56%	55%	45%	51%
Wood	28%	28%	28%	28%	28%	28%
Total	67%	68%	71%	70%	55%	66%

⁴ A social discount rate of 3.5% is used to obtain present value estimates, see HM Treasury (2018) Green Book. Any estimate quoted (PV) or the Net Present Value (NPV) is discounted using this rate. The appraisal is over a ten-year period.

⁵ Under Scenarios 2 and 3, the lost material revenue from kerbside recycling collections would be a saving to producers and recycling sector reprocessing that material through the DRS. Thus, this is regarded as a transfer in societal terms, but as a cost to EPR packaging system.

⁶ Scenarios 2 and 3 reflect the savings of Scenario 1 only. The additional GHG savings achieved by DRS are accounted for in the DRS Impact Assessment (£302m for Scenario 2; £52m for Scenario 3).

⁷ NPV is calculated by adding all the costs and benefits lines and switching sign so that positive NPV reflects higher savings than costs and vice versa.

The remainder of this documents is structured as follows:

- Problem under consideration
- Rationale for intervention
- Policy objectives
- Scenarios considered
- Monetised costs and benefits of Baseline
- Monetised costs and benefits of each Scenario
- Small and micro sized business assessment
- Greenhouse gases emissions impacts

This is then followed by an Annex section that provides further details on the policy principles, governance models and underpinning evidence and analysis:

- Annex A: Principles of extended producer responsibility for packaging waste
- Annex B: Description of governance options for a reformed packaging producer responsibility system
- Annex C: Qualitative analysis of governance model 4 (deposit-based government managed system)
- Annex C: Underpinning UK packaging data
- Annex E: Methodology used to analyse the lowering or removal of the de-minimis threshold
- Annex F: Non-monetised costs and benefits
- Annex G: Key quantitative assumptions
- Annex H: Sensitivity analysis on Consistent Municipal Recycling options

Problem under consideration

Under the current packaging producer responsibility system, obligated packaging producers are required to meet certain recovery and recycling targets set by Government. Producers must obtain evidence of recycling from accredited reprocessors or exporters to prove they have met their recycling obligation. This evidence is known as Packaging Waste Recovery Notes (PRN) or Packaging Waste Export Recovery Notes (PERNs).

To date, the Packaging Waste Regulations have been successful in ensuring that the UK meets the targets set by the EU at a minimal cost to business. However the current system has many shortcomings and will not be capable of meeting our policy objectives as set out in the consultation document. The following is a list of the main shortcomings of the current system proposed reforms seek to resolve:

- Around 7% of the costs of managing municipal packaging waste are currently covered by industry, so producers are not taking full responsibility for their packaging at end-of-life. In this IA we assume that producers pay 100% of municipal packaging waste management costs.
- The system as it stands does not sufficiently incentivise product redesign for greater reuse and recyclability of packaging.
- Demand amongst reprocessors for collected materials has not increased as intended.
- Local Authorities have seen little support or direct financial reward from the PRN system for collection of packaging waste.⁸
- There are concerns around transparency of the PRN system. Producers do not know how their PRN fees are currently used. Under a reformed system producers will contribute more into the system so all actors will want a clearer sight of how this money is distributed and used. Along with this, to help achieve higher recycling targets, much more transparent and robust data is needed.
- There has not been any significant increase in investment in recycling capability, communications or research and development.
- There are concerns that the UK reprocessing sector is not operating on a level playing field.

In general, the current PRN system is not comprehensive enough, lacks transparency, and falls short of our principles for EPR (see 'Policy objectives' section).

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 reducing 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.

The Directive 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 Scenarios relating to reforming the latter set of Regulations, which are hereafter referred to as 'the Packaging Waste Regulations'. The regulations have been in place since 1997 and operate UK-wide under GB and parallel Northern Ireland regulations. The regulators are the Environment Agency (EA) in England, Natural Resources Wales (NRW), Northern Ireland Environment Agency (NIEA) and Scottish Environment Protection Agency (SEPA).

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

Under the Packaging Waste 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

⁸ Data from the National Packaging Waste Database indicate that PRN revenue that is assigned to funding collections is currently covering somewhere between 3-7% of the costs of recycling collection. 2017 data: <https://npwd.environment-agency.gov.uk/FileDownload.ashx?FileId=50cf92ea-ae92-4fd8-a521-a8e3793a038c>

and exporters, respectively, and are acquired by packaging producers either directly or through a compliance scheme. An accredited reprocessor/exporter can issue PRNs/PERNs to the amount of packaging waste reprocessed (e.g. 100 tonnes of packaging steel waste reprocessed allows the reprocessor to 'sell' 100 PRNs in steel).

The evidence notes were designed to 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 producers pay for these PRNs / PERNs. This internalises some of the costs of recovery and recycling to the packaging producers.

The Packaging Waste 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. Business targets are therefore set for obligated businesses that are higher than the actual EU minimum target in order to take this exempt packaging into account. The actual amount of exempt packaging changes from year to year. Business targets are therefore set at a level to take into account these fluctuations.

Businesses obligated under the Regulations can choose how to comply. They can:

- a) undertake the recycling/recovery themselves in order to obtain the required PRNs
- b) contract directly with reprocessors/exporters and acquire evidence of compliance in the form of PRNs and PERNs (known as individual registration), or
- c) pay to join one of several approved compliance schemes, who take on the regulatory reporting and contractual duties, with greater market clout than individual producers.

The majority of packaging producers choose to join a compliance scheme.

The value of evidence notes is determined by the market. They fluctuate in price in response to a range of factors. For example this includes the supply of recyclables; the price of raw materials; the price of secondary materials; the availability of evidence; the level at which the targets have been set. PRNs can only be bought and sold between registered producers and accredited exporters/reprocessors. The total income raised through the sale of PRNs/PERNs therefore varies from year to year. In the past 10 years the annual income from the sale PRNs/PERNs has ranged from a low £20 million to a high of £110 million.

The Regulations do not mandate how the proceeds from the sale of PRNs/PERNs to producers are spent. However, accredited reprocessors and exporters are required to report on the use of these funds as they are intended to finance improvements in the collection and reprocessing infrastructure across the UK. In reality, LAs in particular have seen little, if any, direct financial benefit from the PRN system. Environmental Audit Committee 2017 report states that the current PRN system covers only around 10% of packaging waste disposal costs, with the remaining 90% funded by the taxpayer.⁹¹⁰

Rationale for Intervention

Using a producer responsibility system to internalise some of the costs of dealing with packaging waste provides incentives for packaging producers to reduce the environmental impacts of waste and ensure a high proportion is recycled. It requires packaging producers to pay towards the cost of recycling, incentivising them to reduce the amount or improve the recyclability of packaging they use. This results in a reduction in the environmental impacts of packaging when it becomes waste.

Polluter pays principle

The current packaging producer responsibility system was introduced to meet material specific recycling targets at lowest cost to producers. In particular it enables the UK industry to meet targets by paying only the added cost of recycling more, rather than the full cost of managing packaging recycling and waste. At present, we estimate that around 7% of the costs of managing municipal packaging recycling and waste costs are covered by industry. The current system therefore does not meet the 'polluter pays' principle in

⁹ <https://larac.org.uk/sites/default/files/LARAC%20POLICY%20PAPER%20The%20future%20of%20LA%20Waste%20Funding%200418.pdf>

¹⁰ Further details on the existing system are available at <https://www.gov.uk/guidance/packaging-producer-responsibilities>

so far as shifting the full financial responsibility for collection and treating end-of-life packaging from taxpayers to producers. This means that there is minimal incentive for producers to choose packaging which takes into account the impact of disposing of the product at end-of-life.

Under the reformed EPR system, producers will become financially responsible for the full costs of collection and treatment of their packaging at end of life. The net costs associated with managing recyclable packaging are lower than those associated with managing packaging in residual waste. For example, recycled packaging can be sold to reprocessors for revenue whilst covering residual waste costs involves paying landfill tax. Producers will therefore have a financial incentive to use less packaging, particularly hard to recycle packaging, to minimise their financial burden. This will reduce the negative externalities associated with waste as set out below – under ‘Environmental externalities’.

Environmental externalities

The environmental externalities associated with the production, use and disposal of packaging include natural resource depletion, wider ecosystem impacts associated with the production of raw materials, greenhouse gas emissions (from both production and sending packaging to landfill and incineration), disamenity impacts from littering or impacts on land use from landfill sites.

At present, not all environmental externalities are internalised in decision-making by households and businesses – the ‘polluter pays principle’ is not met in full. The proposed changes will seek to address these externalities by requiring businesses to take increased responsibility for the environmental impact associated with their packaging when it becomes waste.

Insufficient information

The current system has not encouraged producers or compliance schemes to actively seek to educate and inform consumers. This is because the cost of doing so would be borne by one organisation but the benefits would be felt by all. Some organisations have carried out consumer education campaigns, however to reach high levels of collection and recycling, consumer education and information must be prioritised and scaled up. If consumers are not recycling the optimum amount of packaging, then the costs to local authorities will be higher. This is because recycling activities are generally less expensive and require less infrastructure than residual waste treatment.

The proposed changes will seek to mandate recyclability labelling for packaging and will also require producers to fund national and local consumer awareness campaigns.

Missing or fragile markets

Some materials are not recycled due to limited provision of collection points for them. As a result, the type and amount of packaging placed on market, the achieved levels of recycling performance, and the treatment of unrecycled packaging under the current system are not as developed as would be seen in more cost-effective scenarios. EPR will encourage producers to choose to use packaging materials that have effective infrastructure already in place for recycling.

System-wide inefficiencies

There is a lack of a shared goal across the supply chain for long term transition towards more packaging waste recycled; a failure to include and coordinate different actors in the supply chain; a lack of support to drive market demand for recycled materials; and insufficient mechanisms to deal with uncertainty and learning through innovation.

There is a need to improve the collection, treatment and reprocessing infrastructure of the whole system. This is unlikely to happen without government intervention because the costs associated with innovation and improving the flow of knowledge and technology between actors would need to be faced by individual businesses - whilst the whole sector would enjoy the resulting benefit. The current system therefore does not drive the optimum level of innovation.

Policy Objectives

There are several objectives of the proposed policy reforms. These are rooted in the commitments made in the Clean Growth Strategy, 25 Year Environment Plan and Resources and Waste Strategy. These commitments include:

- BEIS Industrial Strategy / Clean Growth Strategy
 - Commitment to explore how we can better incentivise producers to manage resources more efficiently through producer responsibility systems.
- 25 Year Environment Plan
 - Commitment to reform the Producer Responsibility system (including the Packaging Waste Regulations) to incentivise producers to take greater responsibility for the environmental impacts of their products
- Resource and Waste Strategy
 - Maximising resource productivity - through more efficient manufacturing processes
 - Maximising the value we get from resources throughout their lifetimes - by designing products more smartly to increase longevity and enable recyclability
 - Managing materials at end of life – by targeting environmental impacts

Regular stakeholder engagement has enabled us to keep policy objectives well informed. A series of stakeholder workshops were run by Waste Resource Action Programme (WRAP), ACP (Advisory Committee on Packaging), and INCPEN (Industry Council for Packaging and the Environment) in early 2018. These workshops gave stakeholders the opportunity to discuss reforming the packaging waste regulations and put their opinions forward. The principles below were agreed by the attendees:

- To support delivery of nationally consistent recycling collections and higher quality recycle as a condition of local authorities receiving funding.
- To make it easier for consumers to know what to recycle and how to recycle through universal labelling (on packaging) and improved communications (funded by producers).
- To incentivise recyclability, recycled content, and reduce non-recyclable packaging by rewarding good design and/or penalising poor design (e.g. composite, non-recyclable content) through the payment of modulated fees.
- To retain money raised through producer fees within the system to fund collections and recycling infrastructure / services.
- To support more processing of recyclables in the UK through tighter monitoring and enforcement of existing export regulations, with the costs covered through exporter accreditation charges.

In addition to this, we have made a commitment to meet the requirements laid out in the Circular Economy Package (CEP) whilst also ensuring that we tailor these to fit the UK's waste industry once we have left the EU. These include:

- Ensuring that producers are financially responsible for the cost of separate collection, transport and treatment of the waste they put on the market and engaging with consumers.
- Introducing modulated fees to encourage greater durability, reparability and recyclability of packaging
- Establishing adequate reporting and enforcement framework

The policy objectives that have grown from these commitments and views are listed below. These are the overarching objectives of the reforms and some have not been quantified by this impact assessment (i.e. impact of the reform on reducing unnecessary packaging and domestic recycling). The reforms that we are proposing will assist producers to achieve these objectives.

Increase Packaging Recycled

The government will consult on new packaging recycling targets, with the preferred option going further than the new Circular Economy Package (CEP) targets recently set out in the EU Waste Framework Directive. The reforms assessed in this document will help UK businesses (i.e. producers) to achieve these new targets. A principle of EPR is that money raised from producers should be retained in the system to

fund the management of municipal packaging waste. The funding should be used to support improvements to the collection infrastructure. This will contribute towards more packaging waste being collected and in a more consistent way and therefore higher recycling rates.

Increase the Recyclability of Packaging

As set out in the Clean Growth Strategy, 25 Year Environment Plan and Resources and Waste Strategy, the government wants to create the right incentives for producers to design their products to be resource efficient and reduce environmental impact. The consultation to reform the packaging producer responsibility system sets out proposals for a modulated fee structure / deposit system for packaging placed on the market. This will encourage producers to make big changes to the way in which they design their packaging. For example, they will pay less if they use materials which are easily recyclable or more if they use materials which cannot be recycled.

Improve the Environment

Increased recycling and use of recycle will lead to less landfilled and incinerated packaging waste, less litter and decrease in the use of virgin raw materials. These outcomes will improve the environment for the public and for wildlife, as well as generating carbon savings.

Reduce Unnecessary Packaging (not quantified in this IA)

The reforms that we are consulting on will include an increase in the fees that producers will be required to pay for the packaging that they handle. The fees will be calculated based on the weight of packaging handled. This will provide a direct incentive to producers to reduce the amount of packaging they use. The modulated fee structure / deposit systems (described above) will be an additional driver to ensure that it is materials that are harder to recycle that will be driven off the market first.

Increase Domestic Recycling (not quantified in this IA)

The aim of the current producer responsibility regulations was to help businesses achieve their obligation set out in the EU's Waste Framework Directive as well as to encourage growth in the UK recycling industry through the PRN system. This has not been achieved to the level that government and stakeholders would like to see. The reforms will address this through requiring producers to cover 100% of the net costs of collection, sorting and treatment of packaging waste. The increased funds in the system will not only increase recycling, but also the quality of material going to recycling. In turn, this will allow investors to be more confident in the UK's recycling industry. The consultation also sets out options to ensure that reprocessors and exporters of packaging waste are operating on a level playing field. This will create more opportunities for the UK reprocessing industry to grow.

Annex A provides the details of the principles of extended producer responsibility for packaging waste in more detail.

Scenarios considered

The following describes the baseline and the proposed scenarios for EPR packaging reform and DRS interaction considered in this early stage IA. The baseline makes an ex-ante assumption about the approach to consistency of recycling collections. This reflects the highest net present value option in the corresponding impact assessment on consistent municipal recycling collections¹¹. The proposed reforms consists of three scenarios, or different states of the world. These reflect the three possible options in the corresponding impact assessment on introducing a deposit return scheme on beverage containers and directly affect the material we take as eligible in the packaging producer responsibility scheme.

The principal change in all three scenarios will see the implementation of modulated fees / deposit rates so that packaging producers bear the full costs of managing the packaging they place on the market when it becomes waste. This transfer of costs from LAs and wider municipal sector to packaging producers will help finance the proposed changes set out in the IA associated with the consultation on consistent municipal recycling collections.

These modulated fees/deposit rates are assumed to incentivise producers of packaging to move away from difficult to recycle packaging materials towards readily recyclable alternatives. In quantitative terms

¹¹ Please see the 'Consistent municipal recycling collections' impact assessment.

we can currently only illustrate this through two forms of plastic packaging: PVC and polystyrene. For this reason the IA is only a partial assessment of the overall societal impact that could result from packaging producer responsibility reform.

It should also be noted that because of this partial assessment, changes to eligible packaging under EPR, once accounting for a DRS, will affect the amount of packaging that goes to municipal kerbside recycling. This makes the three impact assessments interdependent insofar as the DRS materials' diversion affects EPR/Consistency by reducing the amount of material in kerbside collections. Whilst there are interdependencies, this IA relates specifically to packaging related material at kerbside while the consistency IA refers to total municipal waste and the DRS IA to drinks bottles. We therefore choose to assess these scenarios here rather than in the consistency IA.

There are four governance models that are being considered for a reformed system. Each model will interact with a reformed system in different ways. They will therefore have different impacts on the system and on stakeholders. A quantitative appraisal of the governance models is out of scope for this consultation IA and will be fully addressed in the next version of the IA.

The four governance models are:

- Model 1: Enhanced near-to-business as usual compliance schemes.
- Model 2: Single not-for-profit producer management organisation
- Model 3: Separate schemes for household/household-like packaging and commercial/industrial packaging
- Model 4: Deposit-based government managed system

Models 1 and 4 are primarily market based approaches; the other two models involve the establishment of a producer-led management organisation.

Annex B provides descriptions of all of the governance models (more detailed descriptions are available in the Consultation) and Annex D provides a qualitative assessment of the deposit-based governance model (Model 4). Defra will be conducting further research assessing the role of placed on the market fee rates and deposits logistics, which should allow us to assess the preferred governance models in the final impact assessment.

Baseline (Do Nothing): Do not reform the packaging producer responsibility system following implementation of consistent municipal recycling collections

The baseline is for the period 2023-2032. The baseline assumes that the measures detailed in the Consistent municipal recycling collections IA are already in place and the associated costs, benefits and recycling rates are reflected in the baseline. This baseline therefore allows us to consider the marginal impacts of introducing EPR on top of the measures set out in the consistent municipal recycling collections IA. The three EPR scenarios then take into account the eligible packaging material based on what type of deposit return scheme, if any, is in place.

EPR reform under Scenario 1: Reform the packaging producer responsibility system with modulated fees/ deposit rates

Scenario 1 is to reform the packaging producer responsibility system. It proposes to charge a modulated fee on hard to recycle packaging to producers. At this point, we have only been able to model a modulated fee on two hard to recycle plastics, PVC and polystyrene as these are the material categories that we have access to the most robust research and data on the implications of charging modulated fees¹². We expect the positive NPV of the policy to increase in magnitude when we extend modulated fees to other packaging materials in further analysis.

In addition, Scenario 1 accounts for the cost transfer of municipal packaging costs from LAs to producers.

This Scenario 1 would deliver higher plastic packaging recycling rates on top of those set out in the baseline and would also help us to meet the new packaging recycling targets that we have proposed.

¹² Based on Plastic Pact information and data from Valpak/WRAP PackFlow 2025. Assumed impacts of modulated fees / deposit rates as per WRAP and Defra assumptions.

The analysis assumes that the packaging reform is introduced from 2023 onwards. Thus, any costs and benefits associated with the change in the current producer responsibility system are observed from 2023.

EPR reform under Scenarios 2 and 3: Reform the packaging producer responsibility system with modulated fees, excluding material collected by a Deposit Return Scheme on beverage containers

For the purposes of packaging EPR policy, Scenarios 2 and 3 are the same as Scenario 1. Thus modulated fees/deposit rates incentivise changes in packaging placed on the market, partially quantified here only by assessing the projected fall in PVC and polystyrene packaging.

The difference under Scenarios 2 and 3 is that certain packaging materials, e.g. plastic and glass bottles and aluminium and steel cans, are now allocated to the deposit return scheme (DRS) and therefore excluded from the packaging EPR analysis. We consider two scenarios depending on which DRS Option might be implemented.

EPR reform under Scenario 2 assumes that the DRS 'All-in' Option is rolled out in the future. This Option would remove the following items from the packaging EPR scheme by 2023: plastic drinks bottles, steel drink cans and glass drinks bottles. There would be no restriction on the size/format of drinks containers in scope.

EPR reform under Scenario 3 assumes that the DRS 'On-the-go' (OTG) Option is rolled out by 2023. This Option would cover the same drinks containers as the 'All-in' DRS Option but the scope is reduced to a defined size/format to target those most often sold for consumption 'on-the-go'.

EPR reform under Scenarios 2 and 3 are both projected to reduce the amount of packaging materials collected through municipal kerbside recycling collections compared to Scenario 1 and Baseline. This is because eligible beverage containers are instead diverted to DRS collection. When aggregating Scenario 2 or 3 with the respective DRS IA options, both are expected to achieve higher overall recycling rates for packaging materials than through the packaging EPR Scenario 1 alone (see Table 44). The costs and benefits of introducing DRS are covered in the 'Introducing a Deposit Return Scheme on beverage containers' IA.

Non-Monetised costs and benefits

Several costs and benefits have been monetised for each Scenario. The non-monetised costs and benefits are detailed in Annex F and are mostly generic across the Scenarios. They are non-monetised because they are either impossible to monetise or because underpinning evidence is still being developed, not because they are less important. The non-monetised costs and benefits include:

- Transition costs to government and producers
- Consumer price changes
- Impact of modulated fees/deposits on other packaging materials
- Enforcement costs under a reformed producer responsibility system
- A more vibrant domestic reprocessing market
- Reduced littering, use of virgin materials, use of landfill and energy-from-waste plants

We have detailed in the consultation document, in Chapter 11 "Estimated Costs and Benefits", the evidence gaps and the plans we have in place to fill these gaps.

Monetised costs and benefits of baseline

There are several significant evidence gaps within our analysis and so assumptions have been used throughout – as such the outputs of our analysis are indicative only at this stage. Throughout this IA we have stated where assumptions have been made and outlined the basis for each assumption. We are hoping the corresponding consultation will help develop our data and understanding in areas where there are key evidence gaps for the next IA stage.

We assume that the baseline would achieve increased recycling rates of packaging materials as a result of the roll out of consistent collection of key materials for recycling in the municipal sector. In particular, it reflects the preferred Option '3M' of the Consistent municipal recycling collections IA¹³.

The baseline shows the costs and benefits in line with having a consistent municipal recycling collection system for packaging in the household (HH) and non-household municipal¹⁴ (NHM) sector. The following provides the projected recycling tonnages under the baseline and an initial costs and benefits assessment¹⁵.

Placed on market packaging

The UK Placed on market (POM) packaging data comes from the National Packaging Waste Database¹⁶. This data has been used throughout the Baseline as well as in Scenarios 1, 2, and 3 to determine recycling rates and associated costs and benefits.

To project the POM data up to 2032 for the best estimate scenario, we used 2020 projections from WRAP and Valpak material specific PackFlow reports¹⁷. We then applied a growth rate of 1% from 2023 onwards with the exception of steel packaging that is assumed to reduce by 1% per year, as per research from the MetalFlow report. See Annex G for further detail on the key assumptions applied to the projection of POM data.

Table 1: Packaging placed on the market data – best estimate

Placed on the market (POM) - tonnes	2023	2027	2032
Paper/board	4,796,389	4,991,142	5,245,740
Glass	2,423,227	2,521,620	2,650,248
Aluminium	184,830	192,335	202,146
Steel	550,440	528,750	502,836
Plastic	2,282,600	2,375,283	2,496,446
Wood	1,439,333	1,497,776	1,574,177
Other	22,781	23,706	24,915
Total	11,699,600	12,130,611	12,696,508

Projected recycling – baseline

For the analysis, we split the overall recycling tonnages¹⁸ to household (HH), non-household municipal¹⁹ (NHM) and commercial and industrial (C&I) sectors to provide detailed costs and benefits estimates per sector. The HH tonnages are based on WRAP's HH analysis used in the consistent municipal recycling collections IA. We assume that the dry recycling collection system is 'multi-stream'. This is where dry recycling materials are collected separately in three bins. This is the preferred Option under the Consistent municipal recycling collections IA.

To determine the NHM and C&I sector, we have used accredited recycling tonnage (up to 2018), removed the amount attributed to the HH sector (evidenced by WRAP²⁰), and then split the remaining tonnage

¹³ Option 3M refers to nationwide collection of key dry materials (plastic bottles, glass packaging, metal packaging, paper and cardboard and plastic pots, tubs and trays), separate food waste, free garden waste at household side and separate glass, dry mixed recyclables and separate food waste at non-household municipal side (businesses and public sector organisations generating household-like waste).

¹⁴ Non-household municipal waste represents businesses and public sector organisations generating household-like waste. See Consistent municipal recycling IA for further details.

¹⁵ Assumed to be both accredited and non-accredited recycling tonnages under PRN system. See Annex D for details.

¹⁶ <https://npwd.environment-agency.gov.uk/>

¹⁷ PaperFlow 2010, MetalFlow Supplementary Report, WoodFlow 2020, 2016 Plastic and glass IA and 2017 Packaging IA.

¹⁸ Accredited reprocessors or exporters recycle or recover packaging waste discarded by UK businesses and households. They generate electronic packaging recovery notes (ePRNs) and electronic packaging export recovery notes (ePERNs), also known as evidence notes. Data on the accredited recycling tonnages is provided by the National Packaging Waste Database.

¹⁹ NHM sector related to wider municipal sector that includes businesses and public organisations producing household-like waste. See the Consistent municipal recycling collections IA for further details. In terms of packaging data, we have assumed that consumer away from home packaging would be part of the NHM sector's waste.

²⁰ Unpublished WRAP modelling results for Defra.

between the C&I and the NHM sectors using a split provided by Valpak. The split provided by Valpak shows proportionately how much of the recycling stream should be attributed to the C&I and ‘away-from-home’ (assumed to be NHM) sector. Once we had established historical recycling tonnages for the NHM and C&I sectors up to 2018, we applied the change in recycling growth rate from WRAP’s analysis for the Consistent municipal recycling collections IA to our estimates²¹. These are shown in Table 2. This growth rate in recycling is a result of the NHM sector transitioning towards a sector-wide recycling collection system that is composed of mixed dry materials recycling, separate food waste and separate glass collections.

Table 2: NHM recycling growth rate due to improvements in separate recycling collections

2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
1.38%	2.08%	2.08%	2.44%	3.66%	3.66%	3.09%	3.09%	3.09%	3.09%

Source: Consistent municipal recycling collections IA, based on WRAP’s NHM analysis

For the C&I sector, we have assumed that the recycling levels would increase in line with historical growth rates.

Table 3 presents the modelled recycling tonnages and Table 4 presents the modelled recycling rates under baseline assumptions. We estimated what the baseline recycling rates are by comparing the projected recycling tonnage against the projected POM tonnage. A sensitivity analysis on baseline recycling tonnages is included in Annex G.

Table 3: Baseline recycling projections in tonnes – best estimate

Recycling tonnages - baseline	2023	2027	2032
Paper	3,870,490	4,083,535	4,412,196
Glass	1,710,100	1,783,297	1,895,481
Aluminium	95,876	105,111	120,233
Steel	411,335	418,143	436,000
Plastic	1,095,879	1,158,331	1,250,263
Wood	419,926	429,396	441,534
Total Recycling	7,603,608	7,977,812	8,555,707

Table 4: Baseline recycling rates – best estimate

Recycling rates - baseline	2023	2027	2032
Paper	81%	82%	84%
Glass	71%	71%	72%
Aluminium	52%	55%	59%
Steel	75%	79%	87%
Plastic	48%	49%	50%
Wood	29%	29%	28%

Sector’s recycling tonnage – baseline

The following section provides the split of recycling tonnages to respective sectors.

²¹ The reason for only using the growth rates is due to the differences between the datasets being used for the NHM waste estimates, in which WRAP data includes both packaging and non-packaging recycling. WRAP’s NHM tonnage estimates use data from the Waste Data Interrogator (WDI) which is significantly different from the POM estimates produced by WRAP and Valpak. Thus, we applied the annual growth improvements from WRAP’s NHM data to the actual POM tonnages.

Table 5: Baseline WRAP HH recycling tonnage – best estimate

WRAP HH recycling - baseline	2023	2027	2032
Paper	825,090	844,324	879,177
Glass	1,436,076	1,480,126	1,540,579
Aluminium	51,391	56,078	63,212
Steel	230,825	232,513	237,149
Plastic	544,518	566,921	590,394
Wood			
Total Recycling	3,087,900	3,179,963	3,310,511

Table 6: Baseline NHM recycling tonnage – best estimate

WRAP NHM recycling - baseline	2023	2027	2032
Paper	748,751	828,392	969,744
Glass	274,024	303,171	354,902
Aluminium	42,135	46,617	54,571
Steel	129,185	142,926	167,314
Plastic	374,490	414,323	485,020
Wood			
Total Recycling	1,568,585	1,735,429	2,031,551

Table 7: Baseline C&I recycling tonnage – best estimate

WRAP C&I recycling - baseline	2023	2027	2032
Paper	2,296,649	2,410,819	2,563,276
Glass			
Aluminium	2,350	2,415	2,450
Steel	51,325	42,704	31,537
Plastic	176,872	177,087	174,849
Wood	419,926	429,396	441,534
Total Recycling	2,947,122	3,062,421	3,213,645

Packaging in residual waste by sector - baseline

Due to a lack of good quality data on the amount of packaging in residual waste, we made several assumptions to estimate the HH, NHM and C&I share in packaging materials that ends up in residual waste. First, we estimated the overall amount of residual waste by taking the difference between the projected POM and the recycling tonnage. The second step was to account for the HH residual tonnage as provided by WRAP. Once the HH residual tonnage was removed from the total residual tonnage, the remaining residual was assumed to belong to the C&I and NHM sector.

Table 8: Baseline packaging in HH residual waste in tonnes – best estimate

Packaging in HH residual - baseline	2023	2027	2032
Paper	326,077	342,047	350,028
Glass	87,141	110,492	154,395
Aluminium	10,514	12,098	14,380
Steel	73,497	76,330	79,614
Plastic	642,172	679,137	735,444
Wood			
Total	1,139,402	1,220,104	1,333,861

Table 9: Baseline packaging in C&I and NHM residual waste in tonnes – best estimate

Packaging in C&I and NHM residual - baseline	2023	2027	2032
Paper	599,821	565,559	483,516
Glass	625,986	627,832	600,372
Aluminium	78,439	75,126	67,532
Steel	65,608	34,278	-
Plastic	544,549	537,816	510,739
Wood	1,019,406	1,068,380	1,132,643
Total	2,933,810	2,908,990	2,794,803

To reflect the uncertainty of the amount of packaging that is disposed of in residual waste by different sectors, we have also developed low and high estimates on residual tonnage. These can be found in Annex G.

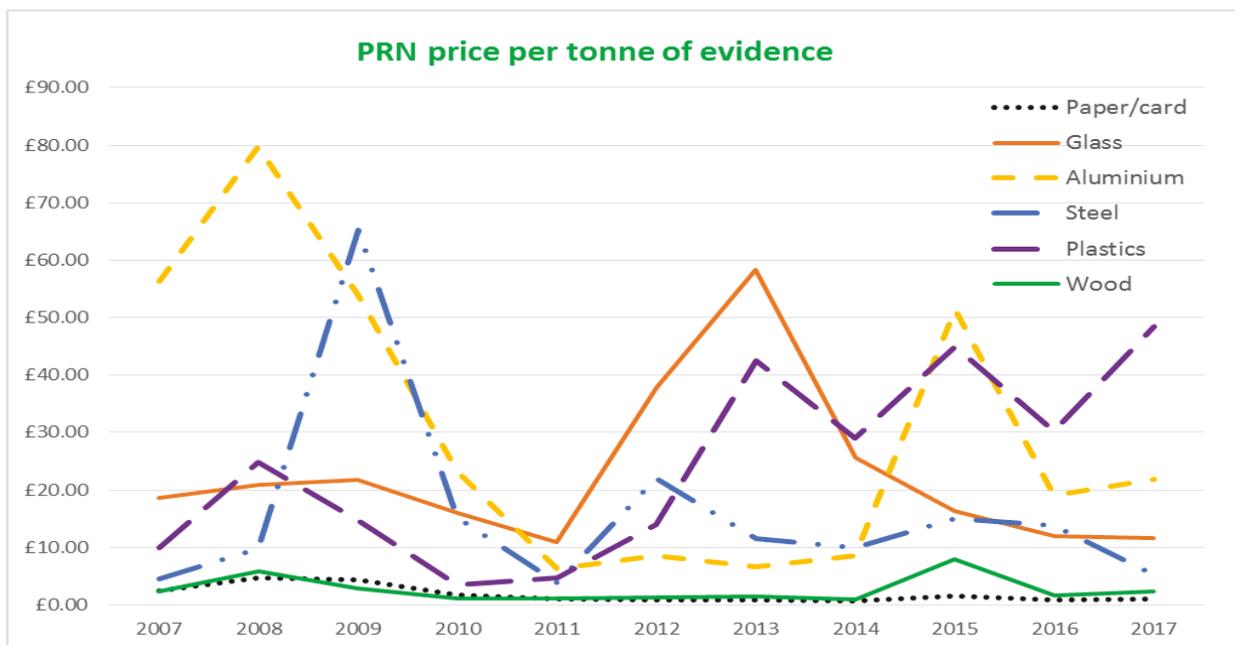
Monetised costs

The costs that have been monetised fall under two key categories. The first is the costs to obligated producers and the second is the costs to local authorities (LAs), wider municipal sector (NHM), commercial and industrial (C&I) packaging waste sector, and Exchequer costs. The costs to packaging producers are the **compliance costs of purchasing the PRN** and the **operational cost of the current PRN system**. The costs to local authorities, NHM and C&I sectors are the **costs of collection and treatment of packaging for recycling and residual waste treatment**.

Cost of compliance to businesses - baseline

Under the current packaging producer responsibility system, obligated producers are required to meet certain recovery and recycling targets set by Government. Producers must purchase evidence (PRN/PERNs) of recycling from accredited reprocessors or exporters to prove they have met their obligation. The cost of this evidence varies by material depending on a number of factors, including how economically feasible it is to recycle it and the market perception of how much evidence is available. The historical PRN price per material has varied over time, with some materials showing more volatility than others.

Figure 1: Historical price of PRN evidence per tonne



Source: The Environment Exchange – average PRN prices²²

²² The Environment Exchange - <https://www.t2e.co.uk/historic-prn-prices.html>

Going forward we expect increased long-term packaging recycling targets, as a result, we assume that on average the PRN prices would shift to a higher price equilibrium. This is because producers need more evidence and thus are willing to pay more for it. We assumed that the PRN price in 2032 would be the highest average price seen historically for the period of 2007-2017²³. For the years in between (2018-2031) the price would grow linearly to the 2032 price of the PRN. These future prices should be regarded with caution as we do not attempt to forecast the behaviour and exact price point for each material under higher business obligation targets. Rather, we basically assume that higher recycling targets would imply higher PRN prices as obliged producers are demanding more evidence of recycled tonnages and thus are willing to pay, on average, more per tonne than now.

Table 10: Projected PRN price for baseline applied to annual additional recycled tonnages only - best estimate

Average Producer Packaging waste Recovery Note (PRN)	2023	2027	2032
Paper/card	£2	£3	£3
Glass	£2	£3	£3
Aluminium	£46	£70	£99
Steel	£25	£44	£68
Plastics	£63	£77	£95
Wood	£4	£6	£8

To estimate the cost to producers of purchasing evidence to comply with their recycling obligation for 2018, the accredited recycling tonnage is multiplied by the relevant PRN prices. We assumed that producers would pay the average PRN material price for the currently recycled tonnages. For future years, the assumed prices (Table 10) were multiplied by the additional recycling tonnage projected in a given year over 2021 recycling tonnages. Thus, only the additional tonnages to 2021 levels face higher PRN prices.

For the best estimate, the cumulative undiscounted cost to businesses is projected to be £894m over the appraisal period, 2023-2032.

Table 11: Compliance costs to packaging producers of purchasing PRN evidence – best estimate

Business compliance costs - baseline (£M)	2023	2027	2032
Paper/card	£4.33	£4.64	£5.05
Glass	£20.03	£21.54	£23.29
Aluminium	£2.13	£2.44	£2.86
Steel	£2.15	£2.38	£2.45
Plastics	£53.36	£56.87	£61.41
Wood	£0.97	£1.00	£1.03
Total	£82.97	£88.86	£96.08

Operational costs for producers - baseline

Producers complying with the current PRN system collectively incur 'operational costs' which range from £1m - £2.4m per annum between 2010 and 2017. This amounts to a range of 1.7% to 3.8% of the total annual costs of the system²⁴. These are costs associated with the compliance system to process the PRNs on behalf of their members, e.g. staff, rent and equipment costs. It is unclear what the exact breakdown of these costs are beyond their headline figure.

Table 12: Historical spending on operational costs of the PRN system

Operational costs (£m)	2010	2011	2012	2013	2014	2015	2016	2017
Total PRN revenue	34.32	23.21	62.19	111.52	63.80	64.25	50.23	72.59
Operational cost in £	1.14	0.98	1.60	1.91	2.00	1.84	1.89	2.41
Share of total PRN revenue	3.3%	4.2%	2.6%	1.7%	3.1%	2.9%	3.8%	3.3%

To project future operational costs for the baseline we researched a number of datasets.

²³ There is significant uncertainty around the future prices within the PRN scheme

²⁴ Data based on NRPD *not publicly available* – Public PRN Revenue Summary Report - <https://npwd.environment-agency.gov.uk/Secure/SecureReports/PublicPRNRevenueReport.aspx?ReturnUrlId=f1cc5e28-4ebb-e811-ba38-b8ac6f957991>

The number of obligated packaging producers is published by the Environmental Agency in the National Waste Packaging Database. The future number of producers has been estimated by using historical growth rates, and these then have been applied to the 2017 figure. We assumed a 0.35% growth per year based on the period of 2014-2017.

Table 13: Projected number of obligated producers up to 2032 – best estimate

Number of obligated producers	2017	2023	2027	2032
best estimate	7,002	7,042	7,201	7,327

The evidence on the cost of joining a compliance scheme is based on the data from the Chartered Institute of Waste Management (CIWM) report *Packaging Waste Recovery – A European comparison*.²⁵ For the best estimate, the cost per producer of joining a compliance scheme is the average of the reported costs at just over £1,400 per producer. This value is assumed to be constant in nominal terms over the appraisal period as we have not found any published evidence showing historical trends.

The costs of issuing PRN evidence are based on the industry engagement and Waste Care website²⁶. This is an additional charge that compliance schemes charge on top of the price of the PRN. This ranges between £1-3, the conservative price of £1 has been assumed to be the best estimate²⁷.

Table 14: Baseline PRN compliance fees and issuing costs – best estimate

Current PRN system operational cost	2017	2023	2027	2032
Cost of joining scheme	£1,438	£1,438	£1,438	£1,438
PRN issuing charge	£1	£1	£1	£1

This reflects operational costs that vary with the PRN charge of issuing evidence, compliance (joining) fee for businesses, number of obligated businesses and total accredited recycling. This was estimated by multiplying the average registration fee for producers (£1,438) by the number of producers (7,002) and multiplying the average PRN charge (£1) by the total accredited recycling tonnage (7.3 million tonnes). Low and high estimates are presented in Annex G.

Table 15: Current PRN system operational costs

Current PRN system operational cost (£m)	2017	2023	2027	2032
Cost of joining scheme	£10.07	£10.17	£10.35	£10.53
PRN issuing charge	£7.36	£7.54	£7.98	£8.56
Total costs	£17.42	£17.71	£18.33	£19.09

Overall costs to producers - baseline

The overall cost to producers through the current PRN system are the costs of purchasing evidence (PRN) to show that the business has met its business obligation (compliance costs). Further, producers face operational costs which are the charges of actually joining and using a compliance scheme (e.g. Valpak) if they choose to do so.

Overall, when compared to net costs of packaging recycling and in residual waste, we estimate producers to cover around 7% of municipal packaging costs (see Tables 16, 17 and 19).

²⁵ Packaging Waste Recovery – A European comparison - <https://www.ciwm-journal.co.uk/downloads/Packaging-Waste-Recovery-A-European-comparison.pdf>

²⁶ Waste Care PRN charge - <http://www.wastecare.co.uk/compliance-services/packaging-compliance/costs-and-fees/>

²⁷ We have used the lowest proposed price from WasteCare research, £1, so as to avoid overestimating the net benefit of an EPR system compared to the current PRN system.

Table 16: Overall costs of the current system to producers in baseline

Overall costs to producers (£m)	2023	2027	2032
Compliance costs	£82.97	£88.86	£96.08
Operational costs	£17.71	£18.33	£19.09
Total cost	£100.68	£107.19	£115.17

Net costs of collecting packaging for recycling - baseline

The HH recycling costs of packaging are for dry recyclables under “multi-stream” systems for low-rise properties. We have used WRAP modelling results as presented in the Consistent municipal recycling IA for Option 3M for the overall costs of dry recycling and then applied the estimated amount of packaging material to estimate the costs associated with packaging recycling. For example, in 2018, WRAP’s model estimates that LAs net collection and treatment costs of multi-stream²⁸ in England would be £824m for all dry recyclables. WRAP estimates that packaging materials could represent around 78.7% of total volume when partially compacted by collecting trucks. Thus, packaging recycling costs are modelled to be around £519m in 2018 for England’s LAs. Given that our packaging data are UK wide, we then inflate this by factor 1.24 to approximate UK costs under this type of household recycling collections²⁹ so our baseline UK costs are then assumed to be £644m in 2018.

For the NHM sector it is assumed that there will be an increased use of separate bins for different waste (i.e. mixed dry recyclables, separate glass waste collections and separate food waste collections). There is no change to C&I collections. For the C&I and NHM sectors, we applied WRAP’s estimated costs of recycling collection per tonne to the recycling tonnage for the C&I and NHM sectors. See Annex H for details on the unit costs of collections.

Overall, we estimate the net costs of packaging recycling collections to municipal sector (HH and NHM sectors) be around £893m in 2023 and rising to £1,056m by 2032.

Table 17: Baseline net costs of packaging recycling collection – best estimate

Net cost of recycling collections - baseline (£m)	2023	2027	2032
HH	£705	£782	£814
NHM	£187	£207	£242
C&I	£159	£166	£174
Total	£1,052	£1,155	£1,230

Net costs of collecting packaging in residual waste - baseline

The unit HH collection costs for residual packaging waste are based on the WRAP estimates of the cost per tonne under multi-stream collection schemes. These costs were determined by looking at WRAP’s projected total residual waste costs (£1.53bn in 2023 in England) and then applying the estimated share of packaging in residual waste collections (12.8%)³⁰. The costs of collection of packaging waste for the residual stream are not fixed and change over time. The costs are inclusive of the landfill tax and average gates fees paid to residual waste treatment facilities.

The NHM sector costs of collection of packaging material are assumed to be constant over time. For the C&I sector we assumed the NHM packaging residual unit collection cost due to weak evidence base on the C&I sector’s residual costs. See Table 18 for the HH, NHM and C&I collection cost of packaging in residual waste.

²⁸ Please refer to the Consistent municipal recycling collections IA for full details.

²⁹ The factor to inflate tonnages, 1.22, is based on the portion of England’s household waste arisings in overall UK household waste arisings which was around 82% in 2015. We inflated England’s HH recycling costs by 1.24 to ensure that we are not underestimating the multi-stream costs already in place in Wales.

³⁰ WRAP’s estimate based on projecting Defra’s composition study estimates for local authority collected waste and recycling in England, 2010/11 (EV0801) that suggests the portion of packaging to be 17.1%. Using this share would likely result in an overestimate of packaging residual costs given further diversion of packaging from residual waste streams to recycling collections in the period of 2010-2018.

Table 18: Unit cost of collection and treatment of packaging in residual waste from each sector

Cost per tonne of residual collections £	2023	2027	2032
Household multi stream	147	148	153
Non-Household	201	201	201
Commercial and Industrial	201	201	201

To determine the total costs for collecting residual waste for the C&I and NHM systems individually, a split was assumed to divide the residual waste associated with the combined sectors. This combined residual waste tonnage is the residual waste leftover once HH residual waste is removed from total residual waste (assumed to be the difference between the POM materials and total accredited recycling).

The split between C&I and NHM was derived by making the initial assumption that each sector accounted for 50% of the remaining residual. We then looked at how this split would alter under a consistent municipal recycling system whereby the NHM sector is assumed to achieve higher recycling rates. We looked at the proposed growth in recycling in the NHM sector for packaging under a consistent municipal recycling collections³¹ and assumed that all this increase in recycled tonnages came out of the NHM residual waste stream. The split therefore shifted from 50:50 so that the C&I sector accounted for relatively more of the remaining residual, whilst the NHM sector accounted for relatively less. The split alters in line with the NHM sector recycling a slightly higher proportion each year. This methodology excludes wood which was 100% allocated to C&I.

This split gave us a total residual tonnage for each year under the NHM and C&I sector. The costs of collecting and treating packaging material in residual waste in HH, NHM and C&I have been estimated by multiplying the tonnage in residual by the costs per tonne.

Overall, the municipal residual waste costs are estimated to be £359m in 2023 and decreasing to £315m by 2032. The growth in household residual waste costs of packaging is a result of assumed growth in total packaging placed on UK market which offsets savings achieved as a result of increased diversion of packaging materials to recycling collections under multi-stream collections at kerbside. For the NHM sector, the growth in packaging recycling is high enough to result in actual reduction in residual waste costs by 2032.

Table 19: Baseline total cost of residual collections – best estimate

Cost of residual collections - baseline (£m)	2023	2027	2032
HH	£167	£181	£204
NHM	£191	£165	£113
C&I	£398	£420	£449
Total	£757	£765	£766

Landfill tax - baseline

The landfill tax in the analysis is fixed at £82.60 per tonne of residual waste (2015 rate) - this is in line with WRAP's scenario analysis³². HMT data shows that each year since 2014 there has been an increase in the rate of landfill tax. The most recent rate is set for 2019 and will be £91.70 per tonne of residual put into landfill. Therefore, by assuming costs of £82.60 per tonne of residual going to landfill for the period 2023-2032, we are making a conservative estimate on the loss associated with reducing landfill tonnage. The fixed landfill tax is assumed for the purposes of economic modelling and in order to be consistent with WRAP recycling scenarios that assume a fixed landfill tax rate.

³¹ See Option 3M in 'Consistent municipal recycling collections' Impact Assessment

³² WRAP have kept this input constant to show the first order impact to LAs of increased recycling. The Landfill tax costs are embedded within the net HH recycling management costs within WRAP's analysis. Thus we too followed the approach of fixing landfill tax at the 2015 price rather than projecting forward for consistency purposes.

Residual waste is split between going to landfill and being used for energy from waste (EfW). Using government data³³ we have assumed that the split in 2016 remains constant throughout the period 2023-2032. Thus, 29% of residual waste goes to landfill and 71% of residual waste is used in EfW plants.

The total expenditure on landfill tax is a product of the residual tonnages, the landfill tax rate and the percentage split on how much residual goes to landfill.

Table 20: Landfill tax expenditure by each sector - best estimate

Landfill tax expenditure - baseline (£m)	2023	2027	2032
HH	£28	£30	£32
NHM	£35	£33	£27
C&I	£36	£38	£40
Total	£99	£100	£100

Monetised benefits

Material revenue - baseline

The key monetised benefit for the baseline is the net revenue from the sale of the packaging material sent for recycling.

The material revenue benefit is split between benefits to local authorities, which have been accounted for in the net cost of recycling collections, and the wider economic benefits, which are quantified in this section. These wider economic benefits would occur down the supply chain, i.e. at the stage of reprocessing and recycling dry materials that are then sold on the secondary materials markets.

For this purpose, we use WRAP Materials Pricing Report Data³⁴. For best estimate, we applied the average prices and assumed they stay constant for the period 2023-2032. Different prices have been assumed for low and high estimate – see Annex G.

Table 21: WRAP's material prices per tonne and projections - best estimate

Material price per tonne in £ - best estimate	2015	2016	2017	2023	2027	2032
Paper/card	95.2	111.5	135.8	114.2	114.2	114.2
Glass	9.9	11.6	12.1	11.2	11.2	11.2
Aluminium	722.4	694.9	722.4	713.2	713.2	713.2
Steel	67.8	49.3	108.7	75.3	75.3	75.3
Plastics	158.2	150.4	182.2	163.6	163.6	163.6
Wood	- 53.5	- 50.0	- 47.5	- 50.3	- 50.3	- 50.3
Wood to Biomass	60.0	60.0	60.0	60.0	60.0	60.0

The recycling industry's economic benefits are then estimated by multiplying the accredited recycling tonnage by the material prices. We then netted of the amount paid to LAs to remove any double counting of material revenues. Table 22 shows the net material revenue to the recycling sector under baseline.

Table 22: Material revenue from recycled material - baseline

Packaging recycling material revenue - baseline (£m)	2023	2027	2032
Best estimate	£415	£441	£481

³³ https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/664608/LA_and_Regional_Spreadsheet_201617.xlsx

³⁴ <http://www.wrap.org.uk/content/materials-pricing-report>

Monetised costs and benefits of EPR reform under each scenario

Costs and benefits of EPR reform under Scenarios 1, 2 and 3 are compared against the Baseline costs and revenues.

There are several significant evidence gaps within our analysis and so assumptions have been used throughout – as such the outputs of our analysis are indicative only at this stage. Throughout this IA we have stated where assumptions have been made and outlined the basis for each assumption. We are hoping the corresponding consultation will help develop our data and understanding in areas where there are key evidence gaps for the next IA stage.

EPR reform under Scenario 1 – Reformed packaging producer responsibility system with full net costs on producers through modulated fees / deposit rates and no Deposit Return Scheme

EPR reform under Scenario 1 is to reform the packaging producer responsibility system and introduce a modulated fee or deposit rate system that allows to recover the full net costs of managing packaging recycling and residual waste in municipal sector. In this scenario there is no DRS and so all packaging is eligible under a reformed packaging producer responsibility scheme.

The analysis presented in this consultation stage IA does not attempt to determine the effectiveness of differential fee rates / deposit payments to be levied on placed on market packaging. This is a current evidence gap and Defra will be conducting further work in this and other relevant areas to improve our understanding of how a system could be implemented. Instead, the key focus of Scenario 1 is to illustrate, albeit partially, the impact that such a mechanism could have. Please refer to Chapter 11 “Estimated Costs and Benefits” for our assessment of key evidence gaps.

Further, we present our estimate of full net costs of managing packaging recycling and waste to the municipal sector. This is defined as the net costs to LAs and wider non-household municipal sector (NHM) of collection, treatment and disposal of recycling and waste disposal, netting off any material revenue received from selling separately collected dry packaging materials for recycling.

EPR reform under Scenario 1 assumes the introduction of a modulated fee or deposit system successfully delivers a move away from hard to recycle packaging materials. Quantitatively, we only assess the expected impact on PVC and polystyrene packaging. Consequently, the system delivers higher plastic packaging recycling rates compared to the baseline as producers switch to more readily recyclable alternatives to these two types of plastic packaging. Scenario 1 also assumes the transfer of the financial burden of the costs of collection for packaging materials from local authorities and the wider municipal sector to producers.

The focus on only PVC and polystyrene reflects the existing availability of evidence and the next stage of the IA will seek to cover a wider range of packaging materials.

The current focus of attention for modulated fees has been on the ease with which materials are recycled. Modulated fees could in theory cover recycled content, carbon impact, likelihood of being found in the oceans, etc. A change in the purpose of the modulated fees from recyclability would affect packaging designers and the rest of the supply chain so it needs to be clear what the purpose is, and for this to remain in place for an extended period.

As part of the Plastics Pact, WRAP has convened a group looking at the recyclability of plastics within the household sector. The group have the task of coming to a consensus on which polymers are recyclable and which are not – based on existing infrastructure for mechanical recycling.

As of mid-July 2018 there is broad consensus that the following polymers are not economically recyclable. Note that this reflects current feedback from industry.

- Polyvinyl chloride (PVC) plastic packaging: It is not currently sorted for recycling. It poses significant contamination issue for recyclers and packaging converters. There are very poor or no market for post-consumer material. Finally, it is not suitable for chemical recycling. This applies to PVC used in both rigid and film applications.
- Expanded polystyrene (EPS): Actively communicated to householders not to recycle. There is active sorting amongst waste management companies but in order to remove it for disposal, not recycling. There are very poor markets for post-consumer material.

- High impact polystyrene (HIPS): Active sorting amongst waste management companies but in order to remove it for disposal, not recycling. There are very poor markets for post-consumer material.

All of these plastic polymers have readily available substitutes. WRAP evidence indicates that PVC would be substituted with PET, while PS could move towards polypropylene (PP) packaging, or in some cases PET (depending on the application).

In terms of analysing the impact of modulated fees as part of a packaging EPR system we asked WRAP to produce the composition data on plastic packaging polymer/format that includes these polymers for both consumer and non-consumer sector. Table 23 below indicates the potential move from polymers destined for residual towards recycling based on the assumed percentage material switch profile provided by Defra.

In total this would mean an additional 88k tonnes of plastic from the consumer and non-consumer waste stream may be recycled rather than going to residual waste disposal. The timing of a switch would be dependent on the relative economic and technological factors involved but we assumed the shift to start when the actual reformed system is in place (2023). In advance of policy implementation in 2023, we assume that some producers will make amendments to their packaging - such changes are not estimated within this IA as they occur outside of the appraisal period. We assume that consumers and businesses will respond to changes in the plastic packaging placed on the market from 2023 and recycle the new recyclable packaging that is placed on the market. We assume that by 2023 households will have increased their recycled tonnage by the full 'Added tonnage of recyclable plastic' but businesses, in the non-consumer sector, will respond to the added tonnage of recyclable plastic more gradually. By 2032, the amount of additional recyclable plastic packaging grows to 93kt as a result of assumed growth rates in POM tonnages of plastic packaging. This methodology is based on agreed assumptions with WRAP.

Table 23: Illustrative impact of modulated fees / deposit rates on unrecyclable plastic packaging placed on market

Ktonnes	2017	2023	2027	2032
Unrecyclable plastics in consumer sector shifting to recyclable polymers				
PVC	24	0	0	0
PS	38	0	0	0
Unrecyclable plastics in non-consumer sector				
PS	31	26	5	0
Added tonnage of recyclable plastics				
PET/PP	0	67	88	93

Source: [PlasticFlow 2025](#) for 2017. WRAP and Defra assumptions for future years.

A number of other plastic polymers and packaging formats were identified by the Plastic Pact group as being of concern in terms of recyclability. However, we have not been able to find robust data that would allow us to quantify the potential size of impact³⁵.

Black plastics (carbon black) can be made using three different polymers – PET, HDPE and PP. Each of these polymers has different characteristics and the degree to which innovation is underway to sort and recycle them is varied. At this stage, no data has been available to be used for Scenario 1.

- **Carbon black PP/HDPE:** If these polymers can be sorted then there are recycling end markets. Collected by most LAs who collect plastic bottles and pots, tubs and trays. Recyclers and waste management companies request that all black PP and HDPE is detectable. No changes of equipment would be required.
- **Carbon black PET:** Potential for markets to develop in the UK. Trials are taking place.

WRAP does not have data on the amount and composition of black plastics used in the consumer sector. Thus, we have not considered black plastics under Scenario 1 at this stage.

³⁵ Further evidence is being sought here through the consultation to support the final impact assessment.

Composite packaging

Composite packaging is defined by the Environment Agency (EA) as: ‘multi-layered sheets of dissimilar materials which are bonded together and cannot be separated by hand’, such as laminated paperboard. This type of packaging is distinct from multi-material packaging, which is defined as: ‘packages constructed of assembled components of different material’, such as a blister pack made from cardboard and plastic and can be separated by hand.

Composite packaging means that polymers are difficult to separate and can be wrongly sorted. Caution is required to ensure that removal of barrier layers does not compromise on food shelf life.

There are data issues with this type of packaging. Within the EA’s technical interpretations guidance, the packaging weight for composite packaging ‘should be recorded under the predominant material by weight’. WRAP does not have data on the amount and composition of composite packaging. Therefore, we have not considered composite packaging in our analysis of the impact of modulated fees under the scenarios at this stage. We expect that if we extend our analysis to include charging modulated fees on composite packaging then the positive NPV will increase in magnitude. This is because producers would be expected to reduce the use of composite packaging materials in favour of more recyclable alternatives to reduce their financial burden of modulated fees.

Recyclable polymers

All other plastic packaging polymers / formats in the consumer sector either have developed end markets or have the potential to develop.

The areas where there needs to be the most progress is coloured PET and LDPE film, where collection tonnages are low, quality is an issue and there is currently volatility in end market destinations³⁶.

The following sections provide results on recycling levels, costs, and benefits under Scenario 1.

Projected recycling

As in the baseline, we have estimated a bottom-up recycling figure. The estimate was produced by building up the household (HH), commercial and industrial (C&I) and non-household municipal (NHM) sectors to create the overall recycling.

The HH analysis is based on WRAP’s HH analysis for the consistent municipal recycling collections IA. We again assume here that the dry recycling collection system is multi-stream, where dry recycling materials are collected separately in three bins.

The NHM sector’s packaging recycling is based on the same approach as in the baseline using Valpak’s split of how much recycling should be attributed to the consumer away-from-home sector (assumed to be NHM recycling within our analysis) and WRAP’s growth rate (See ‘**projected recycling – baseline**’ for more information). The NHM collection system is again assumed to be composed of mixed dry materials recycling, separate food waste and separate glass collections. For the C&I sector, we have assumed that the recycling levels would remain the same as per the baseline scenario.

Recycling tonnage under Scenario 1 increases on the basis of our assumption that efficient levels of modulated fees / deposit rates levied on non-recycled PVC and polystyrene would encourage producers to use more recyclable plastics in their packaging. It is therefore expected that more plastic will be recycled under Scenario 1 compared to the baseline. See Table 24 below for the best case HH recycling tonnage.

As presented in Table 23 above, implementation of modulated fees could mean a 62kt increase in HH plastic recycling in 2027 compared to 2017 – this results from a 24ktn reduction in PVC and a 32ktn reduction in PS. Table 24 below shows the impact on HH recycling from implementing modulated fees on plastic according to our model which assumes that all 62kt will be sent for recycling from 2023 onwards.

³⁶ Further evidence is being sought here through the consultation to be used in the final impact assessment.

Tables 24: Scenario 1 HH recycling projections and Scenario 1 HH recycling net of the baseline (in tonnes) – best estimates

WRAP HH recycling - Scenario 1	2023	2027	2032	WRAP HH recycling - Scenario 1 (net of the baseline)	2023	2027	2032
Paper	825,090	844,324	879,177	Paper			
Glass	1,436,076	1,480,126	1,540,579	Glass			
Aluminium	51,391	56,078	63,212	Aluminium			
Steel	230,825	232,513	237,149	Steel			
Plastic	606,518	628,921	652,394	Plastic	62,000	62,000	62,000
Wood				Wood			
Total Recycling	3,149,900	3,241,963	3,372,511	Total Recycling	62,000	62,000	62,000

For the NHM sector, there could be an increase in plastic recycling of 26kt following the implementation of modulated fees (Table 23). Contrary to household recycling impacts, we assumed a gradual shift in the NHM recycling, starting with 5kt in 2023 and reaching 26kt by 2027. Once accounting for the growth rate in POM tonnages (Table 1), we expect that modulated fees could result in the additional 30kt of recycled plastics by 2032.

Tables 25: Scenario 1 NHM packaging recycling projections and NHM packaging recycling projections net of the baseline (in tonnes) – best estimates

NHM recycling - Scenario 1	2023	2027	2032	NHM recycling - Scenario 1 (net of the baseline)	2023	2027	2032
Paper	748,751	828,392	969,744	Paper			
Glass	274,024	303,171	354,902	Glass			
Aluminium	42,135	46,617	54,571	Aluminium			
Steel	129,185	142,926	167,314	Steel			
Plastic	379,490	440,654	515,844	Plastic	5,000	26,331	30,824
Wood				Wood			
Total Recycling	1,573,585	1,761,759	2,062,375	Total Recycling	5,000	26,331	30,824

The C&I packaging recycling tonnages for Scenario 1 are assumed to be the same as per the baseline.

The overall recycling tonnage was estimated by summing the HH, C&I and NHM recycling tonnages. See Table 26 for the recycled tonnages for Scenario 1 by each material.

Tables 26: Scenario 1 total packaging recycling projections for HH, NHM and C&I (in tonnes) – best estimates

Overall recycling - Scenario 1	2023	2027	2032	Overall recycling - Scenario 1 (net of the baseline)	2023	2027	2032
Paper	3,870,490	4,083,535	4,412,196	Paper			
Glass	1,710,100	1,783,297	1,895,481	Glass			
Aluminium	95,876	105,111	120,233	Aluminium			
Steel	411,335	418,143	436,000	Steel			
Plastic	1,162,879	1,246,661	1,343,087	Plastic	67,000	88,331	92,824
Wood	419,926	429,396	441,534	Wood			
Total	7,670,608	8,066,143	8,648,531	Total	67,000	88,331	92,824

The overall recycling rate was estimated by dividing the overall recycling tonnage by the POM tonnage for each material. See Table 27 for the recycling rates under Scenario 1 by each material.

Tables 27: Scenario 1 packaging recycling rate and percentage point increase in the recycling rate compared to the Baseline – best estimates

Recycling rates - Scenario 1	2023	2027	2032	Recycling rates (net of the baseline) - Scenario 1	2023	2027	2032
Paper	81%	82%	84%	Paper			
Glass	71%	71%	72%	Glass			
Aluminium	52%	55%	59%	Aluminium			
Steel	75%	79%	87%	Steel			
Plastic	51%	52%	54%	Plastic	3%	4%	4%
Wood	29%	29%	28%	Wood			

Packaging in residual waste by sector

The packaging in the residual waste stream for Scenario 1 was estimated in the same way as in Baseline. See 'Net costs of collecting packaging in residual waste in baseline' for further detail on how the sectoral residual tonnages were derived.

The HH and NHM residual tonnages reduce in line with the increase in recycling from the HH and NHM sectors. There is no change to the residual tonnage in the C&I sector as no improvement to the collections have been modelled. Tables 28 and 29 show the residual tonnage of Scenario 1 within the HH sector and within the NHM and C&I sector respectively.

Table 28: Scenario 1 HH packaging in residual and net of the baseline (in tonnes) - best estimate

Packaging in HH residual - Scenario 1	2023	2027	2032	Packaging in HH residual - Scenario 1 (net of the baseline)	2023	2027	2032
Paper	326,077	342,047	350,028	Paper			
Glass	87,141	110,492	154,395	Glass			
Aluminium	10,514	12,098	14,380	Aluminium			
Steel	73,497	76,330	79,614	Steel			
Plastic	580,172	617,137	673,444	Plastic	- 62,000	- 62,000	- 62,000
Wood				Wood			
Total	1,077,402	1,158,104	1,271,861	Total	- 62,000	- 62,000	- 62,000

Table 29: Scenario 1 C&I and NHM packaging in residual waste and net of the baseline (in tonnes) - best estimate

Packaging in C&I and NHM residual - Scenario 1	2023	2027	2032	Packaging in C&I and NHM residual - Scenario 1 (net of the baseline)	2023	2027	2032
Paper	599,013	565,559	483,516	Paper			
Glass	600,255	627,832	600,372	Glass			
Aluminium	77,858	75,126	67,532	Aluminium			
Steel	69,447	34,278		Steel			
Plastic	540,806	511,485	479,915	Plastic	- 3,743	- 26,331	- 30,824
Wood	1,007,490	1,068,380	1,132,643	Wood			
Total	2,894,868	2,882,659	2,763,979	Total	- 3,743	- 26,331	- 30,824

Monetised costs of EPR reform under Scenario 1

The costs that have been monetised for Scenario 1 are the compliance and operational costs of a producer-owned and operated management organisation (PO) and loss of revenue to HM government from landfill tax when compared to baseline.

Landfill tax loss – Scenario 1

This provides an indication of the impact of these changes on the costs to producers of non DRS drinks packaging. With less tonnage going to residual waste in Scenario 1 (due to modulated fees increasing plastic recycling) there will be a fall in landfill tax revenue to HM Government. The undiscounted impact on total landfill tax from introducing modulated fees is a loss of £20m over the appraisal period (2023-2032). This loss is a transfer of savings to municipal sector³⁷.

In addition to the monetised costs above, a wider set of non-monetised costs are presented in Annex F

Cost of compliance to businesses – Scenario 1

For Scenario 1, the producers' costs of compliance would be the costs of packaging (recycling and residual) waste collections from the HH and NHM sector. These costs represent the cost transfer from LAs (HH net costs of packaging recycling and residual waste collection) and NHM businesses (NHM packaging recycling and residual waste collection costs) to producers. The breakdown of the compliance costs into those associated with recycled packaging and residual packaging for each sector can be found in Table

³⁷ As we have fixed landfill at the 2015 rate - to be consistent with WRAP's analysis – the analysis is presenting conservative costs to producers but also conservative losses to HM government.

32 and Table 33 respectively. The compliance costs will be paid through modulated fees/deposit payments on different packaging materials. The split between producer costs going to NHM businesses and LAs is shown in Table 30 below.

Table 30: Scenario 1 producer compliance costs – best estimate

Producer compliance costs to LAs and the NHM sector (£m) - Scenario 1	2023	2027	2032
LAs	£858	£948	£1,003
NHM	£378	£371	£352
Total	£1,236	£1,319	£1,354

Operational costs – Scenario 1

Given the early stage of policy proposals, a detailed costing of operational costs has not been feasible. Therefore we have researched mainly the European packaging EPR systems to indicate the potential scale of operational costs (and administration costs) likely to be seen under a reformed packaging producer responsibility system in the UK. Countries researched include: Belgium, France, Italy, Spain and the Netherlands.

Italy have provided the most detailed review of their system. However, there are some notable differences between theirs and the UK system. For instance, the Italian system involves 900,000 businesses whereas at present the UK system involves close to 7,000 businesses.

The best ‘proxy’ system seems to be Spain which works with 12,000 companies. In addition, Spain employs a similar number of staff (100) compared to the UK’s current system (88). In 2017 each country’s annual operational costs for their EPR systems were approximately €26m and €22m for Italy and Spain respectively. This translates to packaging EPR operational costs of £23m and £20m for Italy and Spain respectively³⁸, or 3% – 4.7% of each system’s total costs.

Using these figures, an indicative range of feasible packaging EPR system’s operational costs has been drawn up, with the average ~£21m being assumed for the best estimate. We have assumed that for the low estimate the price would reduce by 5% annually, and for the high estimate the price would increase by 5% annually. Table 31 presents indicative operational costs.

Table 31: Scenario 1 operational costs

Reformed EPR system operational cost (£m)	2023	2027	2032
Low - Sensitivity	16.26	13.25	10.25
Best estimate	21.32	21.32	21.32
High - Sensitivity	27.57	33.51	42.77

Monetised benefits of EPR reform under Scenario 1

The key monetised benefits of EPR reform under Scenario 1 are the savings from reduced collection and treatment of residual waste and the revenue from the sale of the packaging material sent for recycling. In addition, GHG emission savings have been monetised and are presented in the ‘Greenhouse gases emissions impacts’ section.

Net savings on collecting packaging waste for recycling – Scenario 1

The costs of collecting packaging material for recycling have been estimated based on the collection systems for Household (HH), Non-Household Municipal (NHM) and Commercial and Industrial (C&I) waste. The evidence on costs is based on the WRAP analysis as in the baseline.

³⁸ These have been converted from Euros to Pounds using the Bank of England average exchange rate for 2017 at €1.1413

Compared to the baseline, the net cost of recycling falls within the HH sector under Scenario 1. This is because the costs associated with collecting and sorting the increased HH recycled plastic (due to the implementation of modulated fees) are less than the benefits associated with the increase in material revenue that LAs are able to benefit from.

The NHM sector experiences a slight increase in costs under the modulated fees Scenario 1. This is a conservative estimate as it only takes into account the increased costs associated with collecting and treating the greater tonnage of recycled plastic but does not take into account the material revenue gained from the additional plastic recycled. In long-term, the dry recycling net costs per tonne would fall if there is increased amount of valuable material presented. We have decided to keep the costs conservative and not accounted for the change in the costs of recycling within the NHM sector due to the volumes being relatively small and uncertainty around how much the materials that are collected from NHM sector for recycling sell for. Overall, the cost of recycling collections falls in response to modulated fees.

Tables 32: Scenario 1 net cost of collection for HH, NHM and C&I packaging recycling and against Baseline – best estimates

Net cost of recycling collections - Scenario 1 (£m)	2023	2027	2032	Net cost of recycling collections - Scenario 1 (net of the baseline) (£m)	2023	2027	2032
HH	£699	£776	£808	HH	-£6	-£6	-£6
NHM	£188	£212	£248	NHM	£1	£4	£5
C&I	£159	£166	£174	C&I	£0	£0	£0
Total	£1,047	£1,153	£1,229	Total	-£5	-£2	-£1

Net collection and treatment savings from reduced residual tonnage – Scenario 1

As per the baseline, the unit cost of collecting packaging material in residual waste has been estimated using WRAP's analysis for the HH, NHM and C&I sectors. The cost of collecting packaging waste from residual has been estimated by multiplying the tonnage in residual (difference between recycling and POM) by the costs per tonne.

EPR reform under Scenario 1 delivers savings in the HH and NHM sectors when comparing the baseline costs of residual collection with costs of residual collection in Scenario 1. This is because the amount of packaging going into residual is decreasing for the NHM and HH sectors (but not C&I – which stays constant at baseline levels). These savings are attributed to local authorities (reduction in HH residual) and NHM businesses (reduction in NHM residual). Under the definition of Full Net Cost Recovery, these savings will be passed on to producers³⁹. Over the period 2023-2032, Scenario 1 results in residual collection savings of approximately £137m (undiscounted) for NHM and HH sectors.

Tables 33: Scenario 1 net cost of residual collections – best estimates

Net cost of residual collections - Scenario 1 (£m)	2023	2027	2032	collections - Scenario 1 (net of the baseline) (£m)	2023	2027	2030
HH	£158	£172	£195	HH	-£9	-£9	-£9
NHM	£190	£160	£104	NHM	-£1	-£5	-£6
C&I	£398	£420	£449	C&I	£0	£0	£0
Total	£747	£751	£748	Total	-£10	-£14	-£15

Material revenue benefits – Scenario 1

Another monetised benefit for Scenario 1 is the profit from the sale of the packaging material sent for recycling on the secondary market. For clarity, there is a difference between the material revenue benefits to local authorities, which have been accounted for in the net cost of collections, and the wider economic benefits, which are quantified in this section. These wider economic benefits would occur down the supply chain, i.e. at the stage of reprocessing and recycling dry materials to be then sold on the secondary materials markets. These benefits are considered to be indirect benefits to businesses.

³⁹ Producers will be expected to cover the Full Net Cost Recovery (FNCR) of the collection and treatment of their packaging in the waste system

For this purpose, we used WRAP Materials Pricing Report Data⁴⁰. The recycling industry's economic benefits are then estimated by multiplying the recycling tonnage by the material price (revenue) per tonne minus the costs that the reprocessors had to pay LAs for the materials.

Tables 34: Scenario 1 material revenue of recycled material to reprocessors – best estimate

Packaging recycling material revenue - Scenario 1 (£m)	2023	2027	2032	Packaging recycling material revenue - Scenario 1 (net of the baseline) (£m)	2023	2027	2032
Best estimate	£421	£450	£491	Best estimate	£7	£9	£10

EPR reform under Scenarios 2 and 3 – Reformed packaging producer responsibility system with modulated fees and Deposit Return Scheme (DRS)

EPR reform under Scenarios 2 and 3 allow for the introduction of either an 'All-in' or 'On-the-go' DRS. These two options are assessed in the impact assessment on introducing a deposit return scheme on beverage containers. Although both scenarios follow the same partial quantitative assessment as undertaken in Scenario 1 (for PVC and polystyrene), they both will divert specific types of packaging away from the packaging producer responsibility scheme and into DRS. This will reduce the volume of packaging materials that enter municipal kerbside recycling collections. The net benefits of packaging recycling lost from kerbside effectively transfer to the DRS scheme in place. These two scenarios highlight the interdependencies of the three policy proposals and how a change in one can affect another.

EPR reform under Scenario 2 assumes that the DRS 'All-in' Option is implemented and achieves a recycling rate of 85% of drink containers. Thus, we assume that 85% of the following materials are transferred from kerbside recycling and refuse waste collections to DRS recycling collections: PET drinks bottles, steel and aluminium drink cans and glass drinks bottles. In Scenario 2 there would be no restriction on the size/format of drinks containers in scope. The 85% refers to the expected return rate of DRS packaging materials to reverse vending machines (RVMs) and manual collection points⁴¹ – the remaining 15% is expected to go to kerbside.

EPR reform under Scenario 3 assumes that the DRS 'On-the-go' Option is rolled out in the future. It would cover the same materials as the 'All-in' DRS Option but would restrict the drinks containers in scope to a defined size/format to target those most often sold for consumption 'out-of-home'. Materials that fall under the DRS will be referred to as DRS POM materials in the sections below.

Scenarios 2 and 3 are both projected to deliver lower kerbside packaging recycling rates than Scenario 1 or Baseline. However, when aggregating packaging EPR Scenarios 2 and 3 with the respective DRS IA Option analysis, both Scenarios would achieve higher overall recycling rates for some packaging materials than under Scenario 1. This is investigated in further detail in the DRS IA.

We assumed that DRS type packaging material would be diverted away from LAs and NHM kerbside recycling and residual waste collections and not from the C&I packaging sector. Data on DRS POM materials was taken from Valpak's flow reports and the on-the-go (OTG) drinks container reports. This evidence presents the tonnage of DRS type material that is placed on market and tonnages of recycling under DRS 'All-in' scheme.

Table 35: Deposit Return Scheme packaging materials placed on the market (in tonnes) and the projected return rate to RVMs of DRS materials

Container type	All In POM (tonnes)	OTG POM (tonnes)	Recycling Rate
Glass bottles	1,835,931	457,312	85%
Aluminium cans	119,421	16,723	85%
Steel cans	34,760	1,497	85%
PET Bottles	317,427	118,540	85%
Total	2,307,538	594,072	85%

Source: Valpak's DRS POM report⁴² and the estimated return rate is based on international comparisons⁴³

⁴⁰ <http://www.wrap.org.uk/sites/files/wrap/9th%20Jan%202017%20MPR.pdf>

⁴¹ The 85% return rate of DRS materials is based on international comparison of return rates under similar schemes – see the DRS IA 'Introducing a Deposit Return Scheme on beverage containers' for further information.

⁴² Valpak's DRS POM report - forthcoming as currently unpublished

⁴³ See the DRS IA 'Introducing a Deposit Return Scheme on beverage containers' for further information.

Projected recycling – Scenarios 2 and 3

As in Scenario 1, we estimate here a bottom-up recycling figure by building up the HH, C&I, NHM sectors (without the DRS materials) to create the overall recycling.

We first used Valpak’s DRS on-the-go drinks report⁴⁴ to estimate the amount of DRS material that is in HH and NHM sectors. In particular, we applied the report’s shares of consumer household packaging and consumer away from home⁴⁵ to split overall POM DRS tonnages to the HH and NHM sectors respectively. We then used recycling rates for the DRS specific materials (provided by Valpak) to determine the exact tonnages that would come out of each sector’s recycling and residual tonnages. For example, as shown in Table 36, 65% of glass bottles are currently assumed to be recycled – therefore we assume that 65% of glass will come out of recycled tonnages for both the HH and NHM sector.

Table 36: Current recycling rates of DRS materials for Scenario 2 (All-in) and Scenario 3 (OTG)

All in DRS materials current recycling rate	%	OTG DRS materials current recycling rate	%
Glass	65%	Glass	51%
Aluminium	70%	Aluminium	59%
Steel	70%	Steel	59%
Plastic	70%	Plastic	65%

Table 37 below presents the consumer packaging disposed of at household and away from home percentage estimates. Due to differences between Valpak’s POM and the estimates we used from Waste Data Flow data, we have amended Valpak’s split slightly and assumed a different split for recycled and residual waste. We recognise that this is a data gap within our analysis and we are looking to develop our understanding of how much DRS packaging ends up being recycled in each of the sectors.

In terms of recycling tonnages from the NHM sector, we found that Valpak’s split implied **more** glass should come out of the NHM sector than is assumed to be recycled under Scenario 1. We therefore adjusted the recycling split to allow for the HH sector to account for a greater proportion of the recycled glass lost through the DRS – see Tables 38 and 39.

In addition, in terms of the residual split, we found that a higher tonnage of glass and aluminium was assumed to be coming out of the HH residual than was disposed of in HH residual under Scenario 1. We therefore had to alter the residual waste splits to allow for a higher proportion of the glass and aluminium tonnage to be removed from the NHM residual than HH residual.

Table 37: Valpak’s split of consumer packaging disposed of between the HH sector and ‘away from home’, assumed to be the NHM sector

Consumer recycling/residual disposed of in the HH sector	HH	Consumer recycling/residual disposed of ‘away from home’ - assumed to be in the NHM	NHM
Glass	65%	Glass	35%
Aluminium	64%	Aluminium	36%
Steel	64%	Steel	36%
Plastic	60%	Plastic	40%

Table 38: Amended split of recycled consumer packaging disposed of between the HH sector and ‘away from home’, assumed to be the NHM sector

Consumer recycling disposed of in the HH sector	HH (amended split)	Consumer recycling disposed of ‘away from home’ - assumed in the NHM sector	NHM (amended split)
Glass	80%	Glass	20%
Aluminium	64%	Aluminium	36%
Steel	64%	Steel	36%
Plastic	60%	Plastic	40%

⁴⁴ Valpak’s DRS POM report - forthcoming as currently unpublished

⁴⁵ Again assumed to be representative category for the non-household municipal sector.

Table 39: Amended split of residual consumer packaging disposed of between the HH sector and 'away from home', assumed to be the NHM sector

Consumer residual disposed of in the HH sector	HH (amended split)	Consumer residual disposed of 'away from home' - assumed in the NHM sector	NHM (amended split)
Glass	29%	Glass	71%
Aluminium	44%	Aluminium	56%
Steel	64%	Steel	36%
Plastic	60%	Plastic	40%

We then commissioned WRAP to model the impact on HH sector under (i) a packaging EPR modulated fees system and (ii) a DRS that achieves an 85% capture rate for given materials. Compared to the baseline, both the 'All-in' and 'OTG' Scenarios experience a fall in the HH tonnage of recycling at kerbside. The only DRS material that does not observe a fall in recycled tonnages is plastic packaging under the Scenario 3. This is due to the increase in recycled plastic as a result of modulated fees which has a greater positive impact than the loss observed when the DRS is rolled out (Table 40).

Table 40: Scenario 2 and 3, HH recycling accounting for DRS diversion (in tonnes) – best estimates

WRAP HH recycling - Scenarios 2 and 3	2032 (baseline)	2032 (2, All In)	2032 (3, OTG)	2032 (2, All In) net of the baseline	2032 (3, OTG) net of the baseline
Paper	879,177	879,177	879,177		
Glass	1,540,579	512,458	1,353,996	- 1,028,121	- 186,583
Aluminium	63,212	13,533	56,898	- 49,679	- 6,315
Steel	237,149	222,689	236,584	- 14,460	- 565
Plastic	590,394	519,074	606,163	- 71,319	15,769
Wood					
Total Recycling	3,310,511	2,146,932	3,132,817	- 1,163,579	- 177,694

By 2032, the NHM sector experiences a fall in total recycling tonnages compared to the baseline for both the Scenarios 2 and 3 due to DRS materials being diverted from kerbside collections. (Table 41).

Table 41: Scenario 2 and 3, NHM recycling accounting for DRS diversion (in tonnes) – best estimates

NHM recycling - Scenarios 2 and 3	2032 (baseline)	2032 (2, All In)	2032 (3, OTG)	2032 (2, All In) net of the baseline	2032 (3, OTG) net of the baseline
Paper	969,744	969,744	969,744		
Glass	354,902	97,872	308,256	- 257,030	- 46,646
Aluminium	54,571	26,627	51,019	- 27,945	- 3,552
Steel	167,314	159,180	166,996	- 8,134	- 318
Plastic	485,020	426,964	485,024	- 58,056	3
Wood		-	-		
Total Recycling	2,031,551	1,680,387	1,981,039	- 351,164	- 50,512

As per Scenario 1, we have assumed that the recycling levels would remain the same for the C&I packaging sector as those outlined in the baseline. Therefore there is no net change in 2032 from baseline.

Overall, there is a fall in total recycled tonnages of packaging from kerbside in 2032 – see Table 42.

Table 42: Scenarios 2 and 3, overall packaging recycling tonnage – best estimates

Overall accredited recycling - Scenarios 2 and 3	2032 (baseline)	2032 (2, All In)	2032 (3, OTG)	2032 (2, All In) net of the baseline	2032 (3, OTG) net of the baseline
Paper	4,412,196	4,412,196	4,412,196		
Glass	1,895,481	610,330	1,662,252	- 1,285,151	- 233,229
Aluminium	120,233	42,610	110,367	- 77,624	- 9,867
Steel	436,000	413,406	435,117	- 22,594	- 883
Plastic	1,250,263	1,120,888	1,266,036	- 129,375	15,773
Wood	441,534	441,534	441,534		
Total Recycling	8,555,707	7,040,964	8,327,501	- 1,514,744	- 228,206

The implementation of a DRS results in an overall fall in recycling from kerbside collections (Table 43). However, once the DRS-type materials are collected and recycled under the DRS, there is a net

increase in the UK packaging recycling rates (Table 44).

Table 43: Scenarios 2 and 3, overall packaging recycling rates without 'All-in' and 'OTG' DRS materials – best estimates

Overall recycling rates - Scenarios 2 and 3	2032 (baseline)	2032 (2, All In)	2032 (3, OTG)	2032 (2, All In) net of the baseline	2032 (3, OTG) net of the baseline
Paper	84%	84%	84%		
Glass	72%	23%	63%	-48%	-9%
Aluminium	59%	21%	55%	-38%	-5%
Steel	87%	82%	87%	-4%	0%
Plastic	50%	45%	51%	-5%	1%
Wood	28%	28%	28%		

Table 44: Scenarios 2 and 3, overall packaging recycling rates if accounting for DRS materials – best estimates

Overall recycling - Scenario 2 and 3	2032 (baseline)	2032 (2, All In)	2032 (3, OTG)	2032 (2, All In) net of the baseline	2032 (3, OTG) net of the baseline
Paper	84%	84%	84%		
Glass	72%	82%	77%	10%	6%
Aluminium	59%	71%	62%	12%	2%
Steel	87%	88%	87%	1%	0%
Plastic	50%	56%	55%	6%	5%
Wood	28%	28%	28%		

Packaging residual waste by sector – Scenarios 2 and 3

We estimated the overall packaging in the residual waste stream for Scenarios 2 and 3 based on the same approach used in Baseline and Scenario 1. For both the NHM and HH sectors an amount of DRS material was then assumed to be removed from the residual waste stream.

The amount of DRS material taken from HH residual waste was determined using the Valpak split on packaging in the waste stream – see Table 36 above. To determine how much came out of residual waste specifically we used the percentage split provided by Valpak on how much DRS materials currently go to residual rather than recycling. For example, according to Valpak, 30% of plastic packaging currently goes to residual (Table 36), therefore once DRS is implemented we make the assumption that 30% of DRS-type plastic packaging would come out of residual and 70% out of recycling.

There is no change to the packaging in residual waste tonnage in the C&I sector as no improvement to the collections have been made. Thus, the material removed from C&I and NHM residual waste compared to the baseline scenario is entirely due to the NHM sector improvements.

Tables 45 and 46 show the packaging tonnage in residual waste from HH and C&I and NHM of Scenarios 2 and 3 once accounting for DRS diversion.

Table 45: Scenarios 2 and 3, HH packaging in residual waste (in tonnes) - best estimate

HH residual - Scenarios 2 and 3	2032 (baseline)	2032 (2, All In)	2032 (3, OTG)	2032 (2, All In) net of the baseline	2032 (3, OTG) net of the baseline
Paper	350,028	350,028	350,028		
Glass	154,395	74,532	109,304	- 79,863	- 45,091
Aluminium	14,380	3,871	11,597	- 10,509	- 2,783
Steel	79,614	76,555	79,365	- 3,059	- 249
Plastic	735,444	644,876	659,219	- 90,568	- 76,225
Wood					
Total	1,333,861	1,149,862	1,209,513	- 183,999	- 124,348

Table 46: Scenarios 2 and 3, C&I and NHM packaging in residual waste (in tonnes) - best estimate

C&I and NHM residual - Scenarios 2 and 3	2032 (baseline)	2032 (2, All In)	2032 (3, OTG)	2032 (2, All In) net of the baseline	2032 (3, OTG) net of the baseline
Paper	483,516	483,516	483,516		
Glass	600,372	404,845	489,977	- 195,527	- 110,395
Aluminium	67,532	54,157	65,967	- 13,375	- 1,565
Steel					
Plastic	510,739	460,870	470,432	- 49,869	- 40,307
Wood	1,132,643	1,132,643	1,132,643		
Total	2,794,803	2,536,032	2,642,536	- 258,771	- 152,267

Monetised costs of EPR reform under Scenarios 2 and 3

The costs that have been monetised for EPR reform under Scenarios 2 and 3 are the operational costs of a producer-owned and operated management organisation (PRO), compliance costs and additional packaging collection costs of recycling when compared to baseline.

Net costs of collecting packaging waste for recycling – Scenarios 2 and 3

As in Scenario 1, the costs of collecting packaging material for recycling have been estimated based on the collection systems for household (HH), non-household municipal (NHM) and commercial and industrial (C&I) waste. Table 47 shows the annual cost for recycling collections for each sector for Scenarios 2 and 3.

Table 47: Scenarios 2 and 3, net packaging recycling collection costs – best estimates

Net cost of recycling collections - Scenario 2 (All In), (£m)	2023	2027	2032	2032 (net of the baseline)	Net cost of recycling collections - Scenario 3 (OTG), (£m)	2023	2027	2032	2032 (net of the baseline)
HH	£714	£800	£833	£19	HH	£705	£786	£819	£5
NHM	£195	£198	£229	-£14	NHM	£179	£203	£234	-£8
C&I	£159	£166	£174	£0	C&I	£159	£166	£174	£0
Total	£1,068	£1,164	£1,235	£6	Total	£1,044	£1,155	£1,226	-£3

Net material revenue – Scenarios 2 and 3

For the material revenue received by reprocessors, we use WRAP Materials Pricing Report Data⁴⁶ and follow the same approach as per the baseline and Scenario 1. For further details on the methodology see 'Material revenue benefits – Scenario 1'.

Because of the diversion of DRS-like materials out of the packaging EPR system there is a reduction in material benefits for the secondary market in both Scenarios 2 and 3 compared to Scenario 1. In addition, the materials that the DRS removes from the packaging EPR system are considered high value in comparison to the average recycled material which heightens the fall in revenues.

To ensure that we are not double counting material revenue, we have determined the profit made from recycled materials on the secondary market by taking the average price that the secondary market buys each material for and then subtracted the price that the reprocessors buy the unprocessed material for⁴⁷. These benefits are considered to be indirect benefits to businesses.

Table 48: Scenarios 2 and 3, net material revenue from recycled material

Packaging recycling material revenue - Scenarios 2 and 3 (£m)	2023	2027	2032
Scenario 2 (All In)	£323	£349	£388
Scenario 3 (OTG)	£385	£412	£451
Scenario 2 (All In), net of the baseline	-£92	-£92	-£93
Scenario 3 (OTG), net of the baseline	-£30	-£29	-£30

⁴⁶ <http://www.wrap.org.uk/sites/files/wrap/9th%20Jan%202017%20MPR.pdf>

⁴⁷ This is assumed to be equal to the price that LAs sell their separately collected material for. See the Consistent municipal recycling IA for assumed material prices for separately collected dry materials.

Cost of compliance to businesses – Scenarios 2 and 3

As in Scenario 1, for Scenarios 2 and 3, the cost to business of compliance would be to meet the net costs of packaging collections from the HH and NHM sectors. Table 49 below shows the costs to producers for waste collections from NHM businesses (NHM recycling and residual) and HH kerbside (HH recycling and residual).

Tables 49: Scenarios 2 and 3 producer compliance costs (municipal packaging costs)

Producer compliance costs to LAs and the NHM sector (£m) - Scenario 2, ALL IN	2023	2027	2032	Producer compliance costs to LAs and the NHM sector (£m) - Scenario 3, OTG	2023	2027	2032
LAs	£854	£954	£1,009	LAs	£854	£951	£1,004
NHM	£257	£250	£230	NHM	£345	£331	£312
Total	£1,111	£1,204	£1,240	Total	£1,200	£1,282	£1,315

Operational costs – Scenarios 2 and 3

The operational costs in Scenarios 2 and 3 are the same as those assumed in Scenario 1, see ‘**operational costs (including administration costs) – Scenario 1**’ for a full description. See Table 50 below for estimated operational costs.

Table 50: Scenarios 2 and 3, operational costs of reformed packaging system

Reformed EPR system operational cost (£m)	2023	2027	2032
Low - Sensitivity	16.26	13.25	10.25
Best estimate	21.32	21.32	21.32
High - Sensitivity	27.57	33.51	42.77

Monetised benefits of EPR reform under Scenarios 2 and 3

The key monetised benefits of EPR reform under Scenarios 2 and 3 are the savings from reduced collection and treatment of packaging material in residual waste.

Net savings from reduced packaging residual waste – Scenarios 2 and 3

As per the baseline, the cost of collecting packaging material in residual waste has been estimated for household (HH), non-household municipal (NHM) and commercial and industrial (C&I) waste based on WRAP’s analysis.

When comparing the packaging’s residual waste costs for Scenario 2 and Scenario 3 against the baseline, a saving appears. This is due to the fall in residual tonnage under Scenarios 2 and 3 as a result of some DRS materials being diverted to the DRS rather than staying in municipal sector’s residual waste streams. The savings compared to the baseline over the 2023-2032 period amount to an undiscounted £770m for both the NHM and HH sectors for Scenario 2 and £469m for Scenario 3⁴⁸.

Table 51: Scenarios 2 and 3, residual waste costs

Cost of residual collections - Scenario 2 (All In), (£m)	2023	2027	2032	2032 (net of the baseline)	Net cost of residual collections - Scenario 3 (OTG), (£m)	2023	2027	2032	2032 (net of the baseline)
HH	£140	£154	£176	-£28	HH	£149	£163	£185	-£19
NHM	£144	£113	£58	-£52	NHM	£166	£135	£80	-£30
C&I	£398	£420	£449	£0	C&I	£398	£420	£449	£0
Total	£682	£686	£682	-£79	Total	£713	£717	£714	-£49

⁴⁸ No savings in the C&I costs as the residual tonnage does not change.

Greenhouse gases emissions impacts

The greenhouse gas emissions analysis of packaging recycling scenarios have been done using Defra’s in-house model which estimates the net increase or decrease in carbon emissions across the following activities:

- Dry recycling and reprocessing of packaging materials
- Energy recovery (incineration) of packaging waste
- Landfill impacts of packaging waste

The calculations are based on BEIS greenhouse gas conversion factors from 2017⁴⁹. For each of the Scenarios’ GHG emissions savings, we applied the carbon prices as presented in Table 52 over the appraised period.

Table 52: Applied carbon prices, in £/t of CO₂e, rounded

Year	Traded carbon prices			Non-traded carbon prices		
	Low	Central	High	Low	Central	High
2023	12	27	43	36	71	107
2024	16	34	54	36	73	109
2025	20	42	64	37	74	111
2026	23	49	75	37	75	112
2027	27	57	86	38	76	114
2028	31	64	97	39	77	116
2029	35	72	108	39	78	117
2030	40	79	119	40	79	119
2031	43	87	130	43	87	130
2032	47	94	141	47	94	141

Source: BEIS UK traded carbon values for policy appraisal 2017; Table 3 from supporting the toolkit and the guidance 2017 for non-traded carbon values.

Table 53 below presents the GHGs emissions savings under Scenarios 1-3 of the EPR packaging reform. These are shown for best estimate only. The key observations are:

- EPR reform under Scenario 1 delivers emissions savings of 1.3MtCO₂e over the period of 2023-2032. This is the result of increased plastic packaging recycling due to the impact of modulated fees / deposit rates.
- EPR reform under Scenarios 2 and 3 also delivers savings of 1.3MtCO₂e. The introduction of a DRS is assumed to deliver higher recycling rate for relevant packaging materials (from around 70% to 85%) and thus GHG emission savings. These are outlined and included in the calculation of the NPV within the DRS IA. The ‘All-In’ and ‘OTG’ DRS options deliver GHG emission savings of 2.9MtCO₂e and 0.9MtCO₂e (traded and non-traded) respectively above the savings achieved through a reformed EPR system. The GHG emission savings calculated in the DRS Impact Assessment should be added to the 1.3MtCO₂e saving from a reformed EPR system for packaging to provide the full picture of the combined impact on GHGs emission savings as a result of reforming the packaging producer responsibility system and implementing DRS.

Table 53: Traded and non-traded greenhouse gases emissions under Scenarios 1-3, in kilotons of CO₂e

Traded GHGs emissions increase (+) or decrease (-), ktCO ₂ e					Non-Traded GHGs emissions increase (+) or decrease (-), ktCO ₂ e				
	2023	2027	2032	2023-2032		2023	2027	2032	2023-2032
Paper					Paper				
Glass (aggregate)					Glass (aggregate)				
Aluminium					Aluminium				
Steel					Steel				
Plastic	- 70	- 93	- 98	- 885	Plastic	- 37	- 49	- 51	- 464
Wood					Wood				
Total	- 70	- 93	- 98	- 885	Total	- 37	- 49	- 51	- 464

⁴⁹ <https://www.gov.uk/government/publications/greenhouse-gas-reporting-conversion-factors-2017>

Applying the relevant traded and non-traded carbon prices, Table 54 shows the monetised GHGs emissions savings under Scenarios 1, 2 and 3. Again, please note that Scenarios 2 and 3 only show a partial picture (impact of increased recyclability of plastic packaging) and needs to be combined with GHG emission savings achieved through a DRS.

Table 54: Monetised greenhouse gases emissions savings(-) under Scenarios 1-3, in £m

GHGs costs (+) or savings (-), £m	2023	2027	2032	2023-2032
Paper				
Glass (aggregate)				
Aluminium				
Steel				
Plastic	-£4.52	-£8.99	-£13.98	-£92.00
Wood				
Total	-£4.52	-£8.99	-£13.98	-£92.00

Small and Micro sized Business Assessment

Packaging producers

Small and micro sized enterprises (SMEs) have been taken into account throughout the process of coming to this consultation. We have engaged SMEs in our stakeholder engagement process and we have considered carefully any scenarios that may put an unnecessary burden on SMEs.

The principal issue that has arisen during the process, that directly affects SMEs, is that of the de-minimis. The de-minimis is a threshold that was created to protect small businesses from the burden of complying with the current packaging producer responsibility regulations. Any business who handles less than 50 tonnes of packaging and has a turnover of less than £2m a year is exempt from the packaging waste obligation⁵⁰.

Throughout our stakeholder engagement process, and in line with the “polluter pays” principle, many have called for the de-minimis to be lowered or removed. These calls are driven by differing motivations, including: to encourage SMEs to do the right thing, and to lower the business target for currently obligated producers⁵¹. We are therefore consulting on this topic. We are not proposing a sole solution but rather looking for views and opinions on this issue.

As explained below, we have been unable to analyse this issue as part of this consultation stage IA. Consequently we are using the consultation as a call for evidence (as well as for views) for this issue. In the final impact assessment for these reforms, before any regulatory change, we want to improve the current analysis to ensure that whatever option is taken forward does not put any avoidable burden on SMEs.

We have also considered that, should the de-minimis remain unchanged, then SMEs may still be impacted by the reforms. If producers elsewhere in the supply chain are having to pay much more money into the packaging EPR system, then they may well pass these costs along the chain to SMEs. We anticipate however that SMEs would then pass these costs on, where they would ultimately be passed to the final consumer of packaging.

The De-Minimis

Assessing the lowering or removing of the de-minimis threshold is an important aspect of any future packaging EPR system. It would have a cost impact on many small and micro businesses and it would also increase the burden on the regulators through an increased compliance monitoring workload.

⁵⁰ See here for more information about who is currently obligated: <https://www.gov.uk/guidance/packaging-producer-responsibilities#check-if-youre-an-obligated-packaging-producer>

⁵¹ A factor is applied to the recycling targets to account for the fact that not all packaging that is placed on the market is accounted for.

We have made assessments of previous attempts to look at this issue, including previous work by Defra and Valpak. After looking at these previous attempts and the variation between them we decided to look at the issue again. We concluded that for the current evidence base, and the associated analysis we have done, is not of a satisfactory standard to be integrated fully into the current impact assessment.

The method we used involved assessing data from the Office for National Statistics (ONS). We used SIC (Standard Industrial Classification) Codes from currently complying businesses to filter the ONS data. We then used several methods to try and account for the fact the not all businesses within each SIC Code would be a packaging "producer". We looked at methods to model reducing the de-minimis and also at removing it entirely. A more detailed explanation of the method along with the results can be found in Annex E.

The number of businesses that our analysis suggests would become obligated if the de-minimis were removed range from 60,000 to 900,000. We believe that the true number is likely to be nearer to 900,000.

We will be looking to improve this analysis in the coming year and following the consultation. We will be commissioning an external evidence project which will look at the lowering/removal of the de-minimis, as well as the effect of moving to a single point of compliance. The main element that we need to make a big improvement to here is the data. We have asked open questions in the consultation as to whether there is the right data available to do this analysis properly and accurately.

Non-household municipal sector

As part of reforming the packaging producer responsibility system, producers would be required to fund the full net costs of collection of packaging for recycling and costs associated with residual waste treatment of packaging materials. This covers both LAs costs of household packaging and wider municipal sector costs (i.e. the non-household municipal sector). As presented in the Consistent municipal recycling collections IA, there might be around 1.95m business units under the micro and small business size.

Table 55: Number of business and public administration units in the non-household municipal sector

Sector	Micro	Small	Medium	Large	Total
Food Manufacturers	4,695	1,710	720	320	7,445
Retail & Wholesale	343,265	71,040	9,420	1,505	425,230
Hotels & catering	106,705	44,345	4,390	205	155,645
Transport & Storage	80,000	10,020	3,260	665	93,945
Health	88,565	37,015	6,595	315	132,490
Office	1,052,825	86,250	17,185	3,500	1,159,760
Education	29,095	7,150	2,080	645	38,970
Total	1,705,150	257,530	43,650	7,155	2,013,485

Source: Defra (2019), Consistent municipal recycling collections impact assessment

Our analysis shows that, when compared to baseline, the undiscounted savings to NHM sector could vary between £3.7bn (Scenario 1) to £2.4bn (Scenario 2) over the period of 2023-2032. These savings are a result of transferring the costs of NHM packaging to packaging producers from 2023 onwards.

There is no packaging data available for the NHM sector but our estimate is that, out of total 20.3Mt of waste generated by the NHM sector, between 5Mt and 6.5Mt of total waste might be generated by micro and small businesses⁵². Or between 24% and 32% of the total NHM waste arisings. Assuming that the proportion of packaging material in total NHM waste arisings does not change with the size of business, we tentatively estimate that possibly around £50m-£70m of annual packaging costs to micro businesses could be paid by packaging producers. Similarly, for small businesses, around £67m-£93m of NHM small businesses' annual packaging costs could be paid for by new requirements on packaging producers.

⁵² Defra (2018), Consistent municipal recycling collections impact assessment

Annex A: Principles of Extended Producer Responsibility for packaging waste

Set out below are the principles on which government's proposals for a packaging waste Extended Producer Responsibility (EPR) system are based. We have taken into account the views of stakeholders across a range of sectors as well as local government, reviewed reports by international organisations and looked into how EPR systems for packaging operate in other countries. The principles reflect the framework for EPR set out in the Resources & Waste Strategy and are consistent with the requirements for EPR in the EU Circular Economy Package.

The proposed overarching principles for packaging EPR are:

- 1) Producers will bear the full net cost of managing the packaging they handle or place on the market at the end of its life; that is 100% of the net economic cost of dealing with packaging waste.
- 2) Producers will be incentivised to design and make packaging that is recyclable, and to reduce unnecessary and problematic (for recycling) packaging.
- 3) All producers will be expected to pay into the system, either directly or through the price they're charged by others in the supply chain, in line with 'the polluter pays' principle
- 4) Money raised from producers will be retained within the system to support the management of packaging waste at end of life and the achievement of targets and outcomes for packaging waste. Subject to this consultation for packaging this may include: collection, recycling, disposal, the clear-up of littered and fly tipped packaging, and communications. The funding raised will be used to support the collection of a common set of packaging materials for recycling.
- 5) All packaging will be labelled as to whether or not it can be recycled, with appropriate labelling on compostable packaging (and DRS materials, if scheme proceeds), to make it easier for people to know how to recycle and dispose of their packaging waste.

Annex B: Description of governance options for a reformed packaging producer responsibility system

The following summarises the governance proposals through which the reformed packaging producer responsibility system could operate. For more details, please refer to the consultation on reforming the packaging producer responsibility system.

Model 1: Enhanced near-to-business as usual - compliance schemes

This model is based on the current compliance scheme model. Obligated producers would choose a compliance scheme to join. All obligated producers would need to join a scheme thereby removing the option of direct registration with the regulator that is available under the current system. Schemes would take on the legal obligations of their members as currently.

Some consolidation of schemes could result as the resources and expertise required to deliver compliance under a packaging EPR scheme would be greater compared to the current system. There would be nothing to prevent new schemes from being established. The market would determine the appropriate number of schemes.

Similar to the current system, each scheme would be responsible for achieving the recycling targets for the packaging their members place on the market. Schemes would also be required to demonstrate full net cost recovery payments had been made for household and household-like packaging.

Household/household-like packaging waste

Schemes would levy modulated fees on their members based on the quantity and type of packaging each handles. Each scheme would set its own fee rates to ensure full net cost recovery of the household/household like packaging it is managing, but in setting their rates would take account of national guidance on:

1. the costs to be recovered through modulated fees (full net cost recovery);
2. the packaging materials/formats deemed to be recyclable (i.e. the approved list); and
3. the level of differential expected in the fee rates for different types packaging/ formats to ensure all schemes incentivise the same desired design behaviours and outcomes.

Each scheme would be required to set aside a proportion of producer fees to support communications campaigns and other costs such as litter initiatives in each nation. This funding would be transferred to an independent board to allocate to each nation to distribute (see below).

Schemes would compete with each other to access packaging waste handled by local authorities. They would enter into contracts/agreements with local authorities for an agreed period (possibly 3-5 years). The payments a scheme makes to a local authority would need to cover the cost of collecting and managing packaging waste and meeting any required minimum collection standard. Authorities would recover their costs directly from the scheme they had contracted with, consistent with the approaches discussed in Section 4. Where collection and sorting services are contracted out by a local authority schemes could choose to support authorities in their procurements.

For household-like packaging not collected by local authorities, schemes would enter into agreements with sorting facilities /transfer stations that receive packaging waste from commercial collectors. Payments would need to be based on meeting acceptability criteria related to tonnage, quality, and the presentation of supporting evidence that the packaging had been recycled. Again, options for how this could operate are presented in Section 4.

Commercial/industrial packaging waste

In order to meet their targets schemes would need to acquire evidence directly from accredited reprocessors or exporters of commercial and industrial packaging waste recycling (i.e. distribution and transit packaging). This effectively means a market for evidence of packaging recycling would continue to apply. As the cost of collection and treatment of this packaging waste is (and would continue) to be

borne by business, the value of this evidence (PRN) would effectively represent the additional cost of recycling this material.

If an obligated producer could provide evidence of recycling their own packaging waste (e.g. by back-hauling transit packaging and selling the materials direct) to the scheme, this would count towards their obligation (as currently).

It is proposed that under this model an independent (of the compliance schemes) advisory board would be established by government to provide strategic oversight of the system and the schemes. This could include reviewing plans, monitoring performance and advising schemes, developing the approved list of packaging and other guidance, and managing the allocation of producer funding to each nation for communications campaigns and litter related activities. The membership of the board and its remit would need to be considered further. The Board could provide oversight to ensure that every local authority is contracted by a scheme and could act as an arbiter if a situation arose whereby there was disagreement between a scheme and a local authority. In Sections 9 and 10 we put forward proposals for increasing transparency of a competitive compliance scheme approach.

Model 2: Single not-for-profit management organisation

Delivery of all aspects of the packaging EPR scheme would be the responsibility of a single management organisation (a not-for-profit or a Government Arms' Length Organisation) who would act as the scheme administrator. If the management organisation were a not-for-profit, it is proposed that government would invite proposals from potential operators and award an operating licence for a set period of time. Subject to the performance of the management organisation the licence could be awarded for a further agreed period. There would also be provision for government to withdraw the licence or require remedial action should the management organisation not be performing per the agreement.

The management organisation would be responsible for meeting the legally binding packaging waste recycling targets and other outcomes agreed with government.

All obligated producers would be required to register with the management organisation. The modulated fee rates would be proposed by the management organisation so as to achieve full net cost recovery and would be agreed with government. Fees would be paid by obligated producers based on the quantity and type of packaging they handle (as described in Section 2).

The management organisation would allocate the funds to ensure targets are met and other outcomes are achieved. It would make payments to local authorities and waste management companies/sorters in accordance with priorities and agreed funding formulae. These payments would support a more coherent collection infrastructure for packaging waste and the delivery of minimum service standards/ collection blueprints/codes of practice in each nation (as discussed in Section 4).

The management organisation would set aside a proportion of producer fee income for communications campaigns, for litter initiatives, etc. in each nation. How this funding would be allocated / distributed to each nation would be agreed between the management organisation and the government of each nation.

In this model there is no statutory role for compliance schemes as under the current system.

As exporters and reprocessors would not be required to sell evidence of recycling this essentially removes the need for them to be accredited. Instead they would be required to report tonnages of all packaging waste exported or reprocessed to the regulator. In Wales, as a requirement of their Environmental Permit, reprocessors are already required to provide this information under the 'site return' provisions. A charge could be applied to the provision of this data to the management organisation. An alternative would be to require all exporters and reprocessors of packaging waste to be accredited and to report tonnages of all packaging waste exported and reprocessed.

Model 3: Separate arrangements for household/household-like packaging and commercial/industrial packaging

In this model separate arrangements would be put in place for household/ household-like packaging waste and for commercial and industrial packaging waste (i.e. distribution/ transit). Responsibilities would sit with different organisations. It would require recycling targets to be split for household/household-like packaging waste and commercial/industrial packaging waste.

Arrangements for commercial and industrial packaging

Arrangements for commercial and industrial packaging would be managed by compliance schemes. All obligated producers would join a scheme. Compliance schemes would acquire evidence of commercial and industrial packaging waste recycling from accredited reprocessors and exporters equivalent to the tonnages required to meet their targets (by material).

The evidence would be paid for through a market-based system and producers would be charged for the cost of this evidence as now. In sections 9 and 10 we set out proposals to address shortcomings in the current PRN system.

If an obligated producer could provide evidence of recycling their own packaging waste (e.g. by back-hauling transit packaging and selling the materials direct) to their compliance scheme, this would count towards their obligation (as currently).

Arrangements for household and household like packaging

The requirements for household/household-like packaging would be managed by a single not-for-profit management organisation. This organisation effectively would be the same as that described for Model 2. It would be responsible for meeting the legally binding packaging waste recycling targets as they applied to household/household-like packaging and other outcomes as agreed with government. Fees would be paid by obligated producers based on the quantity and type of household/household-like packaging they handle (as described in Section 2). The modulated fee rates would be proposed by the management organisation and agreed with government.

There are two options for producers to pay these fees:

1. Obligated producers register directly with the management organisation and pay their fees directly; or
2. Obligated producers pay their fees to a compliance scheme and the compliance scheme would pass these fees to the management organisation (for the household/household-like scheme). This would avoid the need for the management organisation to interface directly with all obligated producers and hence could reduce overall scheme administration.

The management organisation would make payments to local authorities as described for Model 2 (and in Section 4). It would also make arrangements with sorting / transfer facilities to support collection of household-like packaging waste from commercial outlets. The management organisation would be required to ring-fence a proportion of producer fees for such as communications campaigns and litter initiatives in each nation, again as proposed under Model 2.

Model 4: Deposit-based government managed system

It is likely that this model would need to be delivered by a government established scheme administrator, however, if it was to be delivered by a scheme administrator independent of government then it would need to operate to the standards required by government. Obligated producers could register directly with the scheme administrator or could join a compliance scheme as now.

Obligated producers would make the following payments based on the packaging they place on the market/handle:

- 1) For **all recyclable packaging** they would pay a deposit fee. The deposit would be payable per tonne and would vary by material. These materials would include those that would be required to be collected at kerbside for recycling, and labelled as such.
- 2) For **all non-recyclable packaging** they would pay a fee, set high enough to create an incentive to use recyclable packaging. Some of the fee would be used to support communications and litter-related measures.
- 3) Alongside 1) and 2) they would pay a packaging fee related to the tonnage of household packaging. This would contribute to full net cost recovery and ensure full net cost recovery for the management of household packaging waste by local authorities.

Packaging deposit/fees would need to be set at a high enough level to incentivise a change towards the use of recyclable packaging. This may require setting deposits at a rate which means that producers overall contribute more than full cost recovery. The government would need to carefully consider the implications if this was the case.

Deposits would be reclaimed by producers against evidence from reprocessors and exporters based on commercial arrangements agreed between producers or compliance schemes and recyclers/reprocessors. The cost of evidence would be determined by the market in much the same way as happens under the current system. The prices of evidence would be expected to rise towards that of the deposit for different materials. If the deposit on, for example clear PET was £300 per tonne, the price of evidence might increase up to this level and hence increase the incentive to recycle. The income raised from recyclers/reprocessors from the sale of evidence would be expected to pass up the chain to collectors and businesses – providing the incentive to separate, collect and recycle more packaging materials including household-like packaging. Evidence could also come from back hauling where producers do this (e.g. collection points in store) and can demonstrate the material has been recycled.

It is proposed that deposits would be returned in full if the recycling is closed loop and to equivalent use, e.g. clear food grade PET to clear food grade PET. The deposit would not be returned in full (proportion would need to be determined) if the material is recycled to a lower grade or alternative use (e.g. food grade to non-food grade).

As now, a producer would not have to recycle their actual packaging but would have to provide evidence that an equivalent amount of the same packaging material had been recycled. Unlike now, materials would be specifically defined – for example, if you use clear PET, you must show that clear PET has been recycled.

The scheme administrator would make payments to local authorities in accordance with an agreed funding formulae. These payments would be expected to support a more coherent collection infrastructure for packaging waste and the delivery of any minimum service standards/ collection blueprints/codes of practice in place in each nation (as discussed in Section 4).

See Annex C for an initial qualitative assessment of Model 4.

Annex C: Qualitative Analysis of Governance Model 4 (deposit-based government managed system)

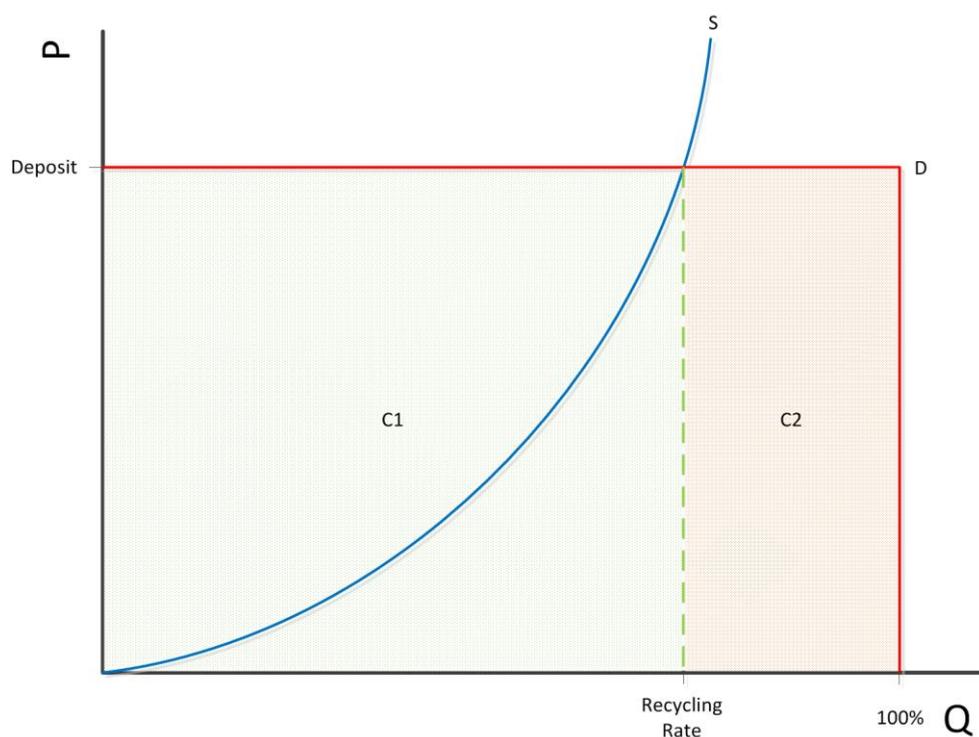
The following section provides a brief qualitative assessment of governance model 4; the deposit-based government managed system. While all governance models considered in the final IA will require a full quantitative assessment this model is likely to be the most transformational one and possibly without previous precedents.

The deposit element is unique to Model 4 amongst the four operating models. The fee is conceptually similar to a POM fee that is varied according to recyclability. The qualitative analysis in this annex thus focusses on this deposit system.

Under a deposit based model, any deposit will always be too low to deliver exactly 100% closed-loop recycling. The second law of thermodynamics implies that a 100% recycling rate would require an impractical expenditure of energy. With an open market for evidence of recycling, a 100% recycling target can thus be expected to drive the price of evidence to a value close to that of the deposit.

Figure 2 shows illustrative supply and demand curves for evidence of packaging recycling, which for these purposes will be taken as a proxy for the supply and demand for reprocessing capacity. The following analysis is largely based on the idealised market conditions of perfect competition.

Figure 2: Illustrative supply and demand curves for evidence of packaging recycling



Producers can be expected to face a loss of the deposit value for every tonne of packaging placed on the market. They will pay cost C1 for evidence of recycling (directly funding waste collection or treatment, or running their own recovery operations), and cost C2 in forfeited deposits.

Producers will probably have an additional one-off cost, resulting from the stock of deposits being held but which will ultimately be returned. This will be additional because of the delay between paying for evidence and receiving the returned deposit. The cost will be equivalent to C1, but in this case will be scaled according to the amount of time elapsing between paying for evidence and receiving the deposit. To the extent that this time period can be minimised, this one-off cost can be minimised.

Setting the values of deposit for different materials is critical in assessing the likely costs and benefits of this model. It follows that the higher the value of the deposit, the greater the incentive to secure evidence of recycling. However, larger deposits will place a larger cost-burden on producers of packaging.

Annex D: Underpinning UK Packaging Data

Placed on the market – evidence and projections

We used WRAP/Valpak Flow reports⁵³ for the tonnage of packaging placed on the market (POM) for the period 2014-2020, and the Environment Agency's National Packaging Waste Database for the tonnage of packaging that is recycled and obligated under the Packaging Waste Regulations.

From 2023 onwards, we assume annual growth rate of 1% per year for the best estimate. These growth rates are assumed for all packaging materials, with the exception of steel which has a negative growth of the same level. The growth assumptions are based on industry engagement and review of Valpak flow reports (Table D1).

Table D1: Packaging placed on the market historical and projections data - best estimate

Placed on the market (POM) - tonnes	2023	2027	2032
Paper/board	4,796,389	4,991,142	5,245,740
Glass	2,423,227	2,521,620	2,650,248
Aluminium	184,830	192,335	202,146
Steel	550,440	528,750	502,836
Plastic	2,282,600	2,375,283	2,496,446
Wood	1,439,333	1,497,776	1,574,177
Other	22,781	23,706	24,915
Total	11,699,600	12,130,611	12,696,508

Sources: Data for 2020 based on PaperFlow 2020, WoodFlow 2020 and MetalFlow 2014. Data from 2020 are Defra's projections.

Recent WRAP research on the non-household municipal waste sector and a study from Eunomia⁵⁴ suggests that the placed on the market estimates could be higher than reported in the WRAP/Valpak Flow reports. Eunomia's 2018 report⁵⁵ has highlighted that that plastic packaging figures for 2016/17 could be as high as 3.9 million tonnes for Eunomia's high estimate, compared to 2.3 million tonnes that is assumed under the best POM estimates for 2017.

To account for this uncertainty, we developed low and high estimates of future growth of current POM estimates. For the low estimate, the growth of materials is assumed to be 0% annual growth. While for the high estimate the growth is assumed to be of 3% per year for all materials, with the exception of steel which has a negative growth of the same level as is assumed in our best estimate. Table D2 shows the low and high estimates of the tonnage placed on the market. These provide a range from 11.6Mt to 15.2Mt of packaging placed on market in 2032.

While we are consulting on policy reform and evidence base, we will be further reviewing the sources of packaging data and different methodologies available to provide a reviewed assessment of the packaging tonnages in the final IA.

⁵³ MetalFlow 2014, Paper and Card Flow 2020, WoodFlow 2020, and any subsequent follow up reports based on the original Flow reports.

⁵⁵ Eunomia (2018), *Plastic Packaging: Shedding Light on the UK data*.

Tables D2: Packaging placed on the market - sensitivity analysis

Placed on the market - low sensitivity	2023	2027	2032
Paper	4,748,900	4,748,900	4,748,900
Glass	2,399,235	2,399,235	2,399,235
Aluminium	183,000	183,000	183,000
Steel	556,000	556,000	556,000
Plastic	2,260,000	2,260,000	2,260,000
Wood	1,425,082	1,425,082	1,425,082
Other	22,555	22,555	22,555
Total	11,594,772	11,594,772	11,594,772

Placed on the market - high sensitivity	2023	2027	2032
Paper	4,891,367	5,505,277	6,382,124
Glass	2,471,212	2,781,371	3,224,371
Aluminium	188,490	212,147	245,937
Steel	539,320	477,456	410,008
Plastic	2,327,800	2,619,959	3,037,251
Wood	1,467,834	1,652,061	1,915,191
Other	23,232	26,147	30,312
Total	11,909,255	13,274,418	15,245,194

Unaccredited Recycling

Unaccredited recycling is recycling by reprocessors that have not become accredited to issue PRNs. Under the current system unaccredited reprocessing is unaccounted, and therefore if there is a large amount of material being reprocessed, but not generating PRNs, the reported recycling rate is an underestimate of the real recycling rate.

For the purposes of the analysis, we are interested in the total amount of reprocessing occurring (accredited plus unaccredited), as this allows us to assess whether higher targets will require additional collection of recyclates. In some cases, higher targets will simply spur previously unaccredited reprocessors to become accredited, and generate evidence for their reprocessing. This increases the official recycling rate, but has no impact from a social cost-benefit perspective.

Given the limited availability of unaccredited recycling data (historical and projections) and given the limited impact this would have on the final results, we assumed that for the baseline and Scenario analysis the unaccredited recycling data is included in the final estimates. This means that we are potentially underestimating the real recycling rate and tonnage.

Annex E: Methodology Used to Analyse the Lowering or Removal of the De-Minimis Threshold

This Annex describes the methodology used to analyse the lowering or removal of the de-minimis threshold. The results look at the number of extra businesses that would become obligated if the turnover threshold were lowered or removed.

There was no direct data available that would enable the modelling of lowering the tonnage threshold. Therefore, for all of the results in the tables, the tonnage threshold is modelled as zero. As set out in the main text, we recognise the weaknesses in this analysis. We are presenting the methodology here in the Annex not as an integral part of this impact assessment, but as a way to share the work we have done so far. This is also in support of the call for evidence questions we have set out in the consultation (see Chapter – “*Obligated Producers*”).

Data sources used

National Packaging Waste Database (NPWD; provided by Environment Agency) - data range from 2012-2018.

Office for National Statistics (ONS; available here <https://www.ons.gov.uk/>) – data from 2017. Number of businesses in the UK per SIC code, separated by turnover bands.

Methodology

1. We extracted from the NPWD data the SIC codes (Standard Industrial Classification) submitted by compliant producers in last five years:
 - This gives a broad list of the types of SIC codes that are relevant to the regulations.
 - A risk here is that codes may not be accurate. Producers submit their own SIC Code and can only submit one code even if companies activities fit into more than one SIC category. Company makes this decision and manually enters the code.
2. We then used this compiled list of SIC codes to filter the 2017 ONS data (ONS Table 9). This gives the numbers in column 2 of Tables E1 and E2.
3. The next step is to account for the fact that not all businesses who lie within a SIC code category will handle packaging. Thus, we compared, for each SIC code, the number of producers compliant in 2017 (from NPWD data) against the number of businesses in 2017 with that same code, that have a turnover greater than £2 million in 2017 (ONS Data). A £2 million turnover is used as this is the current turnover threshold in the regulations. This gives a rough percentage that handle packaging that can be applied to the number of businesses in the ONS data. However, this doesn't account for free-riders and the fact that this percentage may change as businesses get smaller.
4. Below are two methods that were used to apply the percentages derived in step 3 to the ONS numbers.
 - a) We took all of the percentages for each SIC Code (see step 3) and averaged them. We then applied this average percentage to the number of businesses under each turnover bracket in the ONS data. This gives the numbers in column 3 of Tables E1 and E2.
 - b) Instead of averaging the percentages and applying this one percentage to all numbers in the ONS data, the unique percentages are applied for the data within each SIC code individually. This gives the numbers in column 4 of Tables 123 and 124.
5. Finally, we applied the same method as steps 2-4 above, but the SIC codes were from the last five years **and** only from producers with between £2-4 million turnover. This is done to see the effect of only sampling smaller producers.

Table E1: Using SIC Codes from all producers, 2013-2018

Turnover Threshold (£)	No. of additional companies in the UK with the relevant SIC codes (in addition to those currently obligated)	Handling packaging (using average of 16%)	Handling packaging (using individual percentages)
1,000,000	82,515	13,202	3,957
500,000	229,530	49,927	10,747
250,000	490,480	128,404	21,508
100,000	1,176,455	316,637	42,247
50,000	1,685,430	586,306	54,504
0	2,030,170	911,133	66,789

Table E2: Using SIC Codes from producers that have turnover between £2-4 million, 2013-2018

Turnover Threshold (£)	No. of additional companies in the UK with the relevant SIC codes (in addition to those currently obligated)	Handling packaging (using average of 26%)	Handling Packaging (using individual percentages)
1,000,000	46,980	12,273	3,743
500,000	130,940	46,479	10,180
250,000	283,830	120,625	20,392
100,000	671,560	296,060	39,142
50,000	927,675	538,402	49,444
0	1,115,865	829,905	60,230

Assumptions/Caveats

- The methodology accounts for compositional change of businesses as they become smaller by the process of referencing across to the ONS data. If a SIC code is included in the original list, but is not relevant to smaller companies, it will return zero.
- We only used SIC codes from compliant companies from past five years. As you take in smaller companies, the types of companies will change. However, this shouldn't have a huge effect (e.g. we expect that most SMEs will be retailers and these are included already).
- Without tonnage data for SMEs available, this analysis effectively looks at reducing the turnover whilst having no tonnage threshold.
- ONS data account for "VAT and/or PAYE based enterprises". This means that this methodology does not account for businesses who do not pay VAT (e.g. turnover of more than £85,000 per year) **and** are not registered on PAYE (e.g. no employees are paid £116 or more a week, get expenses and benefits, have another job or get a pension). We do not expect that this will have a big effect on the numbers.

Annex F: Non-monetised costs and benefits

Listed here are additional costs and benefits that are currently difficult to monetise.

Non-monetised costs:

- **Increased Enforcement:** the reforms will see more money in the system. In addition, we are consulting on options to create a more transparent system. This means some stakeholders being more tightly regulated. The regulators will therefore have to carry out a much greater amount of compliance monitoring and enforcement duties.
- **Full Scope of a modulated fee:** This IA presents a partial assessment of the impact of a modulated fee system on PVC and PS plastic packaging only. The reforms will see a much wider reaching modulated fee system established. As per the proposals in the consultation, this may also take the form of a deposit system.
- **Government transition:** The costs to government of implementing the reforms have not been quantified. At this stage there are too many variables to how the reforms might end up looking to make monetising this cost practical. There will need to be campaigns to ensure that all stakeholders are aware of the new regulations and have time to familiarize themselves with them. New IT systems may be needed and these could be costly to set up. Staff will need to be trained to use any new IT systems and to make sure the new regulations are understood.
- **Obligated producer changes:** There could be a new cost to businesses from any changes to the definition of who is obligated. If there is a move to a single point of compliance and/or the de-minimis threshold is lowered/removed, then those who are obligated and the amount they may have to pay will change. In such case, these businesses will need detailed guidance on how to comply with the regulations.
- **Business transition:** There will be costs to stakeholders relating to familiarization. As an example, producers will have to train staff to understand the new regulations. They will need to set up new systems and possibly teams to handle any new requirements.
- **Consumer prices:** It is presumed that of any additional costs placed on producers through the reforms, a certain amount could be passed on to the consumer through increased prices in shops. The complexities of how businesses will do this are not quantifiable at this stage.
- **Compliance schemes:** If a governance model is set up that mandates a single producer organisation (e.g. Model 2) then this will have an effect on the existing compliance schemes. This may result in some losing business (many also handle WEEE and battery producer responsibility obligations also) and therefore a loss of jobs. It is not known however if producers would still continue to find benefit in compliance schemes as a “middle man” to help with submitting data and other tasks. There is also a risk that in any governance model, the increased complexity of the system and increased money flowing through could force compliance schemes to consolidate and so may drive some off the market (especially smaller compliance schemes). It is therefore very difficult to quantify the possible costs to compliance schemes.

Non-monetised benefits:

- **A more vibrant domestic reprocessing market:** Proposals set out in the consultation aim to drive better design of packaging to enable greater recycling and to achieve consistency in the packaging materials collected for recycling. These measures are designed to increase the quantity and quality of material available to UK reprocessors, thereby increasing their confidence that they can access materials of the required quantity and quality on a consistent basis. This will be beneficial in creating a stronger, more stable and more vibrant domestic reprocessing market.
- **Reduced littering:** Improvements to the collection of packaging waste and better consumer communication campaigns or recyclability labelling can result in less packaging waste being littered. The benefits of this are that there will be reduced costs associated with cleaning up litter and illegal waste and also it will benefit the natural environment and improve people’s experience of the environment.

- **Reduced use of virgin materials:** The consultation sets out reforms that will look to achieve higher recycling targets. If more packaging waste is recycled then this will benefit the secondary materials market. If cheaper secondary materials are available then this should reduce the use of virgin materials used in manufacturing. The benefits of this are to reduce the depletion of precious resources: the process of extraction can also harm habitats and landscapes. Conversely, making new products from recycled materials can cause less harm, using less water, less energy and generating lower carbon emissions. When we create new markets for recycled materials, we also make recycling more economically viable.
- **Reduced landfill and energy-from-waste:** Increased recycling of packaging waste will also lead to less packaging waste being sent to energy-from-waste and landfill treatment. Packaging waste going to landfill or incineration loses its residual value for good and harms the environment at the same time.
- **Consumers:** We are proposing in the consultation that producers should pay for the costs of providing information to consumers on recycling packaging and to encourage less littering. Additionally it is proposed that a mandatory labelling scheme should be adopted to clearly state whether household and household-like packaging is recyclable or not. These labels would benefit consumers who would be much better informed on what products are recyclable and therefore can make well informed choices on the products they buy.

In addition these are some of the system-wide benefits to the producer responsibility system.

- **Incentives for long-term innovation and strategic planning:** the reforms will create a more stable and transparent system that will de-risk investment in innovation and encourage strategic planning.
- **Increased transparency:** Several measures have been proposed in the consultation that will help towards creating a clearer and fairer system. This will benefit all actors in the system by creating a level playing field and giving stakeholders confidence in the system. In particular we have laid out proposals that would reduce the volatility in the PRN market – see consultation document.
- **Reduced packaging:** the reformed system will be much more expensive for producers as they will have to cover the full net costs of managing the packaging they place on the market once it becomes waste. This per-tonne fee will be a strong driver to encourage producers to use less packaging. This will in turn reduce the use of virgin materials and as well as the environmental impact of the manufacturing process.
- **Circular economy:** all of the measures proposed in the consultation will help in creating a more circular economy where less is wasted and more packaging is recycled.

Annex G: Key quantitative assumptions

Sensitivity analysis has been carried out on a number of key inputs to indicate uncertainty around current evidence and future projections. In this section we present the key assumptions of the analysis and if and how these were changed in low and high estimates per each Scenario.

Table G1: Key modelling assumptions for Baseline and all Scenarios

Assumption	Best estimate	Low estimate	High estimate	Evidence used to help determine assumptions
POM – growth rates applied to 2020 figures (Table 1)	1%	0%	3%	WRAP/Valpak Material Flow reports
Reprocessors' material price growth rates applied to forecasted 2020 figures (Table 21)	0%	-5%	5%	Defra assumptions
Carbon prices				
Traded (Table 53) £/tCO ₂ e increase each year	£8 (approx.)	£4 (approx.)	£11 (approx.)	'Valuation of energy use and GHG emissions for appraisal' ⁵⁶
Non-traded (Table 53) £/tCO ₂ e increase each year	£0.5 (approx.)	£1 (approx.)	£2 (approx.)	
Baseline PRN prices (2032)				
Paper/card	£1.50	£4.62	£12	We used sensitivity analysis ⁵⁷ on the average material PRN prices for a low, best estimate and high scenario for the period 2007-2017 and assumed the highest price for each scenario over this period for 2032, under the respective, low, best estimate and high scenario.
Glass	£41.25	£58.37	£85	
Aluminium	£31.50	£79.77	£215	
Steel	£14.50	£65.18	£125	
Plastic	£17.25	£48.51	£25	
Wood	£1.55	£7.97	£9	
Cost of issuing PRN evidence (Table 14)	£1	£1	£3	www.wastecare.co.uk ⁵⁸
Compliance fee (Table 14)	£1,438	£375	£2,500	CIWM journal ⁵⁹
LAs materials revenue				
Mixed Paper/Card	£40	£50	£80	WRAP material prices assumptions for separate collection of dry materials, based on Gate Fees 2017/18 Final Report ⁶⁰
Mixed glass	-£13	-£20	£10	
Colour separated glass	£4.5	£0	£20	
Cans	£72	£60	£140	
Plastic	£60.5	£25	£77.5	
Secondary market materials prices				
Mixed Paper/Card	£114.16			WRAP Material pricing reports ⁶¹
Colour separated glass	£11.24			
Aluminium	£713.22			
Steel	£75.25			

⁵⁶ Source: <https://www.gov.uk/government/publications/valuation-of-energy-use-and-greenhouse-gas-emissions-for-appraisal>

⁵⁷ The Environment Exchange - <https://www.t2e.co.uk/historic-prn-prices.html>

⁵⁸ <http://www.wastecare.co.uk/compliance-services/packaging-compliance/costs-and-fees/>

⁵⁹ <https://www.ciwm-journal.co.uk/downloads/Packaging-Waste-Recovery-A-European-comparison.pdf>

⁶⁰ http://www.wrap.org.uk/sites/files/wrap/WRAP%20Gate%20Fees%202018_exec+extended%20summary%20report_FINAL.pdf

⁶¹ <http://www.wrap.org.uk/collections-and-reprocessing/recovered-materials-markets/guidance/material-pricing-reports>

Plastic	£163.61			
Wood	£50.33			
Unit collection cost of recycling per tonne (HH)	£242			Adopted from WRAP's Routemap model for England – multi-stream scenario from Consistent municipal recycling IA (Option 3hh).
Unit collection cost of recycling per tonne (C&I)				
Paper	£54			
Glass	£9	-	-	Defra and WRAP assumptions
Aluminium	£43	-	-	
Steel	£43	-	-	
Plastic	£100	-	-	
Unit collection cost of recycling per tonne (NHM)				
Paper	60			
Glass	£216	-	-	Adopted from WRAP's NHM research
Aluminium	£114	-	-	
Steel	£114	-	-	
Plastic	£169	-	-	
Unit collection cost of residual per tonne in 2032 (HH) (Table 18)	£153	-	-	Adopted from WRAP's Routemap model for England – multi-stream scenario from Consistent municipal recycling IA (Option 3hh).
Unit collection cost of residual per tonne in 2032 (NHM) (Table 18)	£201	-	-	Adopted from WRAP's NHM research
Unit collection cost of residual per tonne in 2032 (C&I) (Table 18)	£201	-	-	Defra assumption
Share of packaging out of total dry recycling collections	78.7%	-	-	WRAP Routemap model
UK tonnages uplift from England	1.22	-	-	Based on Defra's statistics for UK household waste arisings ⁶²
UK household costs uplift from England estimate	1.24	-	-	WRAP Routemap model for England – multi-stream scenario from Consistent municipal recycling IA (Option 3hh).

⁶² <https://www.gov.uk/government/statistics/uk-waste-data>

Annex H: Sensitivity analysis on Consistent Municipal Recycling options

Within our Impact Assessment and consultation document we have assumed that a 'Multi-Stream' collection of municipal waste is consistent across all LAs in the UK within the baseline and the scenarios. This is not presented as a preferred option but rather as the option assessed in the consistent municipal recycling IA for England that delivers the highest net present value. The tables below allow us to compare the impacts on key costs/benefits of a **reformed EPR system** if we instead rolled out a different collection strategy across England. The three collection strategies for collection of municipal waste are outlined below.

As throughout this IA, the NPVs presented in tables H1, H2 and H3 reflect the impact on kerbside collection only – they are not inclusive of the costs and benefits associated with implementing a DRS for beverage containers. Therefore to understand the full impact of implementing consistent municipal recycling, reforming the EPR system for packaging and introducing a DRS on beverage containers, the NPVs outlined in the DRS IA⁶³ must be added to those in tables H1, H2 and H3. Further to this, the NPVs outlined in the consistent municipal recycling collections IA should be considered to understand the potential impact of each collection option when looking at all materials, rather than just packaging.

Multi Stream (estimated to collect a total of 32.0m tonnes of recycled packaging, 2023-2032)

- Household sector – multi-stream collection systems, collection of six materials; separate weekly food waste; free garden waste.
- NHM sector – dry mixed recyclables, separate glass, separate food waste.

Twin Stream (estimated to collect a total of 34.6m tonnes of recycled packaging, 2023-2032)

- Household sector – two-stream collection systems, collection of six materials; separate weekly food waste; free garden waste.
- NHM sector – collection of dry mixed recyclables (no glass recycling) and separate food waste collection.

Current systems (estimated to collect a total of 34.8m tonnes of recycled packaging, 2023-2032)

- Household sector: current dry recycling collection systems – requiring collection of six key materials; separate weekly food waste; free garden waste.
- NHM sector - requiring collection of dry mixed recyclables (DMR) and separate glass.

HH impacts

WRAP's projections of recycled packaging differ slightly between the different options for consistent municipal waste collections. For packaging, the 'Multi Stream' collection option offers the lowest tonnage of recycled materials whilst the 'Twin Stream' and 'Current System' project (similarly) higher recycled tonnages of packaging. This is because under 'Multi stream', where there are more bins to sort packaging recycling into, it is assumed that some households will be more reluctant to participate.

Gross costs – Under 'Multi Stream', gross costs are driven up compared to the alternative waste collection options. This is mostly because the lower recycling tonnages mean comparably more waste is disposed of in residual waste. Residual waste collection and treatment costs are higher than recycling collection and treatment costs per tonne.

Material revenue – Despite the projection that fewer tonnes of packaging will be recycled under a 'Multi Stream' scenario, the 'quality' of these tonnages is predicted to be of a higher standard due to the reduced risk of contamination from more bins/separation. As a result, the material revenue for LAs will be higher in value under the 'Multi Stream' collection option compared to the alternative municipal collection options.

Net costs – Taking the material revenue away from the gross costs gives us the net costs of collection and treatment of HH recycled and residual waste. By comparing the net costs of the different waste collection options we can see that 'Multi Stream' has the highest net costs compared to the two alternative options for all of the proposed EPR scenarios.

Business NPV⁶⁴ – in line with the 'Multi Stream' scenario facing the highest net costs in each EPR scenario, the net business costs for each option under Multi Stream is higher relative to the other two waste collection options.

NPV – For scenario 1a, despite the relatively higher net costs of the Multi Stream option (£9.5bn), the scenario results in a comparably high NPV (£245m). This is because when modulated fees are implemented, the additional

⁶³ See the impact assessment on introducing a deposit return scheme on beverage containers

⁶⁴ The Business NPV includes the following costs: administration costs of a new EPR system and the costs of FNCR for HH and NHM packaging. These costs are then netted off with following savings: savings to the NHM sector now that producers are paying for their packaging waste collection and treatment costs (**thus the NHM packaging waste collection and treatment costs are a transfer from business to business**) and the savings associated with no longer paying for the previous PRN systems compliance costs.

tonnage of recycled material under 'Multi Stream' is of a higher quality, and thus there are significant associated benefits. This is in part to the secondary materials market in terms of increased material revenue. The secondary materials market buys collected recyclate and sells the reprocessed materials, reducing the net costs to be recovered from businesses. In addition, the higher quality recyclate under 'Multi Stream' increases the carbon emission savings compared to the alternative systems as there is less contamination of recycled packaging. This means less materials collected for recycling is rejected and ultimately disposed of via incineration/landfill. However, once the DRS packaging materials are removed (scenarios 1b and 1c), the associated loss of materials is of a greater magnitude under 'Multi Stream' compared to the alternative collection options. Therefore, 'Multi Stream' results in the lowest NPV for scenarios 1b and 1c but the highest for 1a.

Table H1: Scenario 1a, under different consistent municipal recycling collection options

Consistency IA (1a MOD FEES)	Gross collection and treatment costs of HH recycled and residual waste (2023-2032)	HH material revenue from recycled tonnage being sold to reprocessors (2023-2032)	HH FNCR - Net costs of the collection and treatment costs of HH recycled and residual waste (2023-2032)	Net Business Costs	Net Present Value (NPV)
Multi stream	£10.9bn	£1.4bn	£9.5bn	£7.4bn	£245m
Twin Stream	£9.0bn	£0.9bn	£8.1bn	£6.2bn	£215m
Current system	£9.2bn	£0.5bn	£8.7bn	£6.7bn	£129m

Table H2: Scenario 1b, under different consistent municipal recycling collection options

Consistency IA (1b 'All-in' DRS)	Gross collection and treatment costs of HH recycled and residual waste (2023-2032)	HH material revenue from recycled tonnage being sold to reprocessors (2023-2032)	HH FNCR - Net costs of the collection and treatment costs of HH recycled and residual waste (2023-2032) and residual waste (2023-2032)	Business NPV	NPV
Multi stream	£10.7bn	£1.2bn	£9.5bn	£7.4bn	-£243m
Twin Stream	£8.6bn	£0.6bn	£8.0bn	£6.1bn	-£124m
Current system	£8.7bn	£0.2bn	£8.5bn	£6.6bn	-£179m

Table H3: Scenario 1c, under different consistent municipal recycling collection options

Consistency IA (1c 'OTG' DRS)	Gross collection and treatment costs of HH recycled and residual waste (2023-2032)	HH material revenue from recycled tonnage being sold to reprocessors (2023-2032)	HH FNCR - Net costs of the collection and treatment costs of HH recycled and residual waste (2023-2032)	Business NPV	NPV
Multi stream	£10.8bn	£1.3bn	£9.5bn	£7.4bn	£187m
Twin Stream	£8.8bn	£0.8bn	£8.0bn	£6.1bn	£318m
Current system	£8.9bn	£0.4bn	£8.5bn	£6.5bn	£263m

NHM and C&I impacts

C&I costs stay the same under each of the Municipal Waste collection options as this sectors collections are not affected.

The differences in the NHM sector costs are not modelled here due to a significant evidence gap. The two key differences relating to the NHM sector between the different municipal waste collection options are whether there is a) separate glass collection and b) separate food waste collection.

a) The collection of glass packaging should not add a significant cost/benefit to society as glass is considered a low value item and thus the material revenue to private-waste-contractors employed by the NHM sector and on the secondary market will be negligible. Furthermore, the additional costs of collecting separate glass are likely to be marginal as the fixed costs of collecting NHM packaging waste will remain quite steady, with or without separate glass collection.

b) By not collecting food waste, packaging collection costs will not be affected. As we are only proposing that producers pay for the 'Full Net Cost Recovery' of the packaging that they use, additional costs/benefits associated with food waste collections will not affect this.

	NHM FNCR - NHM net costs of the collection and treatment costs of NHM recycled and residual waste (2023-2032)	C&I net costs (2023-2032)
(1a MOD FEES)	£3.7bn	£5.9bn
(1b 'All-in' DRS)	£2.5bn	£5.9bn
(1c 'OTG' DRS)	£3.3bn	£5.9bn